Stripe rust *resistance* in soft red winter wheat cultivars and lines

Johnson J[1], Buck J[1], Marshall D[2], Miranda L[1] and Martinez A[1]
University of Georgia, Griffin, GA[1], USDA-ARS, Raleigh, NC[2]

ABSTRACT

Stripe rust, caused by *Puccinia striiformis* f. sp. *tritici*, has emerged as an important disease of soft red winter wheat in the eastern region of the U.S. Identification of stripe rust resistance sources for the eastern U.S. is extremely important to determine the major and minor *Yr* genes involved. Breeding lines and cultivars from Universities and private companies (713 entries in 2006 and 380 entries in 2007) were evaluated in the field at Plains and Griffin, GA. Plots were inoculated with a local field culture of stripe rust. The races of stripe rust used for inoculation were collected in Georgia, identified and designated as PST 100 and 102 (Dr. X.M. Chen, Pullman, WA). Stripe rust infection type and percent severity data were assessed multiple times at each location.

The results indicated that numerous cultivars and lines of soft red winter wheat possess the resistant gene *Yr17* in their background. Other sources of seedling resistance were also identified in PIO26R61, Kinsco, and VA 270. A total of 102 lines from the field nursery were identified as having a level of resistance better than that of 'Pioneer 26R61'. From field evaluations and seedling screening, a number of lines with adult plant resistance were identified such as GA 951395-3A31 and GA 96693-4E16. Additional evaluations are proposed to identify other sources of adult plant resistance

INTRODUCTION

Stripe rust (yellow rust), caused by *Puccinia striiformis* f. sp. *tritici*, has emerged as an important disease of soft red winter wheat in the eastern region of the U.S. Reasons for this increase may include widespread planting of susceptible cultivars, increased overwintering or oversummering of the pathogen, changes in local or regional climatic variables or changes in pathogen aggressiveness. Genetic resistance is the most economical and environmentally safe method for disease control. Over 30 stripe rust resistance genes (Yr) have been identified and catalogued (3). Singh et. al, (4) identified and mapped *Yr31* for resistance in the cultivar, 'Pastor'. Identification of stripe rust resistance sources for the eastern U.S. is extremely important to determine the major and minor *Yr* genes involved. The objectives of this study are to determine the level of resistance of soft red winter cultivars and elite lines to stripe rust and to identify different sources of resistance to stripe rust.

MATERIALS AND METHODS

The first Uniform Eastern Soft Wheat Stripe Rust Nursery (UESWSRN) consisted of 300 entries made up of breeding lines and cultivars from 12 Universities, the USDA, ARS, and four private companies along with an additional 413 breeding lines and cultivars from the University of Georgia and cooperators were evaluated in the eastern region of the U.S. The second UESWSRN had 380 entries. Both nurseries were evaluated under field conditions. Plots were inoculated with a local field culture of stripe rust by transplanting inoculated spreader pots of 'AGS 2000' from the growth chamber to the field in November. The races of stripe rust used for inoculation were collected in Georgia, identified and designated as PST 100 and 102 (Dr. X.M. Chen, Pullman, WA). Stripe rust infection type and percent severity data were assessed multiple times.

RESULTS AND DISCUSSION

Significant levels of infection were detected ranging from 0 to 90% severity. In early February, stripe rust infection was detected within the plots. By mid-March, the infection was at an epidemic level. 'Pioneer 26R61' which had been previously identified in the region to be resistant to stripe rust was used as the resistant check. Pioneer 26R61 had a stripe rust infection type and percent severity of 3.97 and 19.70%, respectively. Entries that had lower stripe rust infection types and percent severities than the mean of Pioneer 26R61 were identified with an acceptable level of resistance. A total of 102 lines from the nursery were identified as having a level of resistance better than Pioneer 26R61. A wide range of phenotypes were detected with stripe rust resistance. The entries in Tables 1 and 2 represent some potential diverse source of resistance to stripe rust detected in the UESWSRN.

The level of resistance in soft winter wheat background for the eastern region of the U.S. is probably due to breeding for leaf rust resistance, caused by *Puccinia triticina* Eriks. The results indicated that numerous cultivars and lines possess the resistant gene *Yr17* in soft red winter wheat based upon pedigrees and the marker locus, Ventriup-Ln2 (2). A chromosomal fragment containing three rust resistance genes was translocated between the short arms of *Triticum ventricosum* 2NS and the bread wheat chromosome 2AS (1). Three disease resistance genes, *Lr37*, *Yr17* and *Sr38,* conferring resistance to leaf rust, stripe rust and stem rust *(Puccinia graminis* Pers. f.sp. *tritici* Eriks. & E.

Henn.), respectively, are contained in the chromosome fragment. Lines with GA 881130 and LA 85411 in their pedigrees have the *Yr17* gene from a French line 81-19.

Other sources of resistance were also identified in PIO26R61, Kinsco, and VA 270. A replicated screening of 591 breeding lines for stripe rust was also undertaken, using growth chambers. Eighty-nine lines were detected with some resistance. Again, the majority of the resistant lines had the resistant gene *Yr17*. From field evaluations and a large seedling screening, a number of lines with adult plant resistance were also identified such as GA951395-3A31 (GA88151/Hickory//AGS2000) and GA96693-4E16 (GA87110/VA55//GA88151). RILs from the cross, Pioneer 26R61 and AGS 2000, are being evaluated for stripe rust resistance in the field for QTL mapping. A diverse source of resistance is available in the germplasm in soft winter wheat background.

Table 1. Entries and pedigrees from the Uniform Eastern Soft Wheat Stripe Rust Nursery with stripe rust resistance.

Designation	**Pedigree**
TERRAL LA841	GA8665-D4/GA85238-C3
GA961567-4A35	Jackson/2*881130
GA97531-5A37	891138/Kinsco//PIO 2628
LA99042E-62	Ducula1(H2O)/Mason,F1//PIO26R61
MO 050146	MO 94-046/Pioneer 2552
IL87-2834-1	Tyler / Howell
992133A2-1-2	Patterson/F201R//INW0101/4/Patton/3/Clark*4 /Ning7840//Foster
GA 96229-3A41	881130/*2 881582
97C-0554-04-06	VA94-54-549/Roane//Kristy
B990133	L890145/LX 8728D
Coker 9553	89M-4035A(IL77-2656/NK79W810)/Pio2580
ARS03-5929	TX98D2106*2/TTCC251 (T.cylindricum)(=WX02ARS155-219)
VA01W-205	PION2684/VA93-54-185
AR97225-4-1	Pioneer2684/PI590277//Pioneer 2684
GA981562-A23	93338/USG 3209
B980696	L880421/BARANJKA
GA 951395-3E25	87110/VA55//88151
INW0412	Huapei 57-2/Patterson
GA981621-5E34	AGS 2485/PIO26R61
GA96693-4E16	88151/Hickory//AGS 2000
ARS03-3849	TX85-264*2/TTCC512 (T.cylindricum) (=WX02ARS149-8)

Table 2. Entries and mean infection from the Eastern Soft Wheat Stripe Rust Nursery.

	IT	%
Designation	**Mean**	**Mean**
TERRAL LA841	0.00	0.00
GA961567-4A35	0.00	0.00
GA97531-5A37	0.00	0.00
LA99042E-62-B	0.75	0.03
MO 050146	0.25	0.03
IL87-2834-1	0.75	0.03
992133A2-1-2	0.25	0.03
GA 96229-3A41	1.13	0.05
97C-0554-04-06	2.13	0.10
B990133	2.00	0.10
Coker 9553	1.38	0.30
ARS03-5929	2.13	0.33
VA01W-205	3.63	0.33
AR97225-4-1	3.50	0.33
GA981562-A23	2.25	1.30
B980696	1.00	5.03
GA 951395-3E25	2.88	6.30
INW0412	0.75	7.53
GA981621-5E34	2.25	7.78
GA96693-4E16	1.88	15.28
ARS03-3849	1.75	17.50

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