observations related to synthetics that involve elite *T. turgidum* cultivars instead of *T. dicoccum* (Mujeeb-Kazi et al. 1996).

Russian wheat aphid screening of synthetic hexaploids. The *T. dicoccum* parents were rated highly resistant or resistant to the aphid, with a majority scoring 1, which indicates high resistance. Comparing the disease reactions of the 56 *T. dicoccum*-based synthetics and their *T. dicoccum* parents showed that five of the synthetics were rated highly resistant, 44 were rated resistant/moderately resistant, and seven moderately susceptible. None were rated susceptible or highly susceptible. All the emmer parents were rated highly resistant or resistant. This demonstrates that the emmer resistance was expressed in the synthetics. However, in certain combinations, it may not be expressed to a high degree as shown by the parental emmer wheat. Table 7 shows the pedigrees of the synthetics rated as highly resistant, of which two SHs have the same *Ae. tauschii* parent.

Table 7. The emmer wheat derived synthetics rated as highly resistant under artificial Russian wheat aphid infestation at El Batan, Mexico.

Synthetic hexaploid pedigree	RWA score
T. dicoccum PI306535/*Ae. tauschii* (518) *	1
T. dicoccum PI347230/*Ae. tauschii* (498)	1
T. dicoccum PI349046/*Ae. tauschii* (518)	1
T. dicoccum PI254147/*Ae. tauschii* (879)	1

* *Ae. tauschii* accession number in CIMMYT wide crosses working collection.

Conclusion. *T. dicoccum/Ae. tauschii* F_1 hybrids were produced with high frequency, gave vigorous seedlings, and all spontaneously doubled to yield fertile synthetic hexaploids. The synthetics involving several *T. dicoccum/Ae. tauschii* accessions were produced to serve as a source for RWA-resistance transfers via bridge crossing to bread wheat cultivars. The RWA resistance of *T. dicoccum* accessions was expressed over different categories of disease scoring in all synthetics tested. Four SHs exhibited high RWA resistance and are superior candidates for a bread wheat improvement program.

References.

Kihara H. 1944. Die Entdeckung der DD-Analysatoren beim Weizen. Agr and Hort (Tokyo) **19**:889-890.

McFadden ES and Sears ER. 1944. The artificial synthesis of *Triticum spelta.* (Abstr) Rec Genet Soc Amer **13**:26-27.

McFadden ES and Sears ER. 1946. The origin of *Triticum spelta* and its free-threshing relatives. J Hered **37**:81-89, 107-116.

Mujeeb-Kazi A, Rosas V, and Roldan S. 1996. Conservation of the genetic variation of *Triticum tauschii* (Coss.) Schmalh. (*Aegilops squarrosa* auct. non L.) in synthetic hexaploid wheats (*T. turgidum* L. s.lat. x *T. tauschii*; 2n=6x=42, AABBDD) and its potential utilization for wheat improvement. Genet Res Crop Evol **43**:129-134.

New synthetic hexaploids and a set of bread wheat/synthetic hexaploid derivatives as sources for scab resistance.

A. Mujeeb-Kazi, L.I. Gilchrist, and R. Delgado.

Fusarium head blight is one of the most devastating diseases of cereal crops that affects wheat, barley, and maize worldwide. Also known as scab, the disease reduces both grain yield and quality and also increases toxins in the grain that pose serious health risks to human and animal consumers. Head blight infections have caused several billion dollars worth of losses to the U.S. wheat sector alone over the last 5 years, not to mention its impact elsewhere in the world.

In bread wheat, limited resistance has been identified, and the diversity is not excessive in the conventional sources available. Predominant resistant sources are the cultivars Frontana, Sumai 3, and Ning. The potential for identifying resistance in diverse alien sources hence ranks high and has been an aspect that we have been exploring in Toluca, Mexico for the past several years. Among the Triticeae gene-pool species, one avenue is to exploit the primary D-genome donor grass *Ae. tauschii*, which has several hundred accessions. Several of these accessions have been combined with elite durum wheat cultivars to result in a synthetic hexaploid germ plasm resource. So far, a total of 790 synthetics have been produced. These synthetics have been screened in Mexico using the Type II-evaluation protocol. A new batch of synthetics with Type II (spread) scab resistance was identified in the summer of 1999 and are reported in Table 8. Bread wheat cultivars Frontana and Sumai-3 were the resistant checks, and Flycatcher was the susceptible check.

Table 8. Some new D-genome synthetic hexaploids *T. turgidum*/*Ae. tauschii* and bread wheat (BW)/SH derivatives with *Fusarium graminearum* head blight resistance under artificial inoculation in Toluca, Mexico. Data are means over two summer cycles.

Pedigree	% Damage Type I	% Damage Type II	DON (ppm)	Test weight losses (%)
Synthetic hexaploids (new set).				
Croc 1/*Ae. tauschii* (662) [1]		13.7		
Ceta/*Ae. tauschii* (172)		12.7		
Cpi/Gediz/3/Goo//Jo/Cra/4/*Ae. tauschii* (305)		10.3		
Ceta/*Ae. tauschii* (306)		14.7		
Ceta/*Ae. tauschii* (371)		13.0		
Ceta/*Ae. tauschii* (445)		13.4		
Ceta/*Ae. tauschii* (533)		15.9		
Cpi/Gediz/3/Goo//Jo/Cra/4/*Ae. tauschii* (1018)		14.9 [2]		
Ceta/*Ae. tauschii* (1031)		14.9 [2]		
Ae. tauschii (1026)/Doy 1		13.7 [2]		
BW/SH advanced derivatives.				
Turaco/5/Chir3/4/Siren//Altar 84/*Ae. tauschii* (205)/3/3*Buc	13.21	9.29	0.58	5.27
Bcn//Doy1/*Ae. tauschii* (447)	9.96	10.2	1.00	2.64
Mayoor//TK SN 1081/*Ae. tauschii* (222)	3.63	9.88	1.20	6.06
Mayoor//TK SN 1081/*Ae. tauschii* (222)	2.07	11.93	1.20	6.50
Sumai # 3 (resistant check)	2.63	13.04	0.27	38.59
Frontana (moderately resistant check)	12.23	22.44	2.00	7.71

[1] *Aegilops tauschii* accession number in CIMMYT wheat wide crosses working collection.
[2] Percentage based upon 10 spike inoculations.

Also provided are the data for advanced derivatives from resistant synthetic/bread wheat combinations that show resistance for other types, i.e., Types I (penetration), III (toxin), and IV (test weight) (Table 8) over two summer cycles in Mexico.

The line 'Mayoor//TK SN 1081/*Ae. tauschii* (222)' in addition to being a good source for all four types of scab resistances, also possesses resistance to leaf, stem, and stripe rusts; Karnal bunt; *S. tritici*; and *H. sativum*. The line is free-threshing type and has a spring habit. F_1s of this line have been made with a bread wheat Flycatcher, which is susceptible for all the above attributes. The F_1 currently is being used to produce a doubled haploid-based mapping population in order to obtain molecular information.

Practical applications of a gene pyramiding strategy with D genome-based synthetic hexaploids for two major biotic stress resistances: wheat head scab and spot blotch.

A. Mujeeb-Kazi, R. Delgado, and S. Cano.

Among the primary gene pool species we have focused on initially to exploit the genetic diversity of the D-genome for wheat improvement are the diploid species accessions of *Ae. tauschii*. The procedure followed has been to cross durum wheats with *Ae. tauschii* accessions and the then double the F_1 hybrids (2n = 3x = 21, ABD) to obtain hexaploid wheats called synthetic hexaploids or SHs. Several such combinations have been produced over the last decade, and have been seed increased, and evaluated for biotic stresses. Two of these stresses are of major global importance for wheat production; head scab and spot blotch (*H. sativum* or *C. sativus*). In field evaluations done in Mexico over the past 10 years, we have observed that the best lines selected for spot blotch in Poza Rica also performed adequately for scab in Toluca. Consequently the best performers of the synthetic hexaploids for spot blotch were intercrossed in order to combine the