Responses of spring bread wheat lines for Central and West Asia and North Africa (CWANA) Program to Stripe Rust Disease

Afshari F
Seed and Plant Improvement Institute, Karaj, Iran

INTRODUCTION

Common wheat is one of the most important sources of energy in the world. Wheat is a host for many groups of parasites. Major threats to wheat production on a world wide basis come from one or more of the three rust diseases. Stripe (Yellow) rust is the most important disease of wheat in West Asia and North Africa (WANA) regions. Use of resistance cultivars is the best method of stripe rust disease control. Multilocational disease testing is used to obtain data to support breeding strategies aimed at broadening the genetic base of resistance in CIMMYT and ICARDA germplasm. Assuming a broad based resistance, this material should also serve as useful germplasm for local breeding programs. Gene postulation based on comparative response data from multipathotype tests (Dinoor and Peleg, 1972; Browder and Eversmeyer, 1980) and genetic and cytogenetic analyses of segregating hybrid populations make up the principal methods for identifying rust resistance genes in wheat germplasm and cultivars. In Iran screening of different nurseries have been done for yellow rust.

While international germplasm is believed to carry broad based and often durable resistance, it is also known to carry a broad array of genes for seedling resistance to each of the three rusts. If this germplasm is to be used in national breeding programs it is essential that some data on local pathotypes are available. It is an even greater advantage, if the actual genes for resistance are known. If local pathotypes and suitable germplasm facilities are available, multipathotype tests and applications of the underlying principles of the gene for gene relationship enable postulation of the genes involved and the development cultivars into genetic diversity groups. The use of actual infection type data and pedigree information can also contribute to the resistance gene process. The objective of this study was to obtain resistant lines through a group of nurseries distributed from international centers such as CIMMYT or ICARDA and to interpret those seedling and adult plant resistance in regard to field assessments.

MATERIAL AND METHODS

In 2005-06 cropping seasons, 378 lines of spring bread wheat included 268 Preliminary Wheat Yeild Trial (PWYT) and 110 lines of Advanced Wheat Yeild Trial (AWYT) for Central and West Asia and North Africa (CWANA) Program were tested for resistance to stripe rust at adult plant stage with pathotype (pt.) 6E4A+ in Karaj (North) and Zargan (South) with pt. 166E6A+,*Yr27+*. The new pt. 166E6A+,*Yr27+* is predicted to become the dominant pathotype in Iran with virulence on plants with *Yr27* gene. In the field, each line was planted in two rows of one-meter length with 30cm distance under artificial inoculation. A susceptible wheat cultivar Bolani was planted as spreader around the nursery and between the rows. Field assessments were based on disease severity according to the modified Cobb's scale (Peterson *et al.,* 1948) and disease reaction (Roelfs, 1992) stripe rust disease.

RESULTS AND DISCUSION

The results showed that among the 378 lines, 97% (366 lines) were resistant to pt. 6E4A+ in Karaj, but in Zargan site 166 lines (44%) were resistant to stripe rust pt. 166E6A+,*Yr27*. This observation confirms that pathogenic variation between regions within large cropping areas can be significant (Afshari *et al*., 2006). Due to large number of data only some details of lines are presented in this paper (Table 1). Among the PRWYT nursery, which was tested with pt. 6E4A+, 256 lines (96%), were resistant to moderate resistant in the field and only 12 lines were susceptible. Tests with pt. 166E6A+,*Yr27*, revealed 123 lines (46%), were resistant to moderate resistant in the field and 145 lines were susceptible.

In adult plant stage of ARWYT nursery, 43 lines (39%) were resistant to pt. 166E6A+,*Yr27*, while all 110 lines were resistant against pt. 6E4A+.. In the field many of lines were moderately resistant to moderately susceptible, which may be indicative of the presence of adult plant resistance gene/s. Ma and Singh (1996) noted that single adult plant resistant gene (*Yr18*) did not provide acceptable level of resistance to yellow rust. Some sister lines such as PASTOR/TUKURU//METSO were resistant to both pathotypes. In other lines , such as, ATTILA-4//SERI 82/SHUHA'S' and ATTILA-5/*2MAYON'S'//CROW'S'/VEE'S' showed susceptibility to pt. 166E6A+,*Yr27* , but resistant to pt. 6E4A+. In line number 9 with pedigree BOCRO-4*2//TEVEE'S'/KAUZ'S' was resistant to both pathotypes, which further supports multilocation test could be a useful method for screening of germplasm.

A spectacular example was the ineffectiveness of the adult plant resistance gene alone in Joss Cambier to a new pathotype identified in 1972 (Johnson and Taylor, 1972). In our breeding program we are looking for adult plant resistance genes or numerous of APR genes (4-5), which have been implicated as contributing to durable resistance. Further study is required on these resistant lines to obtain inheritance data and to know the number of gene/s required to confer resistance.

Table 1: Pedigrees, name, seedling and adult plant responses of PRWYT nursery to wheat stripe rust disease

No.	Pedigree/Name	pt. 166E6A+,*Yr27*	pt. 6E4A+
1	PASTOR/TUKURU//METSO	5MR	5R
2	PASTOR/TUKURU//METSO	10MS	20MR
3	ATTILA-4//SERI 82/SHUHA'S'	**60MS**	5R
4	ATTILA-4//SERI 82/SHUHA'S'	**80MS**	30M
5	ATTILA-5/*2MAYON'S'//CROW'S'/VEE'S'	**80MS**	5R
6	ATTILA-5/*2MAYON'S'//CROW'S'/VEE'S'	**80MR**	20MR
7	ATTILA-5/*2MAYON'S'//CROW'S'/VEE'S'	**70MR**	5R
8	ATTILA-5/*2MAYON'S'//CROW'S'/VEE'S'	**80MR**	20MR
9	BOCRO-4*2//TEVEE'S'/KAUZ'S'	20MR	**80S**
10	QAFZAH-4//SERI 82/SHUHA'S'/3/TNMU-4	10MR	**60MS**
11	NS732/HER//SD8036/3/IRQIPAW 35-S6-98	20MS	**70MS**
12	Bolani (Susceptible)	**100S**	**100S**

REFERENCES

Afshari, F., Kamali, M.R.J. and Rejaei, S. 2006. Comparison of some wheat genotypes at adult plant stage to *Puccinia striiformis* f.sp. *tritici.* Abstracts of Third Regional Yellow Rust Conference for Central & West Asia and North Afria. 8-11 June 2006, Tashkent, Uzbekistan. P.18

Browder, L.E., and M.G. Eversmeyer. 1980. Sorting of *Puccinia recondita*: *Triticum* infection-type data sets toward the gene-for-gene model. *Phytopathology* **76**: 666-670.

Day, P.R. 1974. "Genetics of Host : Parasite Interaction". Freeman Company, San Francisco, pp. 238.

Dinoor, A., and N. Peleg. 1972. The identification of genes for resistance or virulence without genetic analysis, by the aid of the '"gene-for-gene" hypothesis. In: Proceedings of the European and Mediterranean Cereal Rusts Conference. Prague, Czechoslovakia pp. 115-119.

Johnson, R., and A.J. Taylor. 1972. Isolates of *Puccinia striiformis* collected in England from the wheat varieties Maris Beacon and Joss Cambier. *Nature* **238**: 105-106.

Ma, H., and R.P. Singh. 1996. Contribution of adult plant resistance gene *Yr18* in protecting wheat from yellow rust. *Plant Disease* **81**: 66-69.

Peterson, R.F., A.B. Campbell, and A.E. Hannah. 1948. A diagrammatic scale for estimating rust intensity of leaves and stems of cereals. *Canadian Journal of Research* **26**: 496-500.

Roelfs, A.P., Singh, R.P., and Saari, E.E. 1992. Rust Diseases of Wheat: Concepts and Methods of Disease Management. Mexico, D.F. CIMMYT. 81 pp.