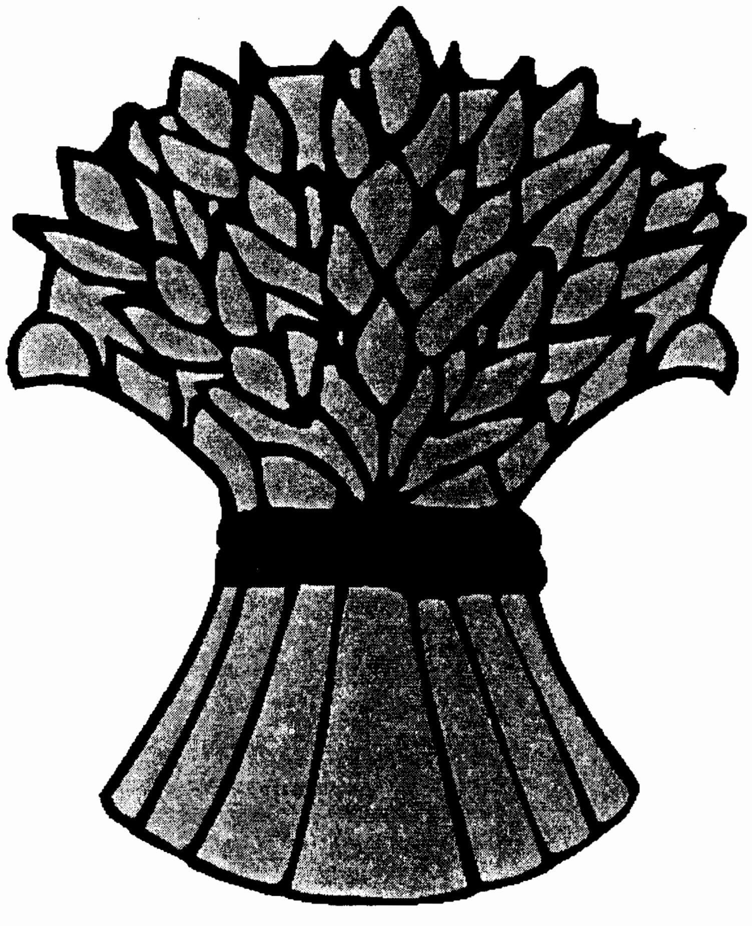
1999 National Fusarium Head Blight Forum



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Sioux Falls, South Dakota
December 5-7, 1999

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RESISTANCE TO FUSARIUM HEAD BLIGHT IN SYNTHETIC HEXAPLOID WHEATS (2n=6x=42, AABBDD)

L. Gilchrist*, C. Velazquez, and A. Mujeeb-Kazi

INTRODUCTION

Fusarium head blight resistance in bread wheat is thought to be controlled by two to three major genes and several minor genes as modifiers. Head blight resistance can be transferred from alien sources to reinforce and improve the resistance already present in bread wheat.

In general the transfer of alien genes from tertiary genepools is a long process. However, bridge crosses utilizing D-genome synthetic hexaploids (SH) (*Triticum turgidum/Aegilops tauschii*) are a powerful means of swiftly improving bread wheat (*T. aestivum*) for resistance to biotic stresses (Mujeeb-Kazi et al., 1998).

In the past few years, CIMMYT wheat wide crosses has worked in conjunction with wheat pathology on the identification of scab resistant synthetic hexaploid wheats and their bread wheat derivatives.

MATERIALS AND METHODS

Germplasm development

Elite durum wheat (*Triticum turgidum*) cultivars were crossed with several hundred *Aegilops tauschii* accessions following the scheme shown in Fig. 1.

Figure 1. Synthetic Hexaploid Generation

T. turgidum X *Ae. tauschii*

↓

Hybrid
(2n=3x=21 ABD)

↓

Synthetic Hexaploid
(2n=6x=42, AABBDD)

↓

Head Blight Screening

Germplasm screening

Preliminary screening for leaf and stem rust resistance is carried out in the Yaqui Valley, State of Sonora. During the summer cycle, germplasm found to possess leaf and stem rust resistance is inoculated with stripe rust and a mixture of five virulent isolates of *Septoria tritici* in Atizapan, Toluca, State of Mexico.

Lines found to be resistant to the three rusts (leaf, stem and stripe) and *Septoria tritici* are evaluated for head blight resistance. Five spikes from each line are inoculated using the cotton method (Gilchrist et al., 1997). All lines showing type II resistance in this preliminary screening are inoculated the following cycle to confirm the initial observations. In addition, a spore suspension (50,000 spores/ml) is sprayed on each plot to determine type I (penetration) resistance. The

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same plot is harvested and a sample is taken and analyzed for DON content using the fluoroQuant method (Romer Labs, Inc.) Lower DON levels suggest type III resistance.

Grain filling is assessed by comparing test plots inoculated using the spray method with a similar plot sprayed with fungicide (Folicur) every 10 days. Minimum losses in test weight indicate type IV resistance.

RESULTS AND DISCUSSION

Presented in Table 1 are lines showing good fusarium head blight resistance, as demonstrated by their scores for different the resistance components.

Some of the SHs produced so far possess desirable fusarium resistance (type II). These SHs were utilized in crosses with bread wheat cultivars and advanced derivatives that had been tested for resistance (types I, II, III, and IV). The SH diversity has been transferred to bread wheat plant types. The *Ae. tauschii* diversity is revealed by the presence of five accessions (Table 1) in the pedigrees of advanced lines 205, 222, 223, 369, and 447. Micro-satellites of the D-genome are being utilized to elucidate the uniqueness of these accessions.

The best resistance combination is present in the cross Mayoor// TK SN1081/*Ae. tauschii*(222), which has also been identified to possess multiple disease resistance (Mujeeb-Kazi et al., 1999). Studies are currently in progress to determine genetic control, as well as develop an F1-based doubled haploid population in which the bread wheat parent Flycatcher is susceptible to all stresses to which the cross Mayoor// TK SN1081/*Ae. tauschii*(222) is resistant.

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Table 1. Synthetic bread wheat hexaploids with fusarium head blight resistance under artificial inoculation, Atizapan, Toluca, State of Mexico, during the 1998 and 1999 summer cycles.

Lines	% Damage Type I 1998 1999	% Damage Type II 1998 1999	DON (ppm)	Test weight losses (%)	Grain (0-5)
TURACO/5/CHIR3/4/SIREN//ALTAR 84/*Ae. tauschii* (205)/3/3*BUC CASS94Y00034S-24PR-2B-0M- 0FGR-0FGR-0FGR	18.42 - 8.01	9.88 - 8.71	0.58	5.27	2+
BCN//DOY1/*Ae. tauschii*(447) CASS94Y00006S-53PR-2B-0M-0FRG-0FGR-0FRG-0FGR	10.34 - 9.59	10.34 10.07	1	2.64	1
MAYOOR//TK SN1081/*Ae. tauschii*(222) CASS94Y00009S-18PR-3M-0M-0FRG-0FRG-0FRG	7.26 - 0.0	5.81 - 13.96	1.2	6.06	1
MAYOOR//TK SN1081/*Ae. tauschii*(222) CASS94Y00009S-50PR-2B-0M-0FRG-0FRG-0FRG	4.14 - 0.0	9.67 - 14.19	1.2	6.50	0-1
OPATA/5/CPI/GEDIZ/3/GOO//JO69/CRA/4/*Ae. tauschii* (223) CASS94Y00215S-5Y-1M-0M-0FRG-0FRG-0FRG	10.93 - 1.74	27.7 - 22.15	n.a.	6.18	3
MAYOOR/5/CS/*Thinopyrum curvifolium* //GLEN/3 /ALD/PVN/4/SC/ *Leymus racemosus* //2*CS /3/ CNO79 CIGM93.619-3Y-2B-0PR-1Y-0M-0FRG-0FRG-0FRG	10.17 - 0.0	29.46 - 22.58	n.a.	5.35	3
BCN/3/68112/WARD//*Ae. tauschii* (369) CASS94Y00125S-5Y-2M-0M-0FRG-0FRG-0FRG-0FR	12.66 - 11.21	20.60 - 3.76	n.a.	12.17	3-4
SUMAI#3 (resistant check)	4.41 0.86	15.49 10.59	0.27	38.59	3
FRONTANA (moderately resistant check)	12.90 - 11.56	17.03 - 27.85	2.0	7.71	2
MAYOOR (moderately resistant check)	16.94 3.4	17.04 - 27.85	4.5	5.09	3

+Grain 0= Excellent (no differences in appearance with fungicide protected grain).
Grain 5= Poor (shriveled, sunken, highly infected).
n.a. = Not available.