

**Arkansas Wheat Promotion Board  
Final Report for Pathology Projects in 2006  
Gene Milus and Sam Markell**

**I. Evaluations for disease resistance**

Entries in the Arkansas Variety Test and Dr. Bacon's Elite and Advanced breeding nurseries were planted at Keiser and Jackson County to evaluate resistances to soilborne mosaic and spindle streak mosaic and at Fayetteville to evaluate resistance to stripe rust. Also, Dr. Bacon's Observation Nursery was evaluated for stripe rust at Fayetteville, and his head row nursery at Fayetteville was inoculated with stripe rust. A natural powdery mildew epidemic developed at Lewisville, and entries were rated for resistance to this disease that usually is not a big problem in Arkansas.

Insufficient soilborne mosaic and spindle streak symptoms developed at Keiser and Jackson County, and no useful data were obtained. The dry fall likely contributed to low disease pressure. This was the second year in a row without useful data on these diseases, and several new cultivars and breeding lines have not been rated for resistance to these diseases. Planting resistant varieties is the only control measure for these diseases that have caused up to a total yield loss in past years.

Multiple irrigations and inoculations and a cooler weather later in the spring finally promoted a stripe rust epidemic, and useful data on stripe rust resistance were recorded. Stripe rust severity for entries in the Variety Test (Table 1) indicate that most of the entries have at least a moderate level of resistance to the contemporary stripe rust population. Avoiding susceptible varieties is the best defense against yield and test weight losses from stripe rust. Although resistance to powdery mildew is not as important as resistance to stripe rust, avoiding the most susceptible varieties would be good insurance against losses. Successive years of evaluation for stripe rust resistance allowed Dr. Bacon to select a high proportion of resistant lines in the Elite (Table 2) and Advanced (Table 3) nurseries and to make crosses that result in a high proportion of resistant lines in his Observation Nursery (Table 4).

**II. Germplasm enhancement**

Crosses have been made over the past several years to transfer genes for adult-plant resistance to stripe and leaf rust and resistance to barley yellow dwarf to adapted lines. Lines selected for resistance to stripe rust (Table 5) also are likely to be resistant to leaf rust. Lines selected for resistance to barley yellow dwarf (Table 6) include the most resistant and agronomically acceptable  $F_8$  lines that transferred resistance from CIMMYT spring wheat lines and  $F_4$  that are attempting to combine the CIMMYT resistance with native resistance in Coker 9663 and Roane to obtain higher levels of resistance.  $F_2$  populations developed to transfer additional sources of stripe rust resistance to adapted lines and to transfer the CIMMYT barley yellow dwarf resistance to better agronomic backgrounds are listed in Table 7.

**III. Stripe rust research**

Research by graduate student, Sam Markell, showed that AFLP molecular markers could clearly distinguish the old population of the stripe rust fungus that existed in eastern United States before 2000 from the new population that predominated in the region since 2000 (Figure 1). Furthermore, there is little genetic diversity within the old and new populations, and both populations are different from isolate PST-21, an unusual isolate from California. Sam's

research also indicated that race identification among new isolates is inconsistent because four differentials are likely to have intermediate infection types that flip-flop between virulent and avirulent categories (Table 8) that lead to new race designations (Table 9). These results indicate that there are fewer true new races than what has been described since 2000. Sam is still working on results from the genetic study of stripe rust resistance, and there is no new information at this time. He plans to complete his Ph. D. program in February.

Molecular markers developed by researchers at USDA Genotyping Centers were not useful for identifying wheat lines with resistance genes *Lr34/Yr18* and *Lr46/Yr29* that confer durable adult-plant resistance to leaf rust and stripe rust. Evaluating lines for resistance is still the most practical way to develop varieties with these resistances.

Dr. Milus' research in Denmark supported earlier research funded by the Wheat Board that new isolates (since 2000) of the stripe rust fungus are more aggressive (cause more disease more quickly) and better adapted to warm temperatures than old isolates (before 2000). New isolates that share identical or very similar AFLP fingerprints have spread quickly around the world, indicating that they have greater fitness than the old isolates.

Table 1. Stripe rust severity at Fayetteville and powdery mildew severity at Lewisville for entries in the Arkansas Variety Test, 2006.

Variety	Stripe rust (%)		Powdery mildew (%)
	2 May	11 May	
AGRIPRO/COKER BERETTA	3.0	17.3	5
AGRIPRO/COKER BRANSON	0.0	30.0	0
AGRIPRO/COKER COKER9375	0.7	17.3	4
AGRIPRO/COKER COKER9553	0.0	3.7	26
AGRIPRO/COKER D0I-7759	0.0	3.7	31
AGRIPRO/COKER PANOLA	1.3	9.7	9
AGS 2000	22.3	59.3	1
AGS 2050	22.3	69.3	1
AGS 2060	0.0	5.3	10
AR 850-1-1	0.0	3.7	36
AR96077-10-1	2.3	8.0	3
ARMOR 2010	0.0	14.7	78
ARMOR 2602	8.0	22.3	1
ARMOR 3015	2.3	11.3	24
ARMOR 3035	0.0	10.7	83
ARMOR 3330	0.0	8.0	77
AXR 5110	0.0	13.0	65
CHOPTANK	31.7	68.3	0
CROPLAN GENET. 554W	26.7	66.0	2
CROPLAN GENET. 8302	0.0	12.3	29
DELTA GROW 1600	3.7	22.3	4
DELTA GROW 4100	0.7	17.3	71
DELTA GROW 4500	0.7	25.0	73
DELTA GROW 5200	0.7	12.3	70
DELTA KING 7710	0.0	8.0	46
DELTA KING 7830	0.0	27.3	80
DELTA KING 9410	0.0	10.7	80
DELTA KING 9577	5.3	25.0	1
DELTA KING GR9108	2.0	12.3	4
DIXIE 500	4.7	20.0	2
DIXIE 900	0.0	8.0	73
DIXIE 9512	0.0	9.7	80
DIXIE 9812	0.7	10.7	83
DIXIE BELL DB1170	10.7	43.3	62
DIXIE BELL DB2125	0.0	38.3	35
DIXIE BELL DB2150	0.7	33.3	59
DIXIE BELL DB3440	5.7	33.3	7
DIXIE DX989	1.3	10.7	1
FFR 8302	0.7	8.0	13
HBK 3266	47.3	71.0	46
JGL EXP 603	0.7	20.0	59

continued

Table 1. Continued.

	Stripe rust (%)	Powdery
--	-----------------	---------

Variety	2 May	11 May	mildew (%)
JGL EXP 604	9.7	25.0	11
LA95135D54-2-3-C	0.7	5.3	4
LA9554D68-3-2-C	0.7	8.0	1
LA97113UC-124-3-B	0.7	3.7	1
LA98094BUB-58-5-B	0.0	6.3	15
MVS-46	56.7	87.0	0
PAT	0.0	9.7	71
PIONEER 26R15	1.3	9.7	0
PIONEER 26R22	1.3	9.7	1
PIONEER XW04XC	0.0	9.7	1
PROGENY 110	0.0	25.0	83
PROGENY 133	0.0	20.0	75
PROGENY 145	0.7	30.0	78
PROGENY 166	0.7	25.0	69
PROGENY 185	20.0	55.0	4
PROGENY 196	1.3	8.0	42
ROANE	10.0	29.0	0
SABBE	0.7	20.0	1
TERRAL LA841	0.0	3.7	12
TERRAL TV8466	4.7	11.3	5
TERRAL TV8558	10.0	20.7	2
TERRAL TVX8331	0.0	8.0	7
TERRAL TVX8332	0.0	9.7	61
TERRAL TVX83H504	0.0	5.3	31
TERRAL TVX8660	7.3	30.0	63
UGA 951079-2E31	0.7	8.0	1
UGA 951216-2E26	2.3	8.0	35
UGA 951395-3A31	0.7	5.3	1
UGA 951395-3E25	0.0	5.3	2
UGA 96229-3A41	0.0	6.3	1
UGA 96229-3E39	1.3	13.0	0
USG 3209	31.7	73.3	1
USG 3244	0.7	12.3	54
USG 3350	0.0	9.7	60
USG 3665	9.7	31.7	4
VIGORO DOMINION	0.0	8.0	0
VIGORO McINTOSH	0.7	7.0	2
LSD (P=0.05)	11.0	21.7	19

Table 2. Stripe rust severity at Fayetteville  
Arkansas Elite Nursery, 2006.

Line	Stripe rust (%)	
	2 May	11 May
AR96052-4-3	5.3	43.3
AR96077-7-2	4.7	17.3
AR96077-10-1	1.3	9.7
TX02D5406	0.0	9.7
AR96077-7-3	3.7	9.7
AR96077-3-1	3.0	9.7
AR97044-10-3	9.7	45.0
AR97170-1-1	5.7	8.0
AR97139-15-2	0.7	26.7
AR97143-7-1	0.7	8.0
AR97139-9-1	7.3	36.7
AR97044-10-2	8.0	56.7
AR97139-15-1	1.3	7.0
AR97226-1-1	3.0	68.3
AR97225-4-1	2.3	31.7
AR97106-2-1	17.3	43.3
AR97044-12-3	10.7	31.7
AR97217-1-1	5.3	15.0
AR97044-3-1	3.0	15.0
AR97044-12-1	3.7	25.0
AR97044-10-1	8.0	68.3
AR97031-8-1	0.7	9.7
AR97139-5-1	0.7	12.3
AR97226-1-2	3.0	43.3
AR97109-9-1	5.3	20.0
AR97226-6-1	6.3	43.3
AR97139-14-1	6.3	43.3
AR97139-11-1	3.0	17.3
AR97139-11-2	0.0	14.7
AR97149-8-1	5.7	20.0
AR97124-4-3	0.0	8.0
AR97124-4-2	0.0	6.3
AR97124-4-1	0.0	3.7
AR97048-1-1	0.0	22.3
AR97048-4-1	3.0	20.0
AR910	2.0	17.3
PAT	2.0	7.0
AGS 2000	15.0	43.3
SABBE	3.7	26.7
AP BERETTA	6.3	14.7
LSD (P=0.05)	6.6	19.3

Table 3. Stripe rust severity at Fayetteville for entries in the Arkansas Advanced Nursery, 2006.

Line	Stripe rust (%)		Line	Stripe rust (%)	
	2 May	11 May		2 May	11 May
98001-5-1	0.7	7.3	98088-7-1	12.3	43.3
98003-1-1	0.0	7.3	98088-7-2	11.3	48.3
98003-7-1	0.0	15.0	98093-3-1	3.0	25.0
98011-8-2	3.0	20.0	98093-5-1	4.7	45.0
98072-3-1	1.3	15.0	98093-5-2	4.7	31.7
98021-11-2	0.0	9.7	98093-5-3	3.0	29.0
98021-12-3	1.3	9.7	98093-5-4	3.7	25.0
98022-19-2	0.0	7.0	98096-3-1	5.3	20.0
98022-19-3	0.7	15.0	98096-3-2	8.0	20.0
98023-1-2	3.7	20.0	98097-4-1	8.0	20.0
98023-2-2	8.0	25.0	98097-5-1	9.7	36.7
98023-4-1	0.7	9.7	98098-11-2	12.3	68.3
98023-4-2	3.0	9.7	98105-3-1	0.7	31.7
98023-5-1	0.7	15.0	98105-3-2	0.0	20.0
98023-5-3	5.7	25.0	98105-4-1	2.3	5.3
98023-6-2	3.0	9.7	98106-1-1	0.7	6.3
98045-1-2	13.0	25.0	98106-3-1	0.0	17.3
98046-6-2	5.7	25.0	98106-4-1	0.7	30.0
98063-3-1	7.0	25.0	98106-8-1	5.3	30.0
98068-4-1	9.7	20.0	98106-8-2	7.0	31.7
98072-2-1	5.7	50.0	98109-9-2	3.0	17.3
98072-2-2	5.7	45.0	98109-9-3	1.3	20.0
98075-5-1	14.7	38.3	98109-9-4	10.7	36.7
98075-7-1	24.0	43.3	98127-1-1	0.0	17.3
98082-1-1	0.0	5.3	98152-1-1	0.0	17.3
98083-1-1	10.0	8.0	98152-4-1	0.0	15.0
98083-1-2	0.0	8.0	98152-9-2	0.0	12.3
98083-1-3	0.0	9.7	98159-5-2	6.3	36.7
98083-7-1	0.0	9.7	98159-8-1	0.0	12.3
98083-8-1	14.7	50.0	98172-1-1	0.0	2.0
98083-9-1	14.7	50.0	98172-1-2	0.0	3.7
98083-10-1	1.3	43.3	98172-3-1	0.0	2.0
98084-4-1	4.7	20.0	98172-6-1	0.0	2.0
98088-1-1	1.3	20.0	AR910	5.7	8.0
98088-1-2	0.0	17.3	PAT	0.7	8.0
98088-3-1	3.0	63.3	AGS 2000	10.7	56.7
98088-3-2	1.3	64.3	DELTA KING 9410	1.3	22.3
98088-6-1	1.3	15.0			
98088-6-2	2.3	25.0	LSD (P=0.05)	8.8	22.5

Table 4. Stripe rust severity at Fayetteville for entries in the Arkansas Observation Nursery, 2006.

Line	Stripe rust (%)		Line	Stripe rust (%)		Line	Stripe rust (%)	
	2 May	11 May		2 May	11 May		2 May	11 May
99001-1-1	0.0	2.0	99026-3-1	2.0	2.0	99087-7-2	0.0	2.0
99001-1-2	0.0	2.0	99026-5-1	15.0	15.0	99087-7-3	0.0	2.0
99001-2-1	0.0	2.0	99026-5-2	15.0	15.0	99093-1-1	0.0	2.0
99009-2-1	7.0	30.0	99027-5-1	15.0	15.0	99093-6-1	0.0	2.0
99009-3-1	0.0	2.0	99027-6-1	15.0	30.0	99093-6-2	0.0	2.0
99009-3-2	0.0	2.0	99027-6-2	15.0	15.0	99093-6-3	15.0	15.0
99009-3-3	0.0	2.0	99027-7-1	7.0	15.0	99095-7-1	7.0	2.0
99009-4-1	0.0	2.0	99027-7-2	15.0	15.0	99095-10-1	0.0	2.0
99010-1-1	7.0	30.0	99027-7-3	7.0	15.0	99095-10-2	0.0	2.0
99010-1-2	7.0	50.0	99027-7-4	7.0	15.0	99095-15-1	2.0	2.0
99010-4-1	0.0	7.0	99027-8-1	15.0	30.0	99095-16-1	30.0	30.0
99011-3-1	0.0	15.0	99030-5-1	2.0	7.0	99095-18-1	0.0	2.0
99011-5-1	0.0	15.0	99030-5-2	0.0	2.0	99095-18-2	0.0	2.0
99011-5-2	0.0	15.0	99030-8-1	2.0	15.0	99095-21-1	0.0	2.0
99011-6-1	30.0	100.0	99030-8-2	2.0	15.0	99097-2-1	2.0	7.0
99012-1-1	0.0	30.0	99030-8-3	0.0	50.0	99097-2-2	0.0	15.0
99012-1-2	0.0	30.0	99030-9-1	0.0	15.0	99097-3-1	30.0	50.0
99012-1-3	0.0	7.0	99032-2-1	0.0	7.0	99097-3-2	15.0	70.0
99012-7-1	0.0	2.0	99033-5-1	0.0	2.0	99097-3-3	15.0	70.0
99015-2-1	0.0	2.0	99033-5-2	2.0	2.0	99097-5-1	2.0	15.0
99015-3-1	0.0	2.0	99033-5-3	0.0	2.0	99097-5-2	0.0	7.0
99015-3-2	0.0	2.0	99033-6-1	0.0	2.0	99097-5-3	0.0	7.0
99015-3-3	2.0	7.0	99033-6-2	0.0	2.0	99097-5-4	0.0	2.0
99015-3-4	30.0	50.0	99033-6-3	0.0	2.0	99097-11-1	0.0	2.0
99015-5-1	2.0	2.0	99037-3-1	0.0	2.0	99097-11-2	0.0	2.0
99015-5-2	0.0	2.0	99037-6-1	0.0	2.0	99097-11-3	7.0	30.0
99016-1-1	0.0	2.0	99039-2-1	0.0	7.0	99097-13-1	0.0	2.0
99016-1-2	0.0	15.0	99044-3-1	0.0	7.0	99099-5-1	2.0	7.0
99016-1-3	0.0	50.0	99045-1-1	0.0	7.0	99100-6-1	0.0	2.0
99016-1-4	0.0	30.0	99045-1-2	0.0	7.0	99100-6-2	0.0	2.0
99016-5-1	0.0	2.0	99045-1-3	0.0	7.0	99106-3-1	0.0	2.0
99016-5-2	0.0	2.0	99045-3-1	0.0	30.0	99106-7-1	0.0	2.0
99020-3-1	30.0	100.0	99045-3-2	0.0	30.0	99108-3-1	0.0	2.0
99022-3-1	30.0	85.0	99045-6-1	0.0	15.0	99108-4-1	30.0	15.0
99022-4-1	0.0	15.0	99047-1-1	50.0	85.0	99108-4-2	0.0	2.0
99023-7-1	15.0	15.0	99047-1-2	70.0	85.0	99108-9-1	0.0	7.0
99023-7-2	30.0	15.0	99047-2-1	50.0	85.0	99108-9-2	0.0	7.0
99023-7-3	30.0	30.0	99086-5-1	0.0	2.0	99109-4-1	0.0	7.0
99024-7-4	50.0	50.0	99086-5-2	0.0	2.0	99109-5-1	0.0	2.0
99023-7-5	7.0	7.0	99086-5-3	0.0	7.0	99110-3-1	2.0	2.0
99024-3-1	0.0	2.0	99086-5-4	0.0	7.0	99110-3-2	0.0	2.0
99026-2-1	0.0	2.0	99087-7-1	0.0	2.0	99110-5-1	0.0	30.0

continued

Table 4. Continued.

Line	Stripe rust (%)		Line	Stripe rust (%)		Line	Stripe rust (%)	
	2 May	11 May		2 May	11 May		2 May	11 May
99110-11-1	0.0	2.0	99148-1-2	2.0	15.0	99187-5-1	7.0	2.0
99110-11-2	0.0	2.0	99148-1-3	2.0	30.0	99187-7-1	0.0	2.0
99110-11-3	0.0	2.0	99148-2-1	2.0	15.0	99187-8-1	0.0	7.0
99110-11-4	0.0	2.0	99154-2-1	0.0	2.0	99192-1-1	0.0	7.0
99110-12-1	0.0	2.0	99154-2-2	0.0	2.0	99192-1-2	2.0	2.0
99110-12-2	0.0	2.0	99161-1-1	15.0	2.0	99192-3-1	0.0	30.0
99110-13-1	0.0	2.0	99161-4-1	7.0	2.0	99192-5-1	0.0	93.0
99112-1-1	15.0	2.0	99163-3-1	0.0	2.0	99192-7-1	0.0	7.0
99112-2-1	0.0	2.0	99163-4-1	0.0	2.0	99196-3-1	0.0	7.0
99114-2-1	0.0	2.0	99163-5-1	0.0	2.0	99206-9-1	30.0	15.0
99114-2-2	0.0	15.0	99163-8-1	2.0	2.0	99216-1-1	7.0	15.0
99115-2-1	7.0	15.0	99164-7-1	0.0	2.0	99230-4-1	7.0	30.0
99118-5-1	0.0	7.0	99166-1-1	0.0	2.0	99230-4-2	7.0	15.0
99118-5-2	0.0	7.0	99166-1-2	0.0	2.0	99230-6-1	50.0	85.0
99122-4-1	0.0	2.0	99168-4-1	0.0	2.0	99230-6-2	30.0	85.0
99122-5-1	0.0	7.0	99168-5-1	0.0	2.0	99230-10-1	15.0	15.0
99127-2-1	0.0	2.0	99172-2-1	7.0	7.0	99232-2-1	0.0	7.0
99127-7-1	0.0	2.0	99174-1-1	7.0	2.0	99232-2-2	0.0	7.0
99127-7-2	0.0	15.0	99174-4-1	0.0	2.0	99232-3-1	0.0	7.0
99127-9-1	0.0	2.0	99174-4-2	0.0	2.0	99236-1-1	0.0	15.0
99127-10-1	2.0	7.0	99174-5-1	0.0	2.0	99236-4-1	0.0	15.0
99129-1-1	2.0	70.0	99174-6-1	0.0	2.0	99238-2-1	0.0	7.0
99129-1-2	2.0	50.0	99174-6-2	0.0	2.0	99238-3-1	0.0	2.0
99129-7-1	15.0	85.0	99174-8-1	0.0	2.0	99238-4-1	0.0	2.0
99129-8-1	7.0	70.0	99174-9-1	0.0	7.0	99238-6-1	7.0	15.0
99129-10-1	2.0	2.0	99174-9-2	0.0	2.0	99238-9-1	7.0	93.0
99129-10-2	2.0	2.0	99174-11-1	2.0	7.0	99240-2-1	0.0	30.0
99136-13-1	2.0	7.0	99174-14-1	0.0	2.0	99241-1-1	7.0	30.0
99136-13-2	0.0	7.0	99174-16-1	15.0	15.0	99241-2-1	2.0	30.0
99138-3-1	0.0	2.0	99174-19-1	30.0	30.0	99241-2-2	2.0	15.0
99138-5-1	2.0	2.0	99174-21-1	0.0	2.0	99241-3-1	0.0	7.0
99138-6-1	15.0	30.0	99174-21-2	0.0	2.0	99242-4-1	2.0	15.0
99138-6-2	2.0	15.0	99174-21-3	0.0	2.0	99242-4-2	0.0	15.0
99138-7-1	0.0	7.0	99174-22-1	0.0	2.0	99270-1-1	0.0	7.0
99138-12-1	0.0	15.0	99174-25-1	0.0	2.0	99270-3-1	2.0	15.0
99138-12-2	0.0	7.0	99180-5-1	15.0	30.0	99270-5-1	2.0	15.0
99148-1-1	2.0	15.0	99185-2-1	70.0	85.0	99270-2	7.0	30.0
						99270-6-2	2.0	15.0



Table 5. Advanced lines selected for good agronomic type and resistance to stripe rust.

Cross	Pedigree	Generation
02-0042	Mason*2/Ming Xian 169	BCF5
02-0042	Mason*2/Ming Xian 169	BCF5
02-0042	Mason*2/Ming Xian 169	BCF5
02-0042	Mason*2/Ming Xian 169	BCF5
02-0042	Mason*2/Ming Xian 169	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0043	Mason*2/Xian Nong 4	BCF5
02-0045	Shiloh/P2684/Xian Nong 4	BCF5
02-0045	Shiloh/P2684/Xian Nong 4	BCF5
02-0045	Shiloh/P2684/Xian Nong 4	BCF5
02-0045	Shiloh/P2684/Xian Nong 4	BCF5
02-0045	Shiloh/P2684/Xian Nong 4	BCF5
02-0046	Sabbe/P2684/Xian Nong 4	BCF5
02-0046	Sabbe/P2684/Xian Nong 4	BCF5
02-0046	Sabbe/P2684/Xian Nong 4	BCF5
02-0046	Sabbe/P2684/Xian Nong 4	BCF5
02-0047	Mason/Chapio	F5
02-0047	Mason/Chapio	F5
02-0047	Mason/Chapio	F5
02-0047	Mason/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0048	Sabbe/Chapio	F5
02-0049	Shiloh/Chapio	F5
02-0049	Shiloh/Chapio	F5
03-0050	Mason*2/Chapio	BCF4
03-0050	Mason*2/Chapio	BCF4
03-0050	Mason*2/Chapio	BCF4
03-0050	Mason*2/Chapio	BCF4
03-0050	Mason*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4
03-0051	Sabbe*2/Chapio	BCF4

continued

Table 5. Continued.

Cross	Pedigree	Generation
03-0052	Shiloh*2/Chapio	BCF4
04-0064	LR crossing Block	F4
04-0065	LR crossing Block	F4
.	P26R61/VA96W-270	F6
.	P26R61/VA96W-270	F6
.	P26R61/VA96W-270	F6
.	P26R61/VA96W-270	F6
.	P26R61/VA96W-270	F6
.	P26R61/VA96W-270	F6
02-1140	Mason*2/3/MAYOOR//TK SN1081/AE.SQ.	BCF5
02-1140	Mason*2/3/MAYOOR//TK SN1081/AE.SQ.	BCF5
02-1140	Mason*2/3/MAYOOR//TK SN1081/AE.SQ.	BCF5
02-1140	Mason*2/3/MAYOOR//TK SN1081/AE.SQ.	BCF5
02-1140	Mason*2/3/MAYOOR//TK SN1081/AE.SQ.	BCF5

Table 6. Lines selected for resistance to barley yellow dwarf.

Selection	Pedigree
99-2029-20-1-3-10	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-13	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-14	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-2	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-3	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-4	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-1-3-5	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2029-20-2-2-2	MASON*2//THB/CEP7780 (F <sub>8</sub> )
99-2022-3-2-8	P2684*2//MILAN/SHA7 (F <sub>8</sub> )
04-2045-002	C9663/3/MASON*2//THB/CEP7780
04-2045-003	C9663/3/MASON*2//THB/CEP7780
04-2045-004	C9663/3/MASON*2//THB/CEP7780
04-2045-005	C9663/3/MASON*2//THB/CEP7780
04-2045-006	C9663/3/MASON*2//THB/CEP7780
04-2045-007	C9663/3/MASON*2//THB/CEP7780
04-2045-008	C9663/3/MASON*2//THB/CEP7780
04-2045-009	C9663/3/MASON*2//THB/CEP7780
04-2045-010	C9663/3/MASON*2//THB/CEP7780
04-2045-011	C9663/3/MASON*2//THB/CEP7780
04-2045-013	C9663/3/MASON*2//THB/CEP7780
04-2045-014	C9663/3/MASON*2//THB/CEP7780
04-2045-016	C9663/3/MASON*2//THB/CEP7780
04-2045-019	C9663/3/MASON*2//THB/CEP7780
04-2045-020	C9663/3/MASON*2//THB/CEP7780
04-2045-021	C9663/3/MASON*2//THB/CEP7780
04-2045-023	C9663/3/MASON*2//THB/CEP7780
04-2045-024	C9663/3/MASON*2//THB/CEP7780
04-2045-027	C9663/3/MASON*2//THB/CEP7780
04-2045-032	C9663/3/MASON*2//THB/CEP7780
04-2045-035	C9663/3/MASON*2//THB/CEP7780
04-2045-036	C9663/3/MASON*2//THB/CEP7780
04-2045-038	C9663/3/MASON*2//THB/CEP7780
04-2045-039	C9663/3/MASON*2//THB/CEP7780
04-2045-042	C9663/3/MASON*2//THB/CEP7780
04-2045-043	C9663/3/MASON*2//THB/CEP7780
04-2045-044	C9663/3/MASON*2//THB/CEP7780
04-2045-045	C9663/3/MASON*2//THB/CEP7780
04-2045-046	C9663/3/MASON*2//THB/CEP7780
04-2045-047	C9663/3/MASON*2//THB/CEP7780
04-2045-048	C9663/3/MASON*2//THB/CEP7780
04-2045-051	C9663/3/MASON*2//THB/CEP7780
04-2045-053	C9663/3/MASON*2//THB/CEP7780
04-2045-054	C9663/3/MASON*2//THB/CEP7780

continued

Table 6. Continued.

Selection	Pedigree
04-2045-055	C9663/3/MASON*2//THB/CEP7780
04-2045-056	C9663/3/MASON*2//THB/CEP7780
04-2045-058	C9663/3/MASON*2//THB/CEP7780
04-2045-060	C9663/3/MASON*2//THB/CEP7780
04-2045-061	C9663/3/MASON*2//THB/CEP7780
04-2045-063	C9663/3/MASON*2//THB/CEP7780
04-2045-066	C9663/3/MASON*2//THB/CEP7780
04-2045-067	C9663/3/MASON*2//THB/CEP7780
04-2045-078	C9663/3/MASON*2//THB/CEP7780
04-2045-079	C9663/3/MASON*2//THB/CEP7780
04-2045-080	C9663/3/MASON*2//THB/CEP7780
04-2045-082	C9663/3/MASON*2//THB/CEP7780
04-2045-085	C9663/3/MASON*2//THB/CEP7780
04-2045-086	C9663/3/MASON*2//THB/CEP7780
04-2045-087	C9663/3/MASON*2//THB/CEP7780
04-2045-089	C9663/3/MASON*2//THB/CEP7780
04-2045-096	C9663/3/MASON*2//THB/CEP7780
04-2045-100	C9663/3/MASON*2//THB/CEP7780
04-2045-101	C9663/3/MASON*2//THB/CEP7780
04-2045-102	C9663/3/MASON*2//THB/CEP7780
04-2045-103	C9663/3/MASON*2//THB/CEP7780
04-2045-104	C9663/3/MASON*2//THB/CEP7780
04-2045-106	C9663/3/MASON*2//THB/CEP7780
04-2045-107	C9663/3/MASON*2//THB/CEP7780
04-2045-108	C9663/3/MASON*2//THB/CEP7780
04-2045-109	C9663/3/MASON*2//THB/CEP7780
04-2045-110	C9663/3/MASON*2//THB/CEP7780
04-2045-112	C9663/3/MASON*2//THB/CEP7780
04-2045-113	C9663/3/MASON*2//THB/CEP7780
04-2045-118	C9663/3/MASON*2//THB/CEP7780
04-2045-120	C9663/3/MASON*2//THB/CEP7780
04-2044-02	C9663/3/P2684*2//MILAN/SHA7
04-2044-03	C9663/3/P2684*2//MILAN/SHA7
04-2044-05	C9663/3/P2684*2//MILAN/SHA7
04-2044-06	C9663/3/P2684*2//MILAN/SHA7
04-2044-08	C9663/3/P2684*2//MILAN/SHA7
04-2044-09	C9663/3/P2684*2//MILAN/SHA7
04-2044-10	C9663/3/P2684*2//MILAN/SHA7
04-2044-11	C9663/3/P2684*2//MILAN/SHA7
04-2044-12	C9663/3/P2684*2//MILAN/SHA7
04-2044-13	C9663/3/P2684*2//MILAN/SHA7
04-2044-14	C9663/3/P2684*2//MILAN/SHA7
04-2044-15	C9663/3/P2684*2//MILAN/SHA7

continued

Table 6. Continued.

Selection	Pedigree
04-2044-16	C9663/3/P2684*2//MILAN/SHA7
04-2044-17	C9663/3/P2684*2//MILAN/SHA7
04-2044-18	C9663/3/P2684*2//MILAN/SHA7
04-2044-19	C9663/3/P2684*2//MILAN/SHA7
04-2044-20	C9663/3/P2684*2//MILAN/SHA7
04-2044-21	C9663/3/P2684*2//MILAN/SHA7
04-2044-24	C9663/3/P2684*2//MILAN/SHA7
04-2044-29	C9663/3/P2684*2//MILAN/SHA7
04-2044-30	C9663/3/P2684*2//MILAN/SHA7
04-2044-32	C9663/3/P2684*2//MILAN/SHA7
04-2044-33	C9663/3/P2684*2//MILAN/SHA7
04-2044-34	C9663/3/P2684*2//MILAN/SHA7
04-2044-36	C9663/3/P2684*2//MILAN/SHA7
04-2044-39	C9663/3/P2684*2//MILAN/SHA7
04-2044-40	C9663/3/P2684*2//MILAN/SHA7
04-2044-41	C9663/3/P2684*2//MILAN/SHA7
04-2044-43	C9663/3/P2684*2//MILAN/SHA7
04-2044-44	C9663/3/P2684*2//MILAN/SHA7
04-2044-45	C9663/3/P2684*2//MILAN/SHA7
04-2044-46	C9663/3/P2684*2//MILAN/SHA7
04-2044-47	C9663/3/P2684*2//MILAN/SHA7
04-2044-49	C9663/3/P2684*2//MILAN/SHA7
04-2044-50	C9663/3/P2684*2//MILAN/SHA7
04-2044-52	C9663/3/P2684*2//MILAN/SHA7
04-2044-53	C9663/3/P2684*2//MILAN/SHA7
04-2044-54	C9663/3/P2684*2//MILAN/SHA7
04-2044-55	C9663/3/P2684*2//MILAN/SHA7
04-2044-56	C9663/3/P2684*2//MILAN/SHA7
04-2044-57	C9663/3/P2684*2//MILAN/SHA7
04-2044-58	C9663/3/P2684*2//MILAN/SHA7
04-2044-59	C9663/3/P2684*2//MILAN/SHA7
04-2044-61	C9663/3/P2684*2//MILAN/SHA7
04-2046-009	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-019	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-024	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-025	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-027	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-032	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-033	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-036	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-042	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-043	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ
04-2046-096	C9663/4/MASON*2/3/KAUZ*2//OPATA//KAUZ

continued

Table 6. Continued.

Selection	Pedigree
04-2046-097	C9663/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2046-109	C9663/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2048-007	Roane/3/MASON*2//THB/CEP7780
04-2048-012	Roane/3/MASON*2//THB/CEP7780
04-2048-013	Roane/3/MASON*2//THB/CEP7780
04-2048-017	Roane/3/MASON*2//THB/CEP7780
04-2048-020	Roane/3/MASON*2//THB/CEP7780
04-2048-022	Roane/3/MASON*2//THB/CEP7780
04-2048-023	Roane/3/MASON*2//THB/CEP7780
04-2048-025	Roane/3/MASON*2//THB/CEP7780
04-2048-026	Roane/3/MASON*2//THB/CEP7780
04-2048-027	Roane/3/MASON*2//THB/CEP7780
04-2048-032	Roane/3/MASON*2//THB/CEP7780
04-2048-094	Roane/3/MASON*2//THB/CEP7780
04-2048-102	Roane/3/MASON*2//THB/CEP7780
04-2049-007	Roane/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2049-072	Roane/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2049-092	Roane/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2049-100	Roane/4/MASON*2/3/KAUZ*2/OPATA//KAUZ
04-2049-116	Roane/4/MASON*2/3/KAUZ*2/OPATA//KAUZ

Table 7. F<sub>2</sub> populations being advanced for resistance to stripe rust and barley yellow dwarf.

Cross	Pedigree	Purpose
05-0053	Panola/Capelle Deprez	STRIPE RUST
05-0054	Panola/LM	STRIPE RUST
05-0055	Panola/5/JCAM/EMU//DOVE/3/JGR/4/THK	STRIPE RUST
05-0056	Panola/Lacos 10	STRIPE RUST
05-0057	Panola/Lacos 17	STRIPE RUST
05-0058	Pat/LM	STRIPE RUST
05-0059	Pat/5/JCAM/EMU//DOVE/3/JGR/4/THK	STRIPE RUST
05-0060	LA841/Capelle Deprez	STRIPE RUST
05-0061	LA841/5/JCAM/EMU//DOVE/3/JGR/4/THK	STRIPE RUST
05-0062	LA841/Lacos 10	STRIPE RUST
05-0063	LA841/Lacos 17	STRIPE RUST
05-2050	PAT/3/P2684*2//MILAN/SHA7	BYD
05-2051	PAT/3/P2684*2//MILAN/SHA7	BYD
05-2052	PAT/3/MASON*2//THB/CEP7780	BYD
05-2053	LA841/3/P2684*2//MILAN/SHA7	BYD
05-2054	LA841/3/MASON*2//THB/CEP7780	BYD
05-2055	PANOLA/3/P2684*2//MILAN/SHA7	BYD
05-2056	PANOLA/3/MASON*2//THB/CEP7780	BYD

Table 8. Summary of infection types when two replicates of 16 *Puccinia striiformis* f. sp. *tritici* isolates collected between 2000 and 2005 were evaluated on the North American standard differential set indicating that intermediate infection types (4 or 5) on differentials Heines VII, Produra, Yamhill and Stephens flip-flop between virulent and avirulent categories and cause discrepancies and inconsistencies in race identification among new isolates of the stripe rust fungus.

Differential	Infection types <sup>a</sup>									
	14 days					21 days				
	Times rated	0 to 4	5 to 9	4,5	Discrepancies <sup>b</sup>	Times rated	0 to 4	5 to 9	4,5	Discrepancies <sup>b</sup>
Lemhi	31	0	31	0	0	31	0	31	0	0
Chinese 166	32	32	0	0	0	31	31	0	0	0
Heines VII	24	1	23	12	3	27	2	25	9	2
Moro	32	32	0	0	0	32	32	0	0	0
Paha	32	32	0	0	0	31	31	0	0	0
Druchamp	32	32	0	0	0	32	32	0	0	0
Avocet Yr5	32	32	0	0	0	32	32	0	0	0
Produra	31	4	27	11	4	31	1	30	4	1
Yamhill	27	18	9	16	5	27	17	10	16	4
Stephens	31	5	26	11	3	31	7	24	6	3
Lee	31	0	31	0	0	29	0	29	0	0
Fielder	32	0	32	0	0	32	0	32	0	0
Tyee	32	32	0	0	0	32	32	0	0	0
Tres	32	32	0	2	0	32	32	0	2	0
Hyak	32	32	0	1	0	32	32	0	0	0
Express	29	0	29	0	0	29	0	29	0	0
Avocet Yr8	18	0	18	5	0	15	0	15	2	0
Avocet Yr9	29	0	29	2	0	29	0	29	2	0
Clement	26	0	26	8	0	26	0	26	8	0
Compare	27	0	27	3	0	27	3	24	8	3

<sup>a</sup> Infection types were rated at 14 and 21 days. Infection types 0 to 4 are considered avirulent and infection types 5 to 9 are considered virulent.

<sup>b</sup> Number of times infection type was virulent on one replicate and avirulent on the other.



Table 9. *Puccinia striiformis* f. sp. *tritici* race designations when virulent phenotypes are observed on Lemhi, Heines VII, Lee, Fielder Express, Avocet Yr8, Avocet Yr9, Clement, Compair and infection types on Produra, Yamhill, and Stephens are virulent or avirulent as indicated.

Race	Virulence phenotype <sup>a</sup>		
	Produra	Yamhill	Stephens
78	A	A	A
97	A	A	V
Unreported	A	V	A
99	A	V	V
80	V	A	A
98	V	A	V
110	V	V	A
100	V	V	V

<sup>a</sup> A=Avirulent (Infection types 0-4), V=Virulent (infection types 5 to 9).

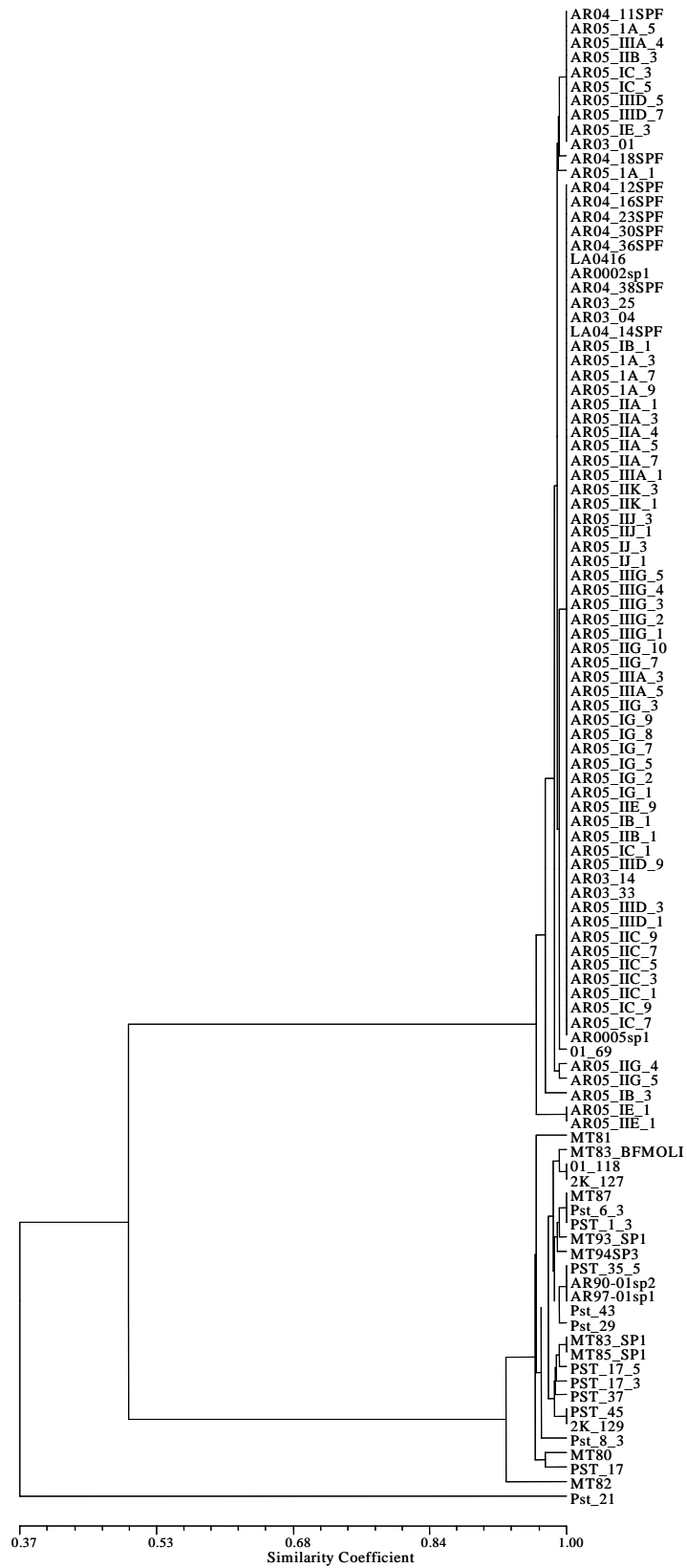


Figure 1.

Dendrogram showing

similarity among 104 *Puccinia striiformis* f. sp. *tritici* isolates generated with polymorphic markers from nine AFLP primer combinations.