EVALUATION OF WHEAT LINES/VARIETIES AGAINST ARTIFICIAL AND NATURAL INOCULUM OF *PUCCINIA RECONDITA* F.SP. *TRITICI* CAUSING BROWN RUST

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One hundred and ninty seven advance lines/varieties were sown on 1st of November and December, 2000 at Department of Plant Pathology. University of Agriculture, Faisalabd. The nursery was inoculated with *Puccinia recondita* f. sp, *tritici* and natural inoculum was also relied upon for infection. Based on a leaf rust severity scale 89 lines/varieties were free from disease symptoms, 43 lines/varieties were resistant, 32 moderately resistant, 10 moderately susceptible. 16 susceptible and 7 were highly susceptible in early sown nursery. In late sown nursery 74 were asymptomatic, 28 were resistant, 31 moderately resistant. 8 moderately susceptible, 17 susceptible and 39 highly susceptible. There were no symptoms of yellow rust in either early or late sown nurseries, Majority of lines/varieties sown on 1st of December had significantly higher leaf rust severity compared to the similar germplasm sown on 1st November. Commercially grown wheat varieties i.e., Inqilab 91. Bahawalpur 97, MH 97. Kohistan 97 and Iqbal 99 had no leaf rust symptoms indicating their resistance status against the disease. Eighty nine and 74 lines/varieties in early and late sown nursery respectively, were free of any disease symptoms or insect attack indicating their good genetic potential which can be exploited for breeding against disease and pest resistance in future.

Key words: leaf rust, *Puccinia recondite* f sp. *tritici*, wheat, resistance. susceptibility.

INTRODUCTION

Wheat leaf rust caused by *Puccinia recondita* Roberge ex Desm. f sp, *tritici* (Eriks & E. Henn.) D,M. Henderson is one of the devastating diseases of wheat in Pakistan and throughout the world. Several epidemics of this disease have been recorded in the past and it continue to be a major threat to future wheat production. Cultivation of resistant varieties is the most economical method of leaf rust control. Several research workers have reported screening of wheat germplasm against leaf rust (Arora *et al.*, 1987; Chaudhry *et al.*, 1993: Chaudhry *et a/*.. 1996; Hussain *et al., 1999),* Objective of these studies was to identify resistant sources against artificial and natural inoculum of *P. recondita* f sp. *tritici* on the available wheat germplasm. The second objective was to determine the amount of leaf rust intensity on early and late sown wheat varieties/lines and to monitor the prevalence of new infection types on the late sown germplasm,

MATERIALS AND METHODS

One hundred and ninety seven lines/varieties collected from Wheat Research Institute, Ayub Agricultural Research Institute and Department of Plant Breeding and Genetics, University of Agriculture were sown on 01-11-2000 and 01-12-2000 at the research area of Department of Plant Pathology, University of Agriculture. Faisalabad. Each of the line/variety consisted of a five meter row separated by two rows of leaf rust spreader varieties i.e. Pak. 81 and Morocco after every five rows. The two nurseries were sown 100 meters apart and kept in good condition following recommended agronomic practices. During February 200 I both the nurseries were inoculated artificially from leaf rust affected wheat leaves of Pak. 81 and Moroco collected from AA RI, Faisalabad. Leaf rust severity based on a scale described by lames, (1971) was recorded at 10 days intervals starting from the initial appearance of disease symptoms and ending at the physical maturity of the crop or when the leaves became necrotic due to rust.. In order to avoid visual observation error the help of a computer programme "DISTRAIN" was taken. Before going to field for actual disease ratings sufficient practice was made by visualizing the leaf rust severity on sample leaf shown by computer monitor and the estimated severity data were punched with keyboard and the actual severity was obtained from computer. Thus the accuracy percentage of skill was enhanced. The leaf rust severity on flag leaf of ten randomly selected leaves of each line/variety was compared with the scale (lames, 1971) and the data recorded were averaged by taking the dates of disease rating as replications of disease observations.

RESULTS AND DISCUSSION

Out of 197 lines/varieties majority of the lines/varieties remained asymptomatic whether sown early or late as indicated by no disease symptoms on 89 and 74 lines/varieties sown 1st of November and 1st of December. 2000. respectively (Table I). A total range of 39-42 lines/varieties showed moderately resistant to moderately susceptible response and 16 lines/varieties remained susceptible. In the early sown nursery only seven varieties/lines were highly susceptible. while in late sown crop 39 lines/varieties became highly susceptible. Most of the lines/varieties showed normal infection types. The appearance of abnormal/off type infection was also not evident indicating no sudden shift. of rust virulences. The incidence of leaf rust in this region varies with

the time and abundance of primary infections, virulences of prevalent races of *Puccinia recondita* f sp. *tritici*, cultivation of susceptible germplasm and conducive environmental conditions. Generally wheat varieties grown in this region express increased incidence of rust after 5-10 years of cultivation (Chaudhry *et al*.. 1993). In southeastern United States wheat varieties express increased incidence of rust after 5 years of cultivation (Leonard et al.. 1992: Long *et al*.. *1993).* In the intervening years. the extent of rust development varies from negligible to moderate amounts depending upon the scale of cultivation of susceptible varieties and favorable weather conditions. Pak-81 remained resistant to leaf rust in the field for 10 years (Chaudhry *et al*.. 1993). Its infection began during 1990 as 10 grade of the scale indicating Moderately Resistant to Moderately Susceptible response and the inoculum continued to multiply rapidly during 1991 and 1992 as the variety occupied more than 60 per cent field area under cultivation. As a result the incidence of leaf rust was recorded up to 80 MS-S (Chaudhry *et al.,* 1993). The resistant gene against leaf rust fungus in Pak-81 and Fsd-85 has been reported to be Lr26. Several genes conditioning seedling and/or adult plant resistance were also postulated by Rizvi and Hussain, (1984). Pak-81 has become highly susceptible while Fsd-85 inspite of having Lr26 maintained its moderate resistance level under rust conditions in this regions since last 15 years. Th is may be due to the combination of Lr34 (adult plant resistant gene) and Lr26 in this variety. also evident from leaf tip necrosis (Chaudhry *et al.,* 1996). This leaf tip necrosis is considered a linked character with Lr34 and provided durable resistance (Singh and Rajaram, 1992). Lu-26 released in 1976 has been reported to be carrying Lr I and Lrl3 genes against leaf rust fungus (Chaudhry *et 01.. 1998).* This variety has been cultivated for a long time and remained quite durable against virulences of leaf rust fungus probably due to the presence of partial resistant adult plant resistant genes. but now it has become vulnerable to the attack of several fol iar pathogens (Khan and Ilyas. 1996). The combination of Lr13, Lr34 and some additional recessive genes may offer durable resistance against leaf rust fungus (Knot! and Yadan, 1993: Mclntosh, 1992). For durable rust resistance Rizvi and Hussain (1984) calculated pathogenicity association coefficient (PAC) and virulence association coefficient (VAC) and suggested combinations for every possible pair of two host genes conferring best control of leaf rust disease.

The current studies indicate that most of the lines/varieties had fair degree of resistance to *P. recondita* f sp. *tritici* and the appearance of normal infection types show that the available wheat germplasm is a good genetic stock which can be relied upon for breeding varieties/lines against leaf rust fungus

Table I. Response of wheat lines/varieties to artificial and natural infection by *Puccinia recondita* f. sp. *trifid*

Sl'. No.	Name of wheat line/ variety	Leaf rust severity (early sowing)	Resistance or susceptibi Iity status	Leaf rust severity (late sowing)	Level of resistance or susceptibility
I.	HD 2169	15	MS	25	HS
2.	HD 2179	15	MS	25	HS
3.	HD 2204	5	R	20	S
4.	HD 2'J85	20	S	25	HS
5.	HD ')329	20	S	25	HS
6.	C 271	5	R	10	MR
7.	C 273	5	R	10	MR
8.	C SIX	3	R	7	MR
9.	C 591	20	S	10	MR
10.	Maxipak	20	S	25	HS
11.	Blue silver	20	S	25	HS
12.	WL 711	5	R	25	HS
13.	Chenab 70	2	R	25	HS
14.	Lyalpur 73	15	MS	10	MR
15.	Pothowar	0	R	10	MR
16.	Punjab XI	15	MS	10	MR
17.	Faisalabad 83	5	R	25	HS
18.	Shalimar 88	5	R	5	R
19.	Pak.81	I	R	25	HS
20.	Punjab 85	I	R	5	R
21.	Faisalabad 85	1	R	5	R
22.	Kohnoor 83	I	R	0	R
23.	Chakwal86	0	R	5	R
24.	Rawal87	5	R	5	R
25.	Pasban 90	0	R	0	R

26.	Rohtas 90	0	R	10	MR
27.	Inqlab 91	0	R	I	R
28.	Auqab 99-94105	0	R	1	R
29.	Bobwhite	0	R	5	R
30.	Lu26S	0	R	25	HS
31.	Punjab 76	20	S	25	HS
32.	SA 42	20	S	25	HS
33.	SA 75	15	MS	25	HS
34.	Nacozar 176	10	MR	25	HS
35.	Spica	10	MR	15	MS
36.	Shahkar 95	I	R	5	R
37.	Punjab 96	5	R	5	R
38.	V 87094- Wattan	10	MR	25	HS
39.	Parwaz 94	5	R	5	R
40.	PBW 343	0	R	5	R
41.	Kohsar 95	0	R	5	R
42.	Era	0	R	0	R
43.	Sarsabz	0	R	0	R
44.	Crow	0	R	0	R
45.	Panda	0	R	0	R
46.	Chris	0	R	0	R
47.	Arz	20	S	25	HS
48.	Morocco	25	HS	25	HS
49.	Frontana	5	R	5	R
50.	V 8520"	0	R	0	R
51.	Chakwal97	I"	MS	5	R
52.	8ahawalpur 97	0	R	0	R
53.	V 92128	0	R	0	R
54.	MH 97	0	R	0	R
55.	Kohstan 97	0	R	0	R
56.	V 95/19	0	R	0	R
57.	Pavon	0	R	0	R
58.	lqbal 99	0	R	0	R
59.	Lrl	10	MR	20	S
60.	Lr2a	10	MR	20	S
61.	Lr2b	10	MR	20	S
62.	Lr2c	10	MR	20	S
63.	Lr3	10	MR	20	S
64.	Lr3Ka	10	MR	20	S
65.	Lr3~	10	MR	20	S
66.	Lr9	0	R	5	R
67.	LrlO	5	R	10	MR
68.	Lrll	5	R	20	S
69.	Lr12	5	R	10	MR
70.	Lrl3	10	MR	15	MS
71.	Lrl4a	10	MR	15	MS
72.	Lrl4b	5	R	5	R
73.	Lrl"	10	MR	20	S
74.	Lrl6	10	MR	20	S
75.	Lrl7	15	MS	15	MS
76.	Lrl8	10	MR	10	MR
77.	Lr19	5	R	5	R
78.	Lr20	20	S	25	HS
79.	Lr/_ I	0	R	0	R
80.	Lr22a	5	R	5	R

81.	Lr22b	10	MR	20	S
82,	Lr23	10	MR	20	S
83,	Lr24	5	MR	10	MR
84,	Lr25	0	R	0	R
85,	Lr26	0	R	0	R
86,	Lr 27 ' 31	10	MR	25	HS
87,	Lr28	5	R	0	R
88.	Lr29	10	MR	10	MR
89.	Lr30	5	R	10	MR
90.	Lr32	5	MR	25	HS
91.	Lr 33	0	R	15	MS
92.	Lr34	0	R	0	R
93.	Lr 35	0	R	0	R
94.	Lr36	0	R	0	R
95.	Lr37	0	R	0	R
96.	Lr B	5	R	10	MR
97.	WI711 Lrl3	25	HS	25	HS
98.	GazaLr23+	15	MS	10	MR
99.	V84133-6	0	R	0	R
100	Yrl-E-I	20	S	15	MS
101.	Local White	25	HS	25	HS
102.	Yrl-E18	20	S	25	HS
103.	Yr2 - E35	20	S	25	HS
104.	Yr5 - EI9	25	HS	25	HS
105.	Yr5 - £25	5	R	25	HS
106.	Yr5 - £29	25	HS	25	HS
107.	Yr6 + E I1	0	R	25	HS
108.	Yr6 + APR - £38	0	R	20	S
109.	Yr6 - Yr7~-E37	0	R	25	HS
110.	Yr7· F36	0	R	I	R
111.	Yr7t FIO	0	R	5	R
112.	Yr8 - E20	0	R	20	S
113.	Yr8 - E26	15	MS	10	MR
114.	Yr9 - E32	0	R	0	R
115.	YrlO - E5	15	MS	25	HS
116.	YrlO EJO	5	R	10	MR
117.	Yrl5 E21	25	HS	25	HS
118.	Yrl5 ~ E27	20	S	25	HS
119.	Yrl8 E33	5	R	10	MR
120.	YrA - E23	20	S	25	HS
121.	YrA -I E40 (Anza)	20	S	25	HS
122.	Yrl) SEERI-E45-CHECK	20	S	25	HS
123.	97046	10	MR	0	R
124.	97052	5	R	0	R
125.	98123	0	R	0	R
126.	98124	25	HS	25	HS
127.	97079	0	R	0	R
128.	97019	5	R	0	R
129.	97022	0	R	0	R
130.	97024	0	R	0	R
131.	98109	5	R	0	R
132.	98121	0	R	0	R
133.	97013	0	R	0	R
134.	97005	0	R	0	R
135.	95069	5	R	0	R

136	95153	5	R	0	R
137	97106	5	R	0	R
138.	97112	5	R	0	R
139.	96052	0	R	0	R
140.	96014	0	R	0	R
141.	97088	0	R	0	R
142.	SH 88	10	MR	15	MS
143.	90A254	0	R	0	R
144.	90A359	0	R	0	R
145.	91038	0	R	0	R
146.	91100	0	R	0	R
147.	19131	0	R	0	R
148.	92133	0	R	0	R
149.	8512-1	10	MR	20	MS
150.	9212-8	10	MR	10	MR
151.	92145	10	MR	10	MR
152.	8453	0	R	0	R
153.	9214	0	R	0	R
154.	92165	0	R	0	R
155.	92171	0	R	0	R
156.	92173	10	MR	10	MR
157.	92190	0	R	0	R
158.	93001	0	R	0	R
159.	93024	0	R	0	R
160.	93032	0	R	5	R
161.	93104	5	R	10	MR
162.	8454	0	R	0	R
163.	93105	0	R	0	R
164.	93108	10	MR	25	HS
165.	93111	0	R	0	R
166.	93115	0	R	0	R
167.	93118	0	R	25	HS
168.	93141	0	R	0	R
169.	93147	0	R	0	R
170.	93152	10	MR	5	R
171.	94/11	0	R	0	R
172.	94117	0	R	0	R
173.	94119	0	R	0	R
174.	87094	5	R	10	MR
175.	90A 104	0	R	0	R
176.	882208	0	R	0	R
177.	8829	0	R	0	R
178.	8466	0	R	0	R
179.	8453	0	R	0	R
180.	8454	0	R	0	R
181.	8460	0	R	0	R
182.	8460-1	0	R	10	MR
183.	8460-2	0	R	0	R
184.	8464	0	R	0	R
185.	8466	0	R	20	S
186.	8466-1	0	R	20	S
187.	8467	0	R	10	MR
188.	8467-2	10	MR	5	R
189.	8469	10	MR	5	R
190.	8470	10	MR	10	MR

191.	8470-2	5	R	10	MR
192.	847\	5	R	10	MR
193.	8475	3	R	9	R
\94.	8479	0	R	10	MR
\95.	8482	0	R	10	MR
196.	4939	0	R	5	R
197.	5039	5	R	5	R

0 = Immune or asymptomatic 1-5% = Resistant 6-10 = Moderately Resistant 11-15 = Moderately Susceptible
16-20 = Susceptible 21-25 = Highly Susceptible

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