J. Wheat Res. 3(1) : 71-72 (2011)

Performance of durum wheat lines for quality and rust resistance

M D Oak, R M Patil, D N Bankar, J H Bagwan, A L Bipinraj, S A Tamhankar, B K Honrao[1] and S C Misra

Received: 18 July 2011 / Accepted : 21 August 2011
@ Society for Advancement of Wheat Research

Stem rust (*Puccinia graminis* Pers. f. sp. tritici) and leaf rust (*Puccinia triticina* Rob. ex. Desm.) are the major constraints in wheat production in the peninsular zone. A number of wheat varieties cultivated in the past, became susceptible to rust, after a few years of cultivation. Traditionally wheat improvement aims at three major aspects viz. grain yield, disease resistance and quality. The effect of disease on yield and its components in general has been adequately studied (Mundy 1973, Knott 1989). However, there is still ample scope to study its interaction with physiology and quality in wheat. Allard (1960) suggested that early generation selection should be restricted to highly heritable traits such as disease resistance and plant height and that the traits showing low heritability should be evaluated only in those lines that survive this screening. Such a pedigree breeding system involves the retention of lines of unknown grain yield potential until a degree of homozygosity is attained (F_5 or F_6). In view of the severeness of the rust diseases, as well as the necessity to improve the quality of wheat, an attempt has been made to combine rust resistance and quality attributes in durum wheat.

A cross was made between MACS3125 and HGPC-1 (UC1114, kindly provided by Dr. J Dubkovsky, a breeding line from UC, Davis). MACS 3125 (*T. durum*) is the highest yielding durum variety with a grain yield of 48.4 q/ha. It has bold grains and is highly resistant to leaf rust and moderately resistance to stem rust. However, this variety has poor yellow pigment content of 4.2 ppm and protein content of 11.4%. Whereas, HGPC-1 carries a NAC transcription factor associated with high grain protein content (16 -17%) and linked with early senescence. It shows high Yellow pigment content and dough strength but is highly susceptible to stem rust. F_1 and F_2 plants were raised under high fertility and irrigated conditions. In the F_2 generation a random single spike was harvested and repeated selfing was continued up to the F_6 generation. At this stage homozygous (RILs) lines were constituted. These 196 newly constituted RILs, were analyzed for grain protein content using a scanning monochromator Infratec 1241 grain analyzer (Foss NIR Systems INC., Hoganas, Sweden). 1000 grain weight was estimated by manually counting 1000 seeds and taking their weight in gram.

These lines were screened for two consecutive years (2009-10, 2010-11) against a mixture of stem rust (11, 40A, 42, 117-6, 122) and leaf rust (12-2, 77-2, 77-5, 104-2) pathotypes. Each homozygous line was grown in a single row of 1 meter length and spaced 30 cm apart. After every 20 cultures a highly susceptible cultivar Gulab, was sown for better spread of infection. The leaf rust epidemic was initiated by inoculating spreader rows with the mixture of virulent pathotypes of stem rust and leaf rust. Inoculations were also carried out through injections and direct spraying of spores in the field using a fine sprayer. Standard inoculation methods were practiced and measures to create optimum, conditions for maximum disease spread were taken. Rust severity was recorded 5 to 6 times according to the scale suggested by Peterson *et al.* (1948).

Incidence and severity of leaf rust was observed during both years in disease-infected plots. The spreader rows of the highly susceptible variety Gulab coupled with spraying of spore suspensions, ensured good inoculum pressure. The observations recorded were compiled and mean values are summarized in Table 1. It was observed that out of 196 RILs, 72 lines were resistant to both leaf and stem rust. These results confirm the findings of Sharma *et al.* (1986) that durum wheat may be an important source of resistance to rust. HGPC-1 was highly susceptible to stem rust and moderately resistant to leaf rust. Among the 72 lines, 10 lines were selected exhibiting high grain protein content (14-1 to 15.8%) and high 1000 grain weight (46.0 to 55.2g). All these lines resembles MACS 3125 with respect to height, erectness, bold amber colored grains which are hard, lustrous, uniformly filled, with increasing thousand grain weight.

Additionally, three lines 233, 261, 365 were early in flowering and maturity than the parent MACS3125, while the others were mid-late. All these lines will be further evaluated in yield trials.

It was observed that some of the added genes conferring rust resistance showed negative impacts on quality and yield under rust-free conditions (Knott 1993, Singh and Huerta-Espino 1997). On the contrary, in a study by Cox *et al.* (1997), *Lr*41 was associated with a reduced bake-mixing time and water absorption, but no serious impediments to the use of *Lr*41 in breeding was reported. Similar results were reported by Kumar and Raghavaiah (2004) in a study on the effect of the gene *Lr*28 on the yield in bread wheats.

This study was conducted to improve the grain protein content of the rust resistant cultivar MACS 3125 and lines with high disease resistance and good grain protein content were obtained.

Genetics Group, Agharkar Research Institute, GG Agarkar Road, Pune 411004
Correspondence: *bkhonrao@yahoo.co.in

Table 1 Performance of 10 RILs and their parents over 2 years for rust resistance, grain protein content and 1000 grain weight

Line No.	Leaf Rust	Stem Rust	GPC(%)	1000 gr.wt(g)
231	Tr	20MR	15.1	50
233	Tr	20MR	14.6	46.4
251	Tr	20MR	14.9	49.2
261	Tr	20MR	14.1	48.4
300	Tr	10MR	14.5	51.2
303	0	10MR	15.2	46
322	0	20MR	14.5	55.2
327	Tr	10MR	14.1	50.4
356	Tr	20MR	14.3	50.4
365	5S	10MR	15.8	46.4
MEAN			14.71	49.36
SD			0.54	2.79
SE			0.17	0.88
CV			0.036	0.056
MACS 3125	Tr-5MR	20MR-20MS	11-12	45-47
HGPC-1	5MR-10MR	30S-60S	16-18	35-40

0-Completely resistant, Tr- Trace resistance, MR- moderately resistant, MS- moderately susceptible, S- susceptible

References

1. Allard R W. 1960. Principles of Plant Breeding. John Wiley and Sons, New York
2. Mundy E J. 1973. The effect of yellow rust and its control the yield of Joss Cambier Winter wheat. *Plant path* **22**: 171-176
3. Cox T S, Bequette R K, Bowden R L and Sears R G. 1997. Grain yield and breadmaking quality of wheat lines with leaf rust resistance gene *Lr*41. *Crop Sci* **37**: 154-161
4. Knott D R. 1989. The effect of alien transfers of genes for leaf rust resistance on the agronomic and quality characteristics of wheat. *Euphytica* **44**: 65-72
5. Knott D R. 1993. Agronomic and quality characters of near-isogenic lines of wheat carrying genes for stem rust resistance. *Euphytica* **68**: 33-41
6. Kumar A A and Raghavaiah P. 2004. Effect of the leaf rust resistance gene *Lr*28 on grain yield and bread-making quality of wheat. *Plant Breeding* **123**: 35-38
7. Peterson R F, Campbell A B and Hannah A E. 1948. A diagrammatic scale for estimating rust intensity of leaves and stem of cereals. *Can J Res* (C) **26**: 496-500
8. Sharma D L, Saini R G, Gupta A K and Gupta S. 1986. Diversity for resistance to leaf rust in *Triticum durum* Desf. *Cereal Rust Bulletin* **14**: 53-57
9. Singh R P and Huerta-Espino J. 1997. Effect of leaf rust resistance gene *Lr*34 on grain yield and agronomic traits of spring wheat. *Crop Sci* **37**: 390-395