Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

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Asian Journal of Plant Sciences 2 (8): 613-615, 2003
ISSN 1682-3974

Screening of Wheat Varieties to Stripe Rust (*Puccinia striformis*) in the Field

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Abstract: 29 wheat lines were tested in the field against stripe rust disease of wheat under natural conditions. These lines had different genotypes of different origin. Only leaf infection was recorded. Reactions were ranging from immunity to extreme susceptibility 15 lines were found resistant. The reactions among these advance line were recorded variable. Rest of the 14 lines were found susceptible to this disease. These were advance lines with high yield potential as well as high disease resistant. After 4-5 years these lines will be determined as commercia wheat cultivars.

Key words: Stripe rust disease, wheat

Introduction

Stripe rust caused by *Puccinia striformis* a major disease that decrease production all over the world losses can be more due to foliar infections than spike infection. In Pakistan reported 60% grain yield loses on susceptible bread wheat Pirsabak 85 from Mardan area. In other high land area Boni Chitral where Pirsabak85 is being planted on large area, the losses due to this disease were recorded upto 20% during 1994-95. *Puccinia striformis* is a low temperature pathogen (Stubbs, 1998). In the wheat growing regions of Asia and East Africa, its occurrence predominates at high elevations. Stubbs (1998) considers to region an epidemiologic zone of stripe rust. According to Kirmani *et al.* (1989) the virulence spectrum of stripe rust in Pakistan is among the broadest in the world consequently, frequent breakdown of resistance to the disease has led to the several bread wheat cultivars being dropped from commercial production, including the very related (1B/1R translocation_ cultivar pak81. Tanner *et al.* (1993) emphasize the importance of stripe rust resistant cultivars for sustainable wheat production under increased fertilizer usage. In fact, breeding for resistance to stripe rust has been the major objective in Pakistan bread wheat improvement programme and attempts have been made to identify resistant sources (Khan, 1991), but only within the primary gene pool, *T. aestivum* sub sp. *aestivum.* Elsewhere, the dynamic nature of P. striformis has forced breeders and pathologists to look for resistance genes for wild relatives of wheat (Geretcher-amitai and Stubbs, 1970). In bread wheat useful variation for resistance to stripe rust is reported for world collection (Pecetti and Annicchiarico, 1991).

The vast majority of Pakistan Bread wheat is produced by the small holder sector in the plains and cool wet high lands which are potentially suitable to stripe rust epidemics. There is also growing interest to produce wheat on large scale on farmers field where stripe rust is the major disease. Therefore, this study was carried out to (1) determine the presence and extent of the variation available for the stripe rust resistant in bread wheat germplasm of different origin and (2) identity potential sources of resistance which may be used in crossing programmes.

Materials and Methods

The study was conducted in 1997-98 at multi locations in Pakistan in moderate to high lands. Some places are recognized hot spot for natural epidemics of Stripe rust (Ehsan *et al.*, 1997-98). In 1997 year a total of 29 bread wheat lines were evaluated. Details of the experiment for the year (1998) together with preliminary results are given by Ehsan *et al.* (1998) in Table 2. Only 15 lines showed the disease score in resistant scale (O to RMR) for leaf infection were evaluated further. 14 lines were found susceptible giving score MS to S. These lines were each grown in one row of one meter length. Cultivar Local white, a susceptible land race identified in the previous year was planted after the entry of each series and around the border as spore spreader and to assess the homogenicity of infection. As in 1998, disease records ere collection during the response of leaf infections were converted to a coefficient of infection (ci) using a constant value for the field response O, R, MR, M, MS

Table 1: Reaction classifications used in this study

Reaction class	Score	ci (leaf)	Spike coverage with pustules (%)
No infection	0	0	0
Resistant	1	0.1-1	trace
Moderately resistant	2	1.1-8	1-5
Moderately susceptible	3	8.1-16	6-15
Susceptible	4	16.1-40	16-30
Highly susceptible	5	>40	>30

Table 2: Bread wheat genotypes resistant to *Puccinia striformis* together with the susceptible checks local white.

	YR disease reactions from various place		
Lines	BARI, Chakwal	NARC, Islamabad	NIFA, Tarnab
DW-1	60S	40MR,S	0.0
NR-51	0.0	40MRMS	0.0
PR-65	0.0	0.0	0.0
NR-102	0.0	0.0	0.0
930065	30MRMS	70MRMS	0.0
94195	IORMR	0.0	0.0
BWL-949549	0.0	5MRMS	0.0
95R48	0.0	0.0	0.0
95022	TS	60MSS	TMR
95202	0.0	0.0	0.0
V-4	10MSS	20MRMS	TMR
V-7002	30MSS	50MRMS	TRMR
V-7012	40MSS	60MRMS	5MS
V-93BT022	0.0	50MSS	20MRMS
V-93032	0.0	10MRMS	TMR
V-93118	0.0	0.0	TMRMS
V-94042	20MSS	60MRMS	TMRMS
V-94091	0.0	0.0	TR
V-94105	TMR	30MRMS	0.0
V-94654	TMR	0.0	0.0
V-95219	10R	20MRMS	TRMR
94B2707	30MSS	70S	20MSS
94B2779	40MSS	80S	20MSS
AUP-9701	0.0	0.0	0.0
V-BR-01	0.0	0.0	0.0
DW-2	0.0	0.0	TR
WS-94102	30MSS	40MRMS	20RMR
WN-94130	10MSS	60MSS	TR
S-190157	40MSS	50MSS	20R
Local white	40s	60s	60s

and S (Stubbs *et al*., 1986). Then for each genotype, the highest disease score from the two seasons was taken to classify entries into reaction classes (Table 1).

Results and Discussion

Since 1993-94 there have been a recurrent epidemics of stripe rust in NWFP, Mardan areas as well as in Chitral. Boni areas (Ehsan *et al*., 1993), confirming the suitability of the 1997 season for prescreening for resistance to the disease. There was also a goo level of natural epidemics in 1996. When most of the immune entries in 1997 were infected to various degrees. None of the released bread wheat cultivar had satisfactory resistance, indicating their suitability for direct use in commercial production on farmers field and the need to look for other sources of resistant 14 varieties are immune to field infection type. Total 15 entries seen sofar are resistant. These lines are received from different sources from the country. Almost most of the lines resistant to stripe rust have amber colour seed. The flour of these lines is suitable for making breads, chapaties and macronies. International center for Agricultural Research in Dry areas (ICARDA) as well as in CIMMYT, genotypes with the score of ci>6 are considered resistant (ICARDA, 1993). An association was observed between resistance to spike infection and genotypes with short awns and lax spikes. These morphological traits have contributed to the high frequency to varieties/land races to spike infection as compared with mediterranean types that are compact and fully awned. According to Allan and Pritchett (1972) awns markedly enhance the prevalence of spike infection by stripe rust. It would be worth investigating this presumed relationship between spike infection by stripe rust. It would be worth investigating this presumed relationship between spike infection and the distinct morphology of such land races which are peculiar to Pakistan (Khan *et al*., 1998).

Futhemore, some lines were resistant only to one to the infection types, suggesting a further study on the relationship between resistance to leaf infection. The to pyothoraces (7E150 and 6E120) they used to create artificial epiphytotics were identified from northern regions of NWFP, although other races were dominant in 1995 (Ehsan and Kirmani, 1995).

The results of one year clearly indicate the broad range of resistance to stripe rust in breeders germplasm. Of particular interest is the variation in the land races, which may explain the sporadic nature of stripe rust on the land races cultivars grown in the cool-wet high lands (Altitude>2500M), despite the highly conducive environmental conditions for the development of the disease. AS in bread wheat, however it is possible that the

situation will change with the advent of genetic uniformity and fertilizer usage Tanner *et al*. (1993), which requires a different resistance breeding approach. The resistance genotypes identified from the present study (Table 2) may serve as donors of genetic material both for inter and intra specific crossing. However resistance cannot be guaranted without being tested overtime and over a wider production area. Therefore, further studies on the identified resistant lines, preferably using artificial inoculation with physiologic races of known virulence/ a virulence formula, are needed. From this study susceptible bread wheat checks were also identified Ehsan *et al*. (1977) for future work including genetic studies.

Acknowledgments

I am very thankful to Zulfiqar Ali Malik, In charge, Lahore computer Center, Sunny Bank, Murree to typing this paper in excellent manner.

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