Resistance Sources Against Predominant Pathotypes of Yellow Rust in Winter Wheat

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Thirty-four lines of winter wheat were screened for yellow rust resistance against predominant pathotypes of northern India. Four of these were found to be resistant against all the four pathotypes. Breeding wheats involving these sources of resistance may diversify the Indian wheats and reduce the impact of new pathotypes.

Key Words: Sources of resistance, Winter wheat, Yellow rust

Yellow rust caused by *Puccinia striiformis* sp *tritici* is one of the most devastating diseases of wheat. The disease is more destructive in cooler regions. The spread of this rust is fast due to prevalence of low temperature in the north-western region of India during the months of January and February which affects tillering and grain development of the plant. Wheat cultivars derived from "Veery" germplasm had Lr26 linked with Yr9 and Pm8 genes located on 1B/1R translocation, were resistant and provided safety against losses due to leaf and stripe rusts till 1995. However, the evolution of new pathotype designated as 46S119 which is virulent on Yr9 and Yr2 has changed the situation (Nayar, 1996). So far in India, about 27 stripe rust races or their biotypes have been identified out of which 14 races were picked up from Nilgiries (Nayar *et al.* 2000). About 27 potentially useful genes are known to condition resistance against stripe rust pathogens (McIntosh *et al.* 1998). Winter wheats are supposed to be a good source of yellow rust resistance besides providing winter hardiness and yield advantage. In northern India, pathogens viz., 46S102, 46S103, 46S119 and 47S103 have been found to be predominant and hence, an attempt was made to identify new sources of resistance which could be utilized for the development of varieties resistant to yellow rust.

Materials and Methods

Seeds of thirty four winter wheat lines along with two spring wheat check varieties and one susceptible check (Agra local) were space planted in aluminium trays (29 X 12 X 7 cm) containing a mixture of loam soil and farm yard manure in the ratio of 3:1. The trays were kept in a spore proof glass house having sufficient light. The trays were watered regularly to keep the soil moist for proper germination of seeds. Seven days old seedlings were inoculated with uredospores of four predominant isolates of yellow rust separately as per the method described by Luthra (1966). The inoculated seedlings were atomized with water and kept for 48 hrs in the humid chamber for germination of spores. The seedlings were then shifted to glass house benches. The 15-20 days old seedlings were evaluated against predominant pathotypes of yellow rust during 2000-01 and 2001-02 and seedling reaction against each of the pathotypes was recorded according to Nayar *et al.*, (1997). The seedlings showing $ (naught fleck), # (fleck), 1-2 reaction were classified as resistant while seedlings with reaction 3 and 3+ were regarded as susceptible.

Results and Discussions

Response of winter wheat lines against predominant pathotypes of yellow rust is presented in Table 1. Four winter wheat lines *viz.*, Moro, Cappelle-Desprez, Mega and Maris-Hunstman showed resistant reaction against all the four predominant pathotypes of yellow rust. The genotype Kavkaz has shown resistance against 46S102, 46S103 and 47S103 races of yellow rust in both the years of testing. *T. spelta album*, Riebsel and Joss Combier have also been found to be resistant against these three pathotypes with escape for some pathotype in one year. Besides, Vilmorin, Bezostaya and Compair have also been found resistant against most prevalent race 46S119 which is virulent on Yr2 and Yr9 (Table 2). Discrepancies in the disease appearance for different years were due to disease escape which is very common for yellow rust (Nayar, 1996) and hence some more confirmation about the resistant lines is required.

Nayar *et al.*, (2001) postulated the presence of Yr9 and Yr18 either singly or in various combinations in 95 among 136 released varieties of wheat in India and emphasized the need of diversification of resistance against yellow rust. Similarly, Kumar and Bhatnagar (2000) reported the presence of Yr9 in 44% of the advanced elite lines of wheat generated during 1996-

Table 1. **Seedling reaction of winter wheats against yellow rust pathotypes during 2000-2002**

Genotype / Variety	Pathotypes							
	2000-01				2001-02			
	46S102	46S103	46S119	47S103	46S102	46S103	46S119	47S103
T. spelta album	$	$	$	$	–	$	3	#
Riebesel	1-2	#	3+	#	–	#	3+	$
Moro	$	$	#	#	1	$	–	$
Aurora	3+	3+	3+	3+	3+	–	3+	–
Vilmorin	2+3	3+	$	1-2	3+	2	#	3
CappelleDesprez	1-2	$	#	1-2	1	2	#	$
Mega	#	#	#	#	$	$	#	$
Maris-Huntsman	#	$	$	$	$	–	#	–
Hobbit	#	$	$	1-2	1	3	3	#
Bon-Fermier	3+	2+3	2+3	3+	3+	3+	3+	3
Chinese-166	3+	$	$	3+	–	$	3	3
Joss Combier	1-2	$	12	#	–	2	3+	2
HeinesVII	1-2	2+3	2+3	2+3	1	3+	3	3+
Peko	3+	1-2	3+	3+	3+	3+	3	3+
Heines Kolbin	3+	3+	2+3	3+	3+	3+	–	3+
Elgin	–	3+	–	–	3	3+	3+	3+
Kavkaz	#	#	3+	$	$	$	3+	#
Altas-66	3+	3+	3+	3+	3+	3+	3+	3+
Bezostaya	3+	3+	$	3+	3+	3+	–	3+
Blue boy	3+	–	3+	3+	3	3	3+	3+
Centurk	2+3	3+	3+	3+	3	3	3+	3
Dacia	1-2	3+	3+	3+	#	#	3+	#
Demar 4	#	3+	3+	3+	$	3+	3+	2
Sava	3+	3+	3+	3+	–	3+	3+	$
Bolal	3+	3+	3+	3+	3+	3+	–	–
Burgas-2	1-2	3+	3+	3+	$	3+	3+	#
Favorit	#	3+	3+	3+	$	3+	–	#
Moldova	$	3+	3+	3+	$	3+	3+	3
PD Extreme	#	$	3+	#	–	3+	3+	#
Rousalka	#	3+	3+	3+	2	3+	3+	3
Opal	#	3+	1-2	1-2	#	$	3+	$
Lee	3+	3+	3+	3+	3+	3+	3+	3+
Compair	3+	3+	#	#	3+	$	#	$
Chancellor	1-2	3+	3+	3+	3	3+	3+	1
HS 240	#	$	3+	#	#	$	3+	#
VL 738	#	$	3+	#	–	$	3+	$
Agra Local	3+	3+	3+	3+	3+	3+	3+	3+

Infection type: $ (naught fleck = immune) # (fleck= very resistant) 1-2 (resistant) 3 (moderately susceptible) 3+ (highly susceptible)

Table 2. Response of winter wheats against yellow rust

Pathotype	Resistant lines
46S102, 46S103, 46S119 and 47S103	Moro, Cappelle – Desprez, Mega and Maris – Hunstman
46S102, 46S103 and 47S103	Kavkaz, T. Spelta album, Riebsel and Joss – Combier
46S119	Vimorin, Bezostaya and Compair

99 at IARI, Regional Station, Shimla. Widespread occurrence of Yr9 in Indian wheat, has necessitated diversification of germplasm with new sources of resistance against yellow rust. In present study the winter lines detected as resistant against predominant pathotypes of yellow rust may serve as good sources of resistance for breeding yellow rust resistant cultivars in India. The spring wheats derived involving such winter stocks may also

broaden the genetic architecture of the cultivars and reduce the frequent evolution of new pathotypes.

References

Kumar S and R Bhatnagar (2000) Rust resistant gene pool in wheat populations of northern hills zone. *Proceeding of 88th Indian Science Congress. Part III (Sec.1): Agricultural Science,* 55p.

Luthra JK (1966) Inheritance of seedling resistance to races 57 and G of yellow rust in barley. *Indian J. Genet.* **26**: 356-359.

McIntosh RA, GE Hart, KM Devos, MD Gale and WJ Rogars (1998) Catalogue of gene symbols for wheat. *Proceedings 9th International Wheat Genetics Symp.* **5**: 129-139.

Nayar SK (1996) Variation in wheat rusts and their management through resistance. *Indian Phytopathol.* **49**: 132-133.

Nayar SK, S Nagrajan, M Prashar and SC Bhardwaj (1997) Manual of current techniques in wheat rusts. *Research Bulletin* No **2**: Directorate of Wheat Research, Regional Station, Flowerdale, Shimla (India), 32p.

Nayar SK, S Nagrajan, M Prashar, SC Bhardwaj and SK Jain (2000) Wheat rust in India: Present Status. *Proceeding of the IPS Golden Jubilee International Conference on Integrated Plant Disease Management for Sustainable* Agriculture **1**: 627-634.

Nayar SK, S Nagrajan, M Prashar, SC Bhardwaj, SK Jain and D Datta (2001) Revised catalogue of genes that accord resistance to *Puccinia* species in wheat. *Research Bulletin* **No 3**. Directorate of Wheat Research, Regional Station, Flowerdale, Shimla (India), 48p.