

DETECTION OF BACTERIAL PATHOGENS IN PADDY SEED LOTS IN PAKISTAN

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One hundred and fifty three seed samples were collected from major paddy crop growing areas during 1987-88 to 1990-91 and tested for the presence of seed-borne bacterial pathogens using a seedling symptom test. Maximum seed infection due to *Xanthomonas oryzae* pv. *oryzae*, ex Ishiyama (Swings *et al.*) was 11 and 12% in variety IRRI-6 at Lahore and Hyderabad respectively. While in case of *Acidovorax avenae* sub sp. *avenae*, infection was 13% in variety B-385 from Sahiwal. It was observed that the percentage of seed infection due to bacterial pathogens varied from cultivar to cultivar in different localities. Keeping in view the high infection level of these bacterial diseases, future studies are needed on seed transmission and epidemiology of these pathogens for better disease control strategies.

Key words: Seed-borne, Bacterial diseases, Paddy (Rice).

Introduction

Seed bacteriology in general and seed health testing for bacterial pathogens in particular is a neglected field in Pakistan. Therefore, testing of paddy seed for plant pathogenic bacteria has received little attention as a mean of controlling seed-borne bacterial diseases. Despite of high incidence of bacterial diseases on paddy crop [1-3], seeds of this crop are only tested to a limited extent in Pakistan before sowing.

Infected seed plays a significant role in the epidemiology of paddy bacterial diseases [4]. Bacterial blight caused by *Xanthomonas oryzae* pv. *oryzae* and bacterial stripe of paddy caused by *Acidovorax avenae* sub sp. *avenae* are reported to be seed-borne in nature [5-8]. Mukerjee and Singh [9] isolated *X. oryzae* pv. *oryzae*, ex Ishiyama (Swing *et al.*) from parenchyma, embryo and endosperm of rice seed. Crop losses as high as 20-30% are reported from this disease in the Philippines and Indonesia [10]. Little, rather negligible information is available on the occurrence of these pathogens in seed in Pakistan.

Keeping in view the importance of paddy crop in Pakistan's economy and disease hazards due to bacterial pathogens, the Federal Seed Certification Department initiated bacterial seed health testing for the first time during 1987 in Pakistan. The present study was carried out to detect, identify and to determine the occurrence of these pathogens in paddy seed lots of commercially grown cultivars in different ecological zones of Pakistan.

Materials and Methods

Collection of seed samples. A total of 153 seed samples of various cultivars of paddy were collected from major cultivated areas through the field laboratories of the Department during 1987-88 to 1990-91. Seed samples (1000 gm) were drawn according to the ISTA rules [11].

Detection of bacteria by seedling symptom test. From the each submitted sample (1000 gm), a working sample of 400 seeds was prepared and tested for identification of *X. oryzae* pv. *oryzae* and *Acidovorax avenae* using a seedling symptom technique [6,8,12-14]. Bacteria isolated from seedlings showing brown stripe were identified by gram staining method [15], tobacco hypersensitivity, pathogenicity and biochemical tests as described by Shakya *et al.* [8]. The pathogenicity of *X. oryzae* was done by leaf clip method [16]. Results were expressed in percentage of seedlings showing bacterial symptoms.

Results and Discussion

Ranges of seedling infection percentage of the bacterial diseases (*X. oryzae* pv. *oryzae* and *A. avenae*) recorded in paddy are listed in Table 1. These bacterial pathogens produced blight and stripe symptoms separately when inoculated on paddy seedling [6,11-13]. Brown stripe symptoms produced by *A. avenae* were observed on seedlings within 10 days in petri dish experiment. Severely affected seedlings were predominantly dwarf stripe and gave heavy bacterial ooze. *X. oryzae* produced pale seedlings with poor growth, light to dark brown coleoptiles and discoloured sheaths. The isolates from bacterial symptom on tobacco were strongly positive, gram negative, indol production negative and oxidase reaction positive.

Maximum infection of *X. oryzae* pv. *oryzae* was 11 and 12% in variety IRRI-6 from Lahore and Hyderabad areas during 1987-88 and 1990-91, respectively. On variety B-385, highest incidence was 11% during 1990-91 at Lahore. Seed samples were found free of seedling infection in variety B-370 during 1987-88 and 1988-89 while the variety Sadahayat and Latefy were also found free during 1989-90. Akhtar and Akram [3] reported that IRRI-6 showed highest susceptibility

TABLE 1. DETECTION OF SEED-BORNE BACTERIAL PATHOGENS IN PADDY SEED.

Locality cultivar	1987-88			1988-89			1989-90			1990-91		
	No. of samples tested	Percentage infection range		No. of samples tested	Percentage infection range		No. of samples tested	Percentage infection range		No. of samples tested	Percentage infection range	
		<i>X. oryzae</i>	<i>A. avenae</i>		<i>Z. oryzae</i>	<i>A. avenae</i>		<i>Z. oryzae</i>	<i>A. avenae</i>		<i>X. oryzae</i>	<i>A. avenae</i>
LAHORE												
B-385	10	0.0-6.5	1.5-5.0	8	0.0-6.5	1.0-5.0	3	0.0-1.0	0.5-2.0	2	5.0-11.0	3.0-9.0
B-198	2	0.5-1.0	0.5-1.5	-	-	-	-	-	-	2	0.5-7.0	0.1-8.0
B-370	1	0.0	0.5	2	0.0	0.5	-	-	-	1	2.0	7.0
IRRI-6	3	0.0-11.0	1.0-6.0	2	0.0-11.0	1.0-6.0	2	0.0-2.0	0.5-3.0	2	0.0-4.0	0.5-6.0
SAHIWAL												
B-385	8	1.0-7.5	5.0-13.0	3	1.5-5.0	1.0-8.5	5	1.0-4.0	2.0-4.0	16	0.0-2.0	1.0-5.0
B-198	2	0.5-1.0	5.0-6.0	1	1.0	1.5	-	-	-	-	-	-
B-370	2	1.5	4.0	1	1.0	2.0	-	-	-	1	2.5	3.0
IRRI-6	4	1.0-4.5	1.0-9.0	3	0.5-1.5	0.0-2.5	3	1.0-6.0	1.0-4.0	3	1.5-10.5	2.5-7.5
KS-282	1	2.0	7.5	1	-	2.5	2	1.0	1.0-3.0	4	1.0-5.5	1.5-3.5
SUKKUR												
IRRI-6	-	-	-	5	1.0-4.0	1.5-4.0	12	0.0-6.0	0.0-4.0	3	1.0-2.5	2.0-3.5
Shadab	-	-	-	4	1.0-3.0	2.0-5.5	-	-	-	-	-	-
Sadahayat	-	-	-	1	1.0	2.0	1	0.0	0.0	1	1.0	1.5
DR-82	-	-	-	1	1.0	4.0	1	1.0	2.0	2	1.0-2.5	2.0-3.5
DR-83	-	-	-	1	1.0	2.5	2	0.0-2.0	0.0-1.0	2	0.5-1.5	0.5-2.5
Lateefy	-	-	-	-	-	-	1	0.0	0.0	1	1.0	4.0
HYDERABAD												
Shadab	2	0.5-1.5	1.0-4.0	-	-	-	-	-	-	1	4.0	6.0
IRRI-6	-	-	-	-	-	-	3	2.0-3.0	0.0-2.0	2	3.0-12.0	0.5-5.5
D.I. KHAN												
IRRI-6	2	0.0-0.5	0.0-1.0	4	0.0-1.5	1.5-3.0	-	-	-	-	-	-
KS-282	1	1.0	0.5	-	-	-	-	-	-	-	-	-
Total:	38			37			35			43		

Note: (-) Seed samples were not available.

to *X. oryzae* during evaluation of national uniform yield trials, 1985. In case of *A. avenae*, maximum infections of 13 and 9% were observed on varieties B-385 and IRRI-6 from Sahiwal during 1987-88 respectively. Seed samples of the varieties Sadahayat and Lateefy from Sukkur area were found free during 1989-90.

Bacterial blight of rice caused by *X. oryzae* pv. *oryzae* has already been reported from the field [3] with an incidence range from 10-20% on cultivars B-385 in major rice growing areas of Punjab. Bacterial stripe (*A. avenae*) has not been reported so far in paddy fields in Pakistan. Detection of *A. avenae* from paddy seed samples confirms the results obtained by Shakya *et al.* [6] who reported 34 and 1% seedling infection in seed samples of the variety IRRI-6 and B-370 respectively.

In this study, the infection level recorded on different varieties might be due to climatic conditions prevalent and degree of resistance exhibited by the individual variety [1]. During 1987-88 to 1990-91, the average temperature ranged between 25-30° in the field with 210.2 mm to 244.6 mm

average rainfall in the months of July and Aug. in and around Lahore paddy growing areas. This relationship of temperature and rainfall has not been observed at other places during the rice growing season. Therefore, it can be assumed that these bacterial diseases may be more prevalent in central Punjab than Sindh areas as it is also evident in this studies. This disease was also recorded in many localities of the rice growing areas of the Punjab [1].

Keeping in view the prevalence and incidence of seed-borne bacterial pathogens involved in seedling infection, testing for health status of pre-basic (breeder seed) and basic class of seed under seed certification has been recommended for management of general seed-borne diseases [17].

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average rainfall in the months of July and Aug in and around Lahore badly growing areas. This relationship of temperature and rainfall has not been observed in other places during the rice growing season. Therefore, it can be assumed that these bacterial diseases may be more prevalent in coastal Punjab than South Punjab as it is also evident in this study. This disease was also recorded in many localities of the rice growing areas of the Punjab [1].

Keeping in view the prevalence and incidence of seed-borne bacterial pathogens involved in seedling infection, testing for health status of pre-basic (brooder seed) and basic class of seed under seed certification has been recommended for management of general seed-borne diseases [17].

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to X. Oryza during evaluation of bacterial wilt in rice fields. In case of A. oryzae maximum infections of 13 and 9% were observed on varieties B-385 and IRI-6 from Sialkot during 1987-88 respectively. Seed samples of the varieties Sialkot and Lahore from Sialkot area were found free from bacterial blight of rice caused by X. oryzae by oryzae has already been reported from the field [3] with an incidence range from 10-20% on cultivar B-385 in major rice growing areas of Punjab. Bacterial wilt (A. oryzae) has not been reported so far in badly fields in Pakistan. Decision of A. oryzae from badly seed samples contains the results obtained by Shakya et al. [6] who reported 34 and 1% seedling infection in seed samples of the variety IRI-6 and B-370 respectively.

In this study the infection level recorded on different varieties might be due to climatic conditions prevalent and degree of resistance exhibited by the individual variety [1]. During 1987-88 to 1990-91 the average temperature ranged between 22-30° in the Punjab with 2102 mm to 2446 mm