

'Mayoor//TKSN1081/*Ae. tauschii*'. Apart from its high level of scab resistance (Table 6), this advanced line has multiple resistances to *S. tritici*, *N. indica*, and *H. sativum* (Table 7). This line is currently being used to develop an F₁-based DH mapping population of 500 DH's. The BW cultivar used in this population is susceptible to all four of these stresses.

Table 7. Mean scores of the bread wheat/synthetic hexaploid line with some multiple biotic stress resistances.

Pedigree	Biotic stress		
	<i>Septoria tritici</i> ¹	<i>Helminthosporium sativum</i> ¹	<i>Neovossia indica</i> ²
Mayoor//TKSN1081/ <i>Ae. tauschii</i> (222) ³ CASS94Y00009S-51PR-2B	2-1	2-2	3.11
Mayoor//TKSN1081/ <i>Ae. tauschii</i> (222) CASS94Y00009S-51PR-4B	2-1	2-2	2.78

¹ *Septoria tritici* and *Helminthosporium sativum* rated on a double-digit modified scale: the first digit indicates the height of infection, where 1 = lowest leaf; 5 = up to mid-plant; and 9 = up to flag leaf; the second digit indicates disease severity on infected leaves, where 1 = 10 % coverage; 5 = 50 % coverage; and 9 = 90 % coverage.

² Values in percentage.

³ Synthetic hexaploid with the *Ae. tauschii* CIMMYT accession number in parentheses.

Advanced derivatives from bread wheat/D-genome synthetic hexaploid combinations resistant to *Helminthosporium sativum*.

A. Mujeeb-Kazi and R. Delgado.

Ten lines with resistance to *H. sativum* were reported in Volume 44, *Annual Wheat Newsletter* 1998. To this set, we added another 13 lines to make the entry total 23, apart from the susceptible check cultivar Ciano 79. One of the entries included was derived from *Ae. searsii* and was the earliest to flower and had a high level of resistance. Three entries were derived from resistant/resistant advanced 'BW/SH' lines with different *Ae. tauschii* accessions in their pedigrees.

This study had greater stringency, in that observations were recorded for days to flowering, days to physiological maturity, and plant height. Progressive infection scores also were recorded at 58, 65, 72, 79, 89, and 96 days after planting. Additionally, we recorded grain finish and yield data. All the above observations were combined in a replicated study on fungicidal treatment or no fungicidal treatment of the plots. Yield and fungicide treatment results are not reported here.

Table 8. Elite trial of advanced *Helminthosporium sativum*-resistant lines from bread wheat/D genome synthetic hexaploids evaluated in Poza Rica, Mexico, during the 1998–99 crop cycle

Pedigree ²	Days to flowering	Days to physiological maturity	Plant height (cm)	Progressive infection score (days) ¹						Grain finish ³
				58	65	72	79	89	96	
CIANO T 79 [CM31678-R]	58	100	73.4	2-1	2-1	3-2	5-3	7-7	9-9	5
Croc 1/ <i>Ae. tauschii</i> (205)//Kauz [CIGM90.261]	76	104	62.4	0	0	0	0	2-1	5-4	2
Altar 84/ <i>Ae. tauschii</i> (224)//2*Yaco [CIGM90.1291]	76	100	79.0	0	0	1-1	1-1	2-1	3-4	1
Filin//Dverd 2/ <i>Ae. tauschii</i> (247) [CASS94Y00069S]	70	100	113.4	1-1	1-1	1-1	1-1	3-2	3-2	1
Bcn//Ceta/ <i>Ae. tauschii</i> (895) [CASS94B00064S]	54	100	81.8	0	1-1	1-1	2-1	2-2	3-2	2
Bcn//Ceta/ <i>Ae. tauschii</i> (895) [CASS94B00064S]	70	100	69.0	0	0	1-1	1-1	2-2	2-2	3
Altar 84/ <i>Ae. tauschii</i> (219)//2*Serl [CMSS92Y01855M]	76	96	77.6	0	0	1-1	1-1	2-2	4-3	3
Altar 84/ <i>Ae. tauschii</i> (219)//2*Opata [CIGM90.429]	70	105	78.4	0	0	0	0	2-2	3-2	2
Altar 84/ <i>Ae. tauschii</i> (219)//Opata/3/Altar 84/ <i>Ae. tauschii</i> (191)//Opata [CIGM93.556]	70	103	92.6	1-1	1-1	2-1	2-1	4-3	4-3	1
Sabuf/7/Altar 84/ <i>Ae. tauschii</i> (224)//Yaco/6/Croc 1/ <i>Ae. tauschii</i> (205)/5/Br12*3/4/Ias55*4/Ci14123/3/Ias55*4/Eagle//Ias55*4/Ald [CASS94Y00045S]	58	96.0	70.4	0	0	0	0	2-1	2-1	1
Altar 84/ <i>Ae. tauschii</i> (191)//Opata/3/Altar 84/ <i>Ae. tauschii</i> (224)//Yaco [CIGM93.566]	58	100	78.6	0	1-1	2-2	2-2	4-3	5-4	3
Bcn//Doy1/ <i>Ae. tauschii</i> (447) [CASS94Y00006S]	60	96	86.2	0	1-1	2-2	2-2	2-2	3-2	1
Bcn//Sora/ <i>Ae. tauschii</i> (323) [CASS94Y00121S]	60	100	82.0	0	0	0	0	2-2	3-3	2
Bcn/4/Snipe/Yav79//Dack/Teal/3/ <i>Ae. tauschii</i> (412) [CASS94Y00154S]	70	100	69.4	1-1	2-1	2-2	3-2	3-2	3-2	1
Bcn//Doy1/ <i>Ae. tauschii</i> (447) [CASS94Y00006S]	70	96	97.2	0	0	2-1	2-1	3-2	3-2	1
Bcn/6/68.111/Rgb-ull/Ward/3/Fgo/4/Rabi/5/ <i>Ae. tauschii</i> (629) [CASS94Y00143S]	68	107	94.4	0	0	0	0	1-1	1-1	2
Opata//Ceta/ <i>Ae. tauschii</i> (895) [CASS94Y00277S]	70	100	101.8	0	0	2-1	2-1	3-3	3-3	2
Bcn//Croc 1/ <i>Ae. tauschii</i> (224) [CASS94Y00057S]	60	100	76.6	0	0	0	1-1	2-2	2-2	1
Opata//TK SB1081/ <i>Ae. tauschii</i> (519) [CASS94Y00281S]	68	105	95.0	1-1	1-1	1-1	2-1	4-3	5-4	3
Altar 84/ <i>Ae. tauschii</i> (224)//Yaco [CIGM90.453]	66	96	82.6	2-2	2-2	2-2	3-2	3-2	3-3	2
Bcn/4/68.111/Rgb-ull/Ward/3/ <i>Ae. tauschii</i> (325)	60	100	80.6	1-1	1-1	1-1	1-1	2-2	4-3	2
Bcn//Ceta/ <i>Ae. searsii</i> (34D) [CASS94Y00141S]	56	98	78.2	0	0	0	1-1	2-1	2-1	2
Opata//Sora/ <i>Ae. tauschii</i> (323) [CASS94Y00235S]	68	100	99.0	0	1-1	1-1	1-1	3-2	3-3	2
Mayoor//TK SNI081/ <i>Ae. tauschii</i> (222) [CASS94Y00009S]	70	105	89.8	0	0	1-1	1-1	2-1	2-2	1

¹ *Helminthosporium sativum* rated on a double-digit modified scale (1): the first digit indicates the height of infection, where 1 = lowest leaf; 5 = up to mid-plant; and 9 = up to flag leaf; the second digit indicates disease severity on infected leaves, where 1 = 10 % coverage; 5 = 50% coverage; and 9 = 90 % coverage.

² Synthetic hexaploid with the *Ae. tauschii* CIMMYT accession number in parentheses and CIMMYT cross numbers in brackets.

³ Grain finish scale of 1 to 5, where 1 = low grain infection and 5 = severely infected.

The disease progressed slowly in most of the test derivatives of the advanced 'BS/SH' lines. These lines maintained a very high level of resistance up to 96 days when the crop was near maturity. The grain finish ranged between 1 to 3. The susceptible BW cultivar Ciano had poor grain finish and a highly susceptible disease score of 9-9 (Table 8, page 109). Observations for days to flowering, maturity, and plant height are all assets for multilocational global testing of these germ plasms, although lateness and taller plants are impediments in their breeding utilization.

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Helminthosporium sativum-resistant double haploid lines derived from bread wheat/D-genome synthetic hexaploids.

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We are distributing *H. sativum*-resistant germ plasm globally based upon the resistance observed under Mexican conditions in Poza Rica, Mexico. Several countries are recipients of the germ plasm. In order to provide stable genetic material to our collaborators, we decided to develop double haploids, retest their performance, increase seed, and then distribute them. Such germ plasms will be homozygous and facilitate disease screening across many locations.

Ten of these double haploid germ plasms, derived from 'bread wheat/D genome synthetic hexaploids' or 'bread wheat/perennial Triticeae//maize' combinations, were produced and evaluated for days to flowering, days to physiological maturity, plant height, progressive disease infection score, and grain finish. Susceptible bread wheats were Ciano, Bacanora, Opata, and Yaco. The results are presented in Table 9 (page 111). Disease progress and final score (2-2 to 3-3) from 65 days to 96 days are indicative of the superiority of the resistant DH lines over the bread wheat susceptible checks (7-7 to 9-9; see Table 9, page 111). The resistant lines had well-filled grain versus blemished or shrivelled grain for the susceptible wheats (1 or 2 versus a score of 3-4).

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Doubled haploid-mediated gene pyramiding among some D-genome synthetic hexaploids for Helminthosporium sativum resistance.

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Biotic stress like *H. sativum* in bread wheat has been until recently one of the main constraints that required improvement. Resistance incorporation at the level of synthetic hexaploids has been satisfactorily accomplished and involves several *Ae. tauschii* accessions.

Because the utilization of these synthetics is for bread wheat improvement, we report here the development of novel synthetic stocks that attempt to pyramid the contribution of various *Ae. tauschii* accessions. Such stocks allow access for simultaneous multigene introgressions when they are crossed onto bread wheat cultivars.