Indian Phytopath. 53 (1) : 19-21 (2000)

Pathogenic variability of *Xanthomonas oryzae* pv. *oryzae*

ARVIND KUMAR*, M.N. SRIVASTAVA[1] and N. LAKPALE[2]
Indira Gandhi Krishi Vishwavidyalaya, Raipur 492 012

ABSTRACT : Comparison of virulence of isolates of *Xanthomonas oryzae* pv. *oryzae* prevalent in eastern Madhya Pradesh and Punjab on a set of isogenic lines under green house conditions revealed that the isolates prevalent in eastern Madhya Pradesh were more virulent than those prevalent in Punjab. Comparison of reaction of eastern Madhya Pradesh isolates of *Xanthomonas oryzae* pv. *oryzae* on a set of differentials with that of their already known reactions against isolates prevalent in Philippines and Japan revealed differences in pathogenicity behaviour of these isolates.

Key words: *Xanthomonas oryzae* pv. *oryzae,* isolates, virulence, pathogenicity

Bacterial leaf blight *(Xanthomonas oryzae* pv. *oryzae)* is one of the most wide spread diseases of rice in several rice growing countries. Several resistant cultivars against this disease have been identified and are extensively grown in different parts of the world. However, evolution of new pathotypes have rendered many of these resistant cultivars susceptible. Several isolates of the pathogen are known to occur in different rice growing countries. Horino (1981) reported existence of nine bacterial isolates in Indonesia. Six isolates of *Xanthomonas oryzae* pv. *oryzae* (Xoo) are known to occur in Philippines (Mew, 1987). Thrimurty *et al.* (1993) reported existence of six different isolates of *Xanthomonas oryzae* pv. *oryzae* in eastern Madhya Pradesh.

In the present study, we compared the virulence of isolates of *Xanthomonas oryzae pv. oryzae* prevalent in eastern Madhya Pradesh and Punjab on a set of isogenic lines obtained from International Rice Research Institute, Philippines. Comparison of reaction of isolates of *Xanthomonas oryzae* pv. *oryzae* prevalent in eastern Madhya Pradesh with that of their known reactions against isolates prevalent in Philippines and Japan was also carried on a set of differentials.

*Author for correspondence

Present address: Plant Breeding & Genetics, IGKV, Regional Agricultural Research Station, Bilaspur 495 001

[1]Guyana Rice Development Board, Govt. of Guyana, Georgetown, Guyana

[2]Department of Plant Pathology, Indira Gandhi Krishi Vishwavidyalaya, Raipur 492 012

MATERLIALS AND METHODS

Two separate experiments were laid out during *kharif* 1995 under green house conditions. Comparison of virulence of isolates of *Xanthomonas oryzae* pv. *oryzae* prevalent in eastern Madhya Pradesh & Punjab was carried out on a set of isogenic lines obtained from International Rice Research Institute, Philippines. Two- metre long two rows of each isogenic lines were sown in eleven sets, (twenty five days old seedlngs of the isogenic lines were transplanted), each set being reserved for inoculation with a individual isolate at maximum tillering stage. Six isolates as reported by Thri Murty *et al.* (1993) and another five isolates of the *Xanthomonas oryzae* pv. *oryzae* obtained from Punjab were used in the present study. For the second experiment, two-metre long two rows of differentials were sown in six set, each set being reserved for inoculation with each of individual isolates prevalent in eastern Madhya Pradesh for comparison of their reaction with reported reaction of isolates from Philippines and Japan.

For inoculation, 48-72 hours old cultures of different pathotypes were multiplied on potato sucrose peptone agar media and the test strains were inoculated with bacterial inoculum containing 10^{7-9} cfu/ml through clipping method (Kauffman *et al.* 1973) at maximum tillering stage. Reactions were recorded 21 days after inoculation following standard evaluation system of IRRI (Anonymous. 1988) and isogenic lines were classified as resistant, moderately susceptible and susceptible on the basis of percentage leaf area infection in the 0-9 scale. Scores 0 and 3 was classified as resistant, 5 as moderately susceptible and 7 and 9 as susceptible as per standard procedure. Further, the reac-

Table 1. Comparision Of virulence of eastern M.P. and Punjab isolates of *Xanthomonas oryzae* pv. *oryzae*

Lines	Percentage leaf area infection / Reaction										
	Eastern M.P. Isolates						Punjab Isolates				
	6	6R	6-4R	6-5R	6-6R	6-7R	P3	P7	P8	P10	P12
IRBB I	30.29/S	9.92/R	43.92/S	55.22/S	36.97/S	48.07/S	9.99/R	23.93/MS	21.31/MS	6.40/R	9.45/R
IRBB 2	29.3 7/S	7.76/R	55.67/S	52.67/S	32.26/S	39.56/S	22.02/MS	13.42/MS	9.67/R	13.79/R	23.99/MS
IRBB 3	10.20/R	5.65/R	27.48/S	31.18/S	18.60/MS	36.22/S	19.42/MS	10.74/R	15.15/MS	23.65/MS	9.16/R
IRBB 4	9.33/R	5.99/R	25.93/S	26.21/S	17.01/N4S	19.56/MS	19.42/MS	7.68/R	18.71/MS	26.38/S	9.56/R
IRBB 5	11.31/R	13.33/MS	33.75/S	23.20/MS	16.32/N4S	24.39/MS	10.37/R	10.30/R	11.69/R	8.90/R	10.26/R
IRBB 7	16.97/MS	10.77/R	40.28/S	54.82/S	23.39/MS	20.68/MS	15.12/MS	21.06/MS	9.99/R	13.89/MS	23.64/
IRBB 8	6.02/R	14.33/N4S	48.63/S	56.55/S	16.98/N4S	24.58/MS	22.04/MS	10.22/R	22.27/N4S	10.94/R	10.60/R
IRBB 10	16.33iMS	16.91/N4S	45.53/S	62.91/S	24.54/MS	33.46/S	15.12/N4S	20.00/MS	21.76/MS	9.00/R	10.07/R
IRBB 11	22.15/MS	15.30/MS	46.83/S	70.38/S	25.71/S	35.17/S	20.21/N4S	20.53/MS	18.84/MS	22.69/MS	27.86/S
IRBB I'	24.22 /MS	11.70/R	14.15/N4S	3.5 1 /R	11.37/R	10.66/R	31.25/S	10.93/R	9.54/R	22.88/N4S	28.94/S
Ave. (%) Area of infection	17.61	11.10	38.21	43.66	22.31	29.24	18.49	14.88	15.85	15.85	16.30
Virulence Index	VI	X	II	I	IV	III	V	IX	VIII	VIII	VII
Reaction	2S	OS	9S	8S	3S	5S	1S	0S	0S	1S	2S
Frequency	4MS	4MS	1MS	1MS	6MS	4MS	7MS	5MS	6MS	4MS	2MS
	4R	6R	0R	1R	1R	1R	2R	5R	4R	5R	6R

S =Susceptible, MS = Moderately susceptible, R = Resistant.

Table 2. Comparision of reaction of eastern Madhya Pradesh, Philippines and Japanese isolates of *Xanthomonas oryzae* pv. *oryzae*

Differentials	Reaction against different isolates																
	Eastern Madhya Prades						Philippine						Japanese				
	6	6R	6-4R	6-5R	6-6R	6-7R	PXO 61	PXO 86	PXO 79	PXO 71	PXO 112	PXO 99	T. 7174	T. 7156	T. 7147	T. 7133	Q. 6809
IR 8	S	R	MS	MS	MS	MS	S	S	S	S	S	S	S	R	R	S	R
IR 20	R	R	MS	MS	MS	S	R	S	S	MS	R	S	R	R	R	R	R
Cas 209	S	MS	MS	MS	MS	MS	S	R	S	S	S	S	S	S	S	S	S
DV 85	R	R	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R
Wase Aikoku 3	R	R	S	S	S	S	R	R	R	R	–	–	R	R	R	S	S
Java 14	R	S	S	S	S	R	R	R	R	R	R	S	R	R	R	S	R
Tetep	R	MS	S	S	S	S	S	S	S	S	S	S	R	R	S	S	R
IR 1545-339	R	MS	Ms	S	MS	S	R	R	R	MS	R	S	R	R	R	R	R
Kogyoku	MS	R	S	S	S	MS	S	S	S	S	S	S	R	S	S	S	R
P1231129	R	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R
Frequency	3S	1S	5S	7S	6S	7S	4S	4S	5S	4S	4S	7S	2S	2S	3S	6S	2S
	1MS	2MS	5MS	4MS	3MS	0MS	0MS	0MS	2MS	0MS	0MS	0MS	0MS	0MS	0MS	0MS	0MS
	6R	7R	0R	0R	0R	0R	6R	6R	5R	4R	5R	2R	8R	8R	7R	4R	8R

R= Resistant, MS= Moderately susceptible, S= Susceptible; — = Reaction not reported.

tions of eastern Madhya Pradesh isolates recorded from different differentials were compared with the reported reactions of Philippines and Japanese isolates on the same differentials (Veracruz and Mew, 1989).

RESULTS AND DISCUSSION

Based on the reactions recorded in terms of the percent leaf area infection, isolate 6-5R of eastern Madhya Pradesh was the most virulent followed by

6-4R, 6-7R and 6-6R isolates (Table 1) . All these four isolates of eastern Madhya Pradesh were found to be more virulent than any of the isolates from Punjab. Among the isolates from Punjab, isolate P3 recorded highest percent leaf area infection of 18.49. Among all isolates, isolate 6R from eastern Madhya Pradesh was the least virulent with percent leaf area infection of 11.10 percent.

For the isolates of eastern Madhya Pradesh, resistant genes Xa-3, Xa-4, Xa-5, xa-8 present in isogenic lines IRBB-3, IRBB-4, IRBB-5 and IRBB-8 respectively showed resistant reaction against isolate 6. Similarly, resistant genes Xa-1, Xa-2, Xa-3, Xa-4, Xa-7 recorded resistant reaction against isolate 6R and Xa-1^h showed resistant reaction against isolates 6R, 6-5R, 6-6R and 6-7R. Sidhu *et al.* (1986) reported that none of the resistant genes Xa-1, Xa-2, Xa-3, Xa-4, xa-5, Xa-6, Xa-7, xa-8, Xa-9, Xa-lo and Xa-1^h conveyed resistant reaction to isolates from Punjab. The isolates of *X.oryzae* pv. *oryzae* in different region may be a product of long evolution stabilized through a long period of gene interaction with the host (Veracruz and Mew, 1989). The behaviour of a gene is also influenced by the prevailing environmental conditions. In the present study, some of the above mentioned genes showed resistant reaction against the isolates prevalent in Punjab when tested at Raipur. Xa-1 gene present in IRR showed resistant reaction against isolates P3, P 10, P12. Xa-4 present in IRBB-4 showed resistant reaction against isolates P7 and P 12 and Xa-5 present in IRBB-5 showed resistant reaction against isolates P3, P71, P10 and P12.

Comparison of reaction of a set of differentials to different eastern Madhya Pradesh isolates (Table 2) with their reported reaction to Philippines and Japanese isolates as reported earlier (Veracruz and Mew, 1989), clearly indicated dfferent pathogenicity behaviour of eastern Madhya Pradesh isolates from those of Philippines and Japanese isolates. However, isolate 6 of eastern Madhya Pradesh exhibited similar reaction as that of isolate Pxo 61 of Philippines. These two perhaps may be the same. Results further indicated that based on gene(s) beating capacity, isolate 6-5R , 6-6R and 6-7R of Madhya Pradesh were more virulent than those of Philippines and Japanese isolates.

Isolates of *Xanthomonas oryzae* pv. *oryzae* from India, Nepal and Bangladesh are reported to have boarder spectrum of virulence than those from South East Asia (Veracruz and Mew, 1989). Sidhu *et al.* (1986) reported that the isolates of *Xc.* pv. *oryzae* of Punjab differs in pathogenicity behaviour from races of Japan and Philippines. Present study indicated that eastern Madhya Pradesh isolates also differ in pathogenicity behaviour from those of Japanese and Philippines isolates, except perhaps isolate 6 of eastern Madhya Pradesh of India which exhibited similar reaction to Pxo 61 of Philippines indicating similarity of these two isolates.

ACKNOWLEDGMENTS

The authors are grateful to Dr. G. S. Khush, International Rice Research Institute,Philippines for providing the isogenic lines and differentials, and Dr. R.G. Saini and Dr. A.K.Gupta of Punjab Agricultural University for providing the Punjab isolates.

REFERENCES

Horino, O. (1981). A survey of geographical distribution of pathogenic groups of *Xanthomonas campestris* pv. *oryzae. Ann. Phytopathol. Soc.* Japan. **47** : 50-57.

Anonymous (1988). *Standard Evaluation System for Rice.* International Rice Research Institute, Philippines. 44pp.

Kauffman, H.E., Reddy, A.P.K., Hsiech, S.P.V. and **Merca, S.D.** (1973). An improved technique for evaluating resistance of rice varieties to *Xanthomonas oryzae. Plant Dis. Reptr.* **57** : 537-541.

Mew, T.W. (1987). Current status and future prospects of research on bacterial blight of rice. *Ann. Rev. Phytopathol.* **25** : 359-382.

Sidhu, G.S., Ganeja, M.R., Raina, G.L. and **Saini, R.K.** (1985). Genetics of bacterial blight resistance in rice. *Rice Genetics* **1** : 481-489.

Thrimurty, V.S., Kumar, Arvind, Lakpale, N., Agrawal, K. C., Kotasthane, A.S. and **Shrivastava, M.N.** (1993). Pathogenic variability of *X c.* pv. *oryzae in* Chhattisgarh region of India. *Oryza* **30** : 239-244.

Veracruz, C.M. and **Mew, T.W.** (1989). How variable is *Xanthomonas campestris pv.oryzae.* In:*Proc. Intern. Workshop Bacterial Blight of Rice*, International Rice Research Institute, Philippines. 153-165.

Received for publication March 3, 1999