TARC Repot

Reaction of Rice Cultivars Resistant to Japanese and Philippine Races of *Xanthomonas campestris* pv. *oryzae*

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Introduction

Xa-1, Xa-2, Xa-3(w) and *Xa-kg* resistance genes were identified in Japan[2,12,17] while *Xa-4, xa-5, Xa-6, Xa-7, xa-8* and *xa-9* were identified at IRRI[7-9,15,16,18-20]. Furthermore, IRRI scientists identified a single gene named *Xa-10*[24]. Since these genes were identified independently using bacterial isolates distributed in each country, the relationship among the genes is unknown.

In order to establish international differentials using near-isogenic lines, it is desirable that each line has only one resistance gene[14]. Thus, for developing near-isogenic lines, it is necessary to know how many resistance genes each original resistant cultivar has. Therefore, each cultivar has to be subjected to the inoculation test using Japanese and Philippine races and then to genetic analysis to find out how many genes each cultivar has. For this purpose, original resistant cultivars having *Xa-1* to *Xa-10* genes (except *xa-8*) were used for the inoculation test. An additional purpose of this study was to confirm the relationship of differentiation systems in Japan and in the Philippines.

Materials and methods

Five Japanese differentials (Kinmaze, Kogyoku, Te-tep, Chugoku 45 and Java 14) and seven IRRI resistant cultivars (IR8, IR20, IR1545-339, DV85, Cas 209, Zenith and Sateng) were mainly used in this experiment. These cultivars were inoculated using seven Japanese isolates and 13 Philippine isolates by the clipping method. The inoculation test was done at the isolation greenhouse of TARC. These cultivars were transplanted in pots and 3 plants per each isolate were inoculated. The seeds of five Japanese differentials came from Chugoku National Agricultural Experiment Station, Japan, while the seeds of other rice cultivars originated in the International Rice Germplasm Center of IRRI.

On the other hand, 24 rice cultivars (including some Japanese and IRRI differentials) were also tested using seven Japanese standard isolates under the field condition. These cultivars were selected from the results of the inoculation test (unpublished) which was conducted by Ogawa, one of the present authors, at Chugoku National Agricultural Experiment Station, Japan. This inoculation test was also carried out using 3 plants per one isolate by the clipping method in the experimental field at TARC. The isolates used in this experiment were the same ones mentioned in the previous paper[14]. The other methods used in this experiment were also described in the previous paper[14].

Results and discussions

1) Reaction of selected rice cultivars to Japanese standard isolates under the field condition

The result of the inoculation test is shown in

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Table 1. The relationship between Japanese differential cultivars and standard isolates was similar to the results previously reported[1,6,13,23].

IR20, one of IRRI differentials, was resistant to all Japanese bacterial groups. Almost all cultivars developed by IRRI such as IR26, IR28 and IR30 which were tested in this experiment showed the reaction similar to that of IR20. These cultivars have been identified having *Xa-4* gene by IRRI scientists[5]. Horino et al.[4] classified these cultivars, IR20, IR26, IR28 and IR30, into the Kogyoku group or the Wase Aikoku group (TKM 6). From the result obtained in our experiment, we do not agree with their view. Thus, we conclude that these cultivars, such as IR20, should be classified into a different group from the Kogyoku and Wase Aikoku groups.

Three cultivars, RP9-3, IR1414-67-32 and Suweon 262 were found to show the reaction type of IR8 (Table 1), which was reported previously by Ogawa[13]. Judging the reaction of these cultivars to races IA, II, IIIA, IV and V, this reaction

Table 1. Reaction of rice cultivars to Japanese standard isolates under the field condition

Cultivar	Japanese race						
	IA T7174	IB T7156	II T7147	IIIA T7133	IIIB Q6803	IV H75373	V H75304
Kinmaze	6.7—14.3 S	8.7—13.7 S	6.8—12.3 S	7.5—14.0 S	5.0—9.7 S	8.9—12.3 S	3.0—6.6 S
IR24	8.3—15.0 S	8.5—16.5 S	7.5—13.7 S	8.3—15.8 S	6.8—9.9 S	9.0—13.5 S	1.8—4.0 S
Milyang 23	7.0—12.3 S	5.5—15.8 S	5.5—10.9 S	9.8—16.0 S	7.0—12.4 S	5.7—14.0 S	1.8—3.8 S
Kogyoku	0.1 R	0.1 R	4.0—9.5 S	3.5—13.2 S	4.5—7.5 S	6.0—8.5 S	0.1 R
Te-tep	0.1 R	0.1 R	0.1 R	8.0—14.0 S	7.7—14.3 S	6.0—9.5 S	0.1 R
Rantai Emas 2	0.1 R	0.1 R	0.1 R	8.0—13.5 S	7.5—11.0 S	6.7—11.1 S	0.1—0.5 R
Tokushu Daihoshu	0.1 R	0.1 R	0.1 R	8.0—12.0 S	8.3—10.9 S	9.5—17.2 S	0.1—0.4 R
Chugoku 45	0.1—0.7 R	0.1—1.0 R	0.1 R	0.1—1.3 R	0.1—0.7 R	4.3—7.5 S	1.8—4.5 S
Wase Aikoku 3	0.1—1.7 R	0.4—1.2 R	0.1—1.7 R	0.1—1.2 R	0.4—1.1 R	3.0—9.2 S	3.7—8.8 S
Java 14	0.1 R	0.1—0.2 R	0.2—3.9 R	0.2—2.0 R	0.5—1.5 R	1.3—8.4 S	0.1 R
IR8	10.9—18.7 S	0.3—0.7 R	0.1—0.2 R	0.5—1.2 R	7.0—14.1 S	9.0—17.0 S	0.1—0.5 R
RP9-3	9.0—16.5 S	0.5—2.5 R	1.0—3.0 R	1.0—2.8 R	10.5—18.0 S	12.4—15.0 S	0.4—1.3 R
IR1414-67-32	7.0—17.6 S	0.2—3.7 R	0.3—1.1 R	0.6—4.5 R	3.8—5.9 S	7.0—14.6 S	0.3—1.1 R
Suweon 262	6.7—11.0 S	0.2—1.0 R	0.1—0.6 R	0.3—2.0 R	6.5—10.4 S	6.7—9.4 S	0.2—0.8 R
IR20	0.1 R	0.1 R	1.5—4.3 R	0.7—2.0 R	0.8—2.2 R	0.8—2.3 R	0.1 R
IR26	0.5—1.8 R	0.4—1.2 R	0.5—4.2 R	2.3—5.2 R	0.8—2.1 R	0.5—1.5 R	0.3—1.5 R
IR28	0.1 R	0.1—0.3 R	0.5—3.2 R	0.7—2.5 R	1.3—3.3 R	0.3—1.6 R	0.2—0.5 R
IR30	0.1 R	0.1—0.4 R	1.7—3.5 R	1.7—3.0 R	1.0—3.1 R	1.0—2.8 R	0.1 R

Table 1. (Continued)

Cultivar	Japanese race						
	IA T7174	IB T7156	II T7147	IIIA T7133	IIIB Q6803	IV H75373	V H75304
IR1528-680-3-2	0.5—2.2 R	0.2—0.8 R	0.3—1.2 R	0.7—1.5 R	1.0—2.3 R	1.0—2.5 R	0.2—0.4 R
Milyang 42	1.1—3.3 R	0.3—1.0 R	0.1 R	0.8—2.8 R	0.8—3.2 R	1.2—3.3 R	0.1—1.8 R
IR2061	0.1 R	0.1 R	1.5—4.3 R	0.8—2.9 R	1.3—2.1 R	0.5—1.7 R	0.1—0.3 R
TKM6	0.1 R	0.1—0.5 R	0.2—0.5 R	2.5—5.3 R	1.5—2.2 R	0.5—0.9 R	0.1 R
X-43	0.6—1.3 R	0.5—1.5 R	0.7—2.3 R	2.8—4.3 R	0.7—1.7 R	0.3—2.0 R	0.3—1.6 R
RP291-7	0.1 R	0.1 R	0.1 R	0.1—0.3 R	0.9—4.3 R	0.1—2.3 R	0.1 R
Kele	1.2—2.3 R	1.0—4.8 R	0.7—2.2 R	0.2—1.5 R	1.2—2.1 R	0.5—1.7 R	0.2—0.8 R
Chinsura Boro II	0.1 R	0.1—0.4 R	0.2—0.5 R	0.6—1.2 R	0.5—1.8 R	0.5—0.9 R	0.2—0.5 R
D204-1	0.2—1.1 R	0.2—1.3 R	0.3—0.8 R	0.3—1.3 R	0.4—2.2 R	0.3—0.9 R	0.3—0.9 R
Dular	0.5—1.4 R	0.8—2.8 R	0.3—1.7 R	0.5—1.5 R	0.6—2.5 R	0.5—1.5 R	0.5—2.6 R
Zenith	0.1 R	0.1—0.3 R	0.1—1.6 R	0.2—1.5 R	1.1—3.1 R	8.0—15.3 S	0.1 R
IR944-102-2-3	0.3—2.6 R	0.1—0.2 R	0.1—0.3 R	0.1—0.2 R	0.9—3.0 R	4.0—14.5 S	0.1—0.8 R
Milyang 30	0.1 R	0.1 R	0.3—0.9 R	0.2—1.2 R	6.0—9.8 S	0.5—2.0 R	0.1 R
Suweon 257	0.1 R	6.3 R	0.1—0.4 R	0.1—0.2 R	10.3—13.5 S	0.1—3.5 R	0.1 R
Suweon 258	0.1 R	0.1—0.3 R	4.7—7.0 S	0.8—2.3 R	4.0—9.3 S	0.5—2.7 R	0.1 R
Suweon 284	0.1 R	0.1 R	3.0—7.0 M	0.5—2.3 R	1.8—3.4 M	0.3—1.0 R	0.2—0.4 R
Tongil	0.3—1.8 R	0.1—0.3 R	0.1—0.6 R	0.8—3.0 R	9.5—18.0 S	9.3—16.8 S	0.1—0.3 R
Wase Tongil	0.3—1.3 R	0.2—0.5 R	0.1—0.8 R	0.2—1.9 R	9.1—16.3 S	7.4—13.7 S	0.1—0.5 R
Yungnam Josaeng	0.3—1.5 R	0.2—0.3 R	0.2—0.5 R	0.3—1.5 R	11.8—17.4 S	8.9—13.8 S	0.2—0.5 R
Yushin	0.1 R	0.1 R	2.5—6.3 M	0.8—3.0 R	6.7—10.2 S	0.1—0.5 R	0.1—0.2 R
TN1	1.0—2.7 R	0.3—2.2 R	0.7—2.9 R	14.6—20.5 S	17.0—25.0 S	14.3—21.2 S	0.8—3.5 M
Asominori	0.1 R	0.1 R	1.8—3.7 M	0.2—1.0 R	0.3—3.0 R	0.3—0.7 R	0.1 R
Kojo 1	0.1 R	0.1 R	1.5—3.5 M	0.2—1.5 R	0.4—1.5 R	0.4—1.5 R	0.1 R
Kojo 2	0.1 R	0.1 R	0.2—3.0 R	0.5—3.3 R	0.3—2.0 R	0.3—1.3 R	0.1 R

Upper row: Minimum-maximum lesion length (cm)
Lower row: R-resistant, S-susceptible

pattern is in harmony with that of the Elwee group classified by Yamada et al.[23].

The cultivars, such as RP291-7, which have been identified having *xa-5* by IRRI scientists[16], also showed resistance to all Japanese races. These cultivars, RP291-7, Kele, Chinsura Boro II and Dular, showed slightly more stable reaction than that of IR20, though the reaction pattern of the two kinds of cultivar groups, one including RP291-7, and the other including IR20, to Japanese bacterial groups could not be distinguished.

Zenith and IR944-102-2-3, which have been reported possessing *Xa-6* gene by IRRI scientists[18], showed the reaction similar to that of the Java group, while Horino et al. classified this cultivar into the Rantai Emas group[4]. This result indicates that it is necessary to conduct further research on the relationship between the genes of Java 14 and Zenith.

On the other hand, Korean cultivars, such as Tongil, which have been developed from the hybrid between indica and japonica cultivars showed reactions different from any Japanese cultivar group. Therefore, it is suggested that Korean cultivars have high possibility of harboring unknown gene(s) introduced from the indica cultivar. This means that it is necessary for the Korean cultivars to be analyzed genetically in detail.

Regarding the pathogenecity of Japanese bacterial groups, the result obtained in this experiment confirmed that each bacterial group has different pathogenecity from each other. This confirms the results already reported by Ogawa[13]. The virulence of seven standard strains of each bacterial group was slightly different from each other. From the lesion length of susceptible cultivars such as Kinmaze, the degree of the aggressiveness was in the order of T7156≒T7133>T7174>H75373>T7147>Q6803>H75304. The isolate H75304 showed the least virulence; thus, it was difficult to determine whether the tested cultivar should be classified into a resistant or susceptible group under a standard concentration (10^7–10^8 cells/m*l*) of inoculum.

2) *Reaction of IRRI differentials to Japanese standard isolates under the greenhouse condition*

The result is shown in Table 2. The cultivars, IR8, IR20, IR1545-339, DV85, and Cas 209 are IRRI differentials while Zenith and Sateng having *Xa-6* and *xa-9* genes are not.

As shown in Table 2, IR8, IR20 and Zenith showed the same reaction pattern under the field condition. IR1545-339, which has been identified

Table 2. Reaction of IRRI's differentials to Japanese races

Variety	Race						
	IA T7174	IB T7156	II T7147	IIIA T7133	IIIB Q6803	IV H75373	V H75304
IR8	13.9—16.7 S	1.1 R	0.5—0.8 R	0.8—1.0 R	11.7—15.5 S	13.9—16.4 S	0.4—0.9 R
IR20	0.8—0.9 R	0.7—1.3 R	1.3—2.0 R	1.2—1.7 R	0.7—1.0 R	0.5—1.1 R	0.7—0.8 R
IR1545-339	1.0—2.0 R	0.6—0.9 R	0.5—1.3 R	0.8—1.1 R	1.5—2.2 R	0.6—1.3 R	0.6—0.8 R
DV85	1.6—2.7 R	1.8—3.4 R	0.7—1.3 R	1.1—1.5 R	0.7—0.8 R	1.2—1.8 R	1.0—1.3 R
Cas 209	7.1—8.4 S	13.3—16.7 S	15.5—20.0 S	16.2—29.5 S	13.9—15.1 S	12.0—16.6 S	5.4—5.7 S
Zenith	1.4—2.8 R	0.6—1.4 R	1.0—2.1 R	1.4—3.1 R	0.3—0.9 R	11.0—16.8 S	0.5—0.8 R
Sateng	0.8—1.7 R	0.8—1.4 R	0.9—1.8 R	0.8—1.6 R	1.8—2.3 R	7.3—8.7 S	1.6—2.5 R

Legend: See Table 1.

having *xa-5*, showed resistance to all Japanese races.

DV85 identified having *xa-5* and *Xa-7* genes at IRRI was resistant to all isolates while Cas 209 was susceptible to all isolates. On the other hand, Sateng having *xa-9* showed the same pattern as that of Zenith having *Xa-6*.

3) *Reaction of Japanese differentials to the Philippine isolates*

Table 3 shows reaction of Japanese differentials to four Philippine standard isolates while Table 4 shows reaction of these cultivars to 9 isolates which were studied by Horino et al.[3].

Kinmaze, Kogyoku and Te-tep showed susceptibility to all Philippine isolates while Chugoku 45 and Java 14 showed resistance to all Philippine isolates. These results are in harmony with the ones of Horino et al.[3,4].

4) *Reaction of IRRI differentials to the Philippine isolates*

As shown in Table 5, the result of the inoculation test showed the reactions similar to those obtained by IRRI scientists[8,9]. That is, IR8 was susceptible to all isolates while IR20 was resistant to races 1 and 4. IR1545-339 was resistant to races 2 and 3. DV85 showed resistance to all four races while Cas 209 showed resistance to only race 2. Zenith and Sateng were resistant to all

Table 3. Reaction of Japanese differentials to Philippine standard isolates

Variety	Race			
	1 PXO 61	2 PXO 86	3 PXO 79	4 PXO 71
Kinmaze	6.6—8.5 S	7.0—12.1 S	5.0—6.4 S	5.7—7.0 S
Kogyoku	3.0—5.2 S	4.3—9.5 S	5.2—6.1 S	3.6—5.6 S
Te-tep	13.1—18.5 S	10.2—16.2 S	8.0—17.5 S	15.4—18.1 S
Chugoku 45	0.3 R	0.3—0.5 R	0.4—0.5 R	0.5—0.8 R
Java 14	1.3—1.6 R	1.2—1.5 R	1.0—1.3 R	0.7—1.3 R

Legend: See Table 1.

Table 4. Reaction of Japanese differentials to Philippine isolates

Variety	Race								
	A IRN210	B IRN246	C IRN249	D IRN243	E IRN237	F IRN280	H IRN212	IRN293	IRN223
Kinmaze	7.5—12.9 S	7.9—10.7 S	9.1—13.5 S	6.5—7.9 S	3.9—10.5 S	5.9—10.1 S	9.0—15.0 S	8.7—15.1 S	8.0—11.2 S
Kogyoku	6.9—7.5 S	4.4—7.0 S	4.2—7.8 S	3.5—6.0 S	3.2—3.7 S	4.9—7.5 S	10.7—14.8 S	6.4—7.3 S	4.7—11.0 S
Te-tep	13.8—19.7 S	14.4—20.0 S	18.7—23.5 S	10.5—15.5 S	5.2—12.7 S	23.2—25.2 S	14.7—23.5 S	24.2—28.8 S	16.6—17.5 S
Chugoku 45	1.3—1.5 R	0.6—1.0 R	0.4—0.5 R	0.5—0.7 R	0.4—0.5 R	0.3—0.7 R	0.3 R	0.3—0.5 R	0.3—1.0 R
Java 14	1.0—1.1 R	0.9—1.4 R	1.5—2.0 R	2.0—2.7 R	1.4—1.9 R	1.2—2.1 R	0.8—1.6 R	1.3—1.5 R	1.0—1.9 R

Legend: See Table 1.

Table 5. Reaction of IRRI's differentials to Philippine standard isolates

Variety	Race			
	1 PXO 61	2 PXO 86	3 PXO 79	4 PXO71
IR8	10.6—11.4 S	9.5—14.2 S	8.7—12.6 S	11.1—12.3 S
IR20	1.3—2.2 R	7.0—8.2 S	6.7—10.3 S	1.6—2.1 R
IR1545-339	1.3—2.4 R	2.4—3.9 R	3.4—3.9 R	10.2—13.7 S
DV85	1.5—1.7 R	1.2—1.3 R	1.5—2.2 R	1.5—2.4 R
Cas 209	12.8—13.7 S	0.6—1.4 R	20.0—38.5 S	13.0—22.7 S
Zenith	0.5—1.1 R	0.7—1.3 R	0.6—0.7 R	0.6—0.9 R
Sateng	0.8—1.3 R	0.8—1.5 R	0.8—1.2 R	1.7—1.9 R

Legend: See Table 1.

Table 6. Reaction of IRRI's differentials to Philippine isolates

Variety	Race								
	A IRN210	B IRN246	C IRN249	D IRN243	E IRN237	F IRN280	H IRN212	IRN293	IRN223
IR8	9.3—15.0 S	9.3—14.5 S	13.8—18.4 S	9.7—19.3 S	3.9—5.7 S	12.3—17.7 S	12.2—15.6 S	15.8—16.5 S	12.0—16.2 S
IR20	6.3—8.9 S	6.5—8.9 S	7.4—16.8 S	1.8—2.7 R	1.8—2.8 R	7.6—7.8 S	8.9—10.2 S	1.3—1.9 R	5.5—13.3 S
IR1545-339	1.9—2.4 R	1.0—1.6 R	1.7—2.3 R	1.0—2.3 R	0.7—1.3 R	2.2—3.5 R	2.3—2.9 R	1.9—3.1 R	1.4—1.8 R
DV85	1.0—1.4 R	0.6—0.8 R	1.5—1.9 R	1.4—1.9 R	1.2—1.5 R	1.2—1.9 R	0.8—1.2 R	1.7—2.1 R	1.1—1.3 R
Cas 209	0.5—0.8 R	0.3—0.5 R	0.5—0.7 R	0.5—1.6 R	0.5—1.8 R	0.5—1.9 R	1.3—3.8 R	13.6—33.5 S	1.0—2.9 R
Zenith	0.5—0.9 R	0.9—1.2 R	1.3—2.9 R	1.0—2.3 R	0.8—1.0 R	0.9—1.5 R	0.7—1.3 R	1.1—1.3 R	0.5—1.1 R
Sateng	1.0—1.9 R	1.2—1.5 R	0.8—2.8 R	1.1—2.7 R	1.0—1.9 R	1.5—2.5 R	0.9—1.1 R	1.4—2.0 R	1.5 R

Legend: See Table 1.

four races.

Table 6 shows the result of the inoculation test of these cultivars to 9 isolates studied by Horino et al.[3]. Horino et al.[3] classified these isolates to 8 groups based on the reaction of IRRI differentials.

In our experiment, almost all of the isolates show similar pathogenecity to IRRI differentials except IRN243 (group D), IRN237 (group E) and IRN293 (unclassified isolate). That is, groups A, B, C, F and H, and isolate IRN223 are virulent to IR8 and IR20 while these isolates are avirulent to IR1545-339, DV85 and Cas 209. This means that these isolates belong to race 2 iden-

tified by IRRI scientists[8,9]. IR8 and Cas 209 showed susceptibility to isolate IRN293 while IR20, IR1545-339 and DV85 showed resistance. Therefore, this isolate should be classified to group 1 which was identified by IRRI scientists[8,9]. On the other hand, isolates IRN243 (group D) and IRN237 (group E) showed virulence to IR8 only. Isolates which show similar pathogenecity can not be classified to the races identified by IRRI scientists. Thus, our results did not agree with the conclusion of Horino et al.[3].

Zenith and Sateng were resistant to all these nine isolates as well as to four standard isolates of IRRI.

From the inoculation test carried out using Japanese and Philippine isolates in this study, the differentiating system in each country was reconfirmed. In addition, the comparison made between the reaction of Japanese differentials to the Philippine isolates and that of IRRI differentials to the Japanese isolates indicated a possibility that some differentials possess additional resistance genes, which are different from the resistance genes already known.

For example, IR8 was susceptible to all the Philippine isolates, but it showed resistance to some Japanese isolates. The reaction pattern of IR8 was different from any Japanese differentials. This result clearly suggests that IR8 has an unknown resistance gene. The authors* recently proposed that IR8 has one dominant gene which is the same one as *Xa-11* in RP9-3.

Furthermore, IR20, IR1545, and DV85 were resistant to all the Japanese isolates. From this result, the following conclusion can be drawn; the resistance genes, already known, of these three differentials express their resistance to the Japanese isolates or these differentials have unknown gene(s), responsible for the resistance to the Japanese isolates.

Sateng and Zenith also showed resistance to Japanese isolates except that of race IV and showed the reaction pattern similar to that of Java 14. Chugoku 45 and Java 14 were resistant to all Philippine isolates. Therefore, these cultivars have a possibility of possessing additional gene(s).

On the other hand, it can be concluded that Kogyoku, Te-tep and Cas 209 do not have additional gene(s) because Kogyoku and Te-tep were susceptible to all Philippine isolates while Cas 209 was susceptible to all Japanese isolates.

From the results mentioned above, it is necessary that IR8, IR20, IR1545-339, DV85, Zenith and Sateng should be analyzed genetically using Japanese isolates while Chugoku 45 and Java 14 should also be analyzed using Philippine isolates.

* Ogawa, T. & Yamamoto, T.: Inheritance of resistance to bacterial blight in rice. *Rice Genetics*, 471–479 (1986).

Summary

In order to test the possibility of the presence of additional gene(s) other than previously identified ones in Japanese and Philippine differentials, a series of inoculation tests were carried out using seven Japanese standard isolates and 13 Philippine isolates. The purpose of the tests is to develop near-isogenic lines with monogenic base for establishing international differentials of rice bacterial leaf blight pathogen as well as to confirm the relationship of differentiation systems in Japan and in the Philippines.

From the results obtained, it is possible that Japanese differentials, Chugoku 45 and Java 14, have additional gene(s) responsible for the resistance to the Philippine isolates. It is also possible that IRRI differentials (IR20, IR1545-339 and DV85) and two resistant cultivars (Zenith and Sateng) have additional gene(s). These cultivars should be analyzed genetically using Japanese and Philippine isolates to confirm the number of resistance genes.

Kogyoku and Te-tep (Japanese differentials), and Cas 209 (IRRI differential) have no possibility of possessing an additional gene responsible for the resistance to Philippine or Japanese isolates.

IR8 was considered to have an unknown resistance gene from its reaction to some Japanese isolates. This gene was found to be the same one as *Xa-11*.

From the inoculation test using rice cultivars to seven Japanese and four Philippine bacterial groups, the existing host-parasite relationship reported by several researchers[1,6,8,9,13] was reconfirmed.

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(Received for publication, October 6, 1986)