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Expression of resistance to Puccinia recondita f.sp. tritici in synthetic hexaploid wheats.

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INTRODUCTION

Among the wild relatives of wheat, the Aegilops species now merged with Triticum, receive priority in making interspecific hybridizations at the Wheat Wide Cross Program of the International Maize and Wheat Improvement Center (CIMMYT). This species is considerably easier to hybridize with wheat and consequently a diverse range of hybrids has been produced. The useful traits identified in Aegilops include tolerance to cold and resistance to rust, powdery mildew and insects. Among the Triticum turgidum x Aegilops spp. crosses made at CIMMYT to develop synthetic hexaploid wheats, those involving T. tauschii (Ae. squarrosa) are the most noteworthy and showed great promise in increasing the genetic variability of materials in our wheat breeding program. Several studies have been initiated on these materials, however, this paper only presents some of our findings on the expression of leaf rust resistance.

MATERIALS AND METHODS

Twelve synthetic hexaploid wheats derived from interspecific crosses between four tetraploid Triticum turgidum L. and ten T. tauschii accessions were evaluated for seedling reaction to seven pathotypes of Puccinia recondita f.sp. tritici. The avirulence/virulence formulas of these pathotypes are described in Singh (2). A set of tester varieties, mostly 'Thatcher' near-isogenic lines, possessing known Lr genes was also included. Standard inoculation and incubation procedures were followed (2). The greenhouse was maintained at 22-24°C for incubation. The seedling infection types (IT) were recorded approximately ten days after inoculation following a 0 to 4 scale (3).

RESULTS AND DISCUSSION

The infection type responses of the T. turgidum and T. tauschii parents and the synthetic hexaploids are given in Table 1. We have presented the responses that were displayed by all, or in some cases, most of the seedlings. T. turgidum cultivar Altar 84 possibly carried two genes conferring low IT ; to pathotypes CBJ/QL and TBD/TM and IT ;2- to other five pathotypes. In contrast, the cultivar Laru was susceptible to all pathotypes. The cultivar Chen appeared to carry a gene that displayed IT ; with pathotypes CBJ/QL and TBD/TM. This gene was not effective with five other pathotypes. 'Cndo/R143//Ente/Mex' possibly carried two genes

one conferred IT ; with pathotypes CBJ/QL and TBD/TM and the other gene conferred ITs ranging between ;2= to 2 with pathotypes LCJ/BN, KBB/JP, TBB/JP and MFB/SP. Both of these genes were ineffective with pathotype BBB/BN.

T. tauschii accessions 192, 198 and 211 displayed ITs ranging between ;1- to 2 with all seven pathotypes, and hence, could carry the same gene for resistance. Similarly, accessions 214 and 219 could also carry the same gene. Accession 215 displayed IT 0; with all pathotypes. Accessions 221 and 223 were susceptible to all seven pathotypes; accession 309 displayed ITs similar to Lr1-carrying Thatcher near-isogenic lines, and is, therefore, postulated to carry Lr1. Gene Lr1 is known to occur in the 5DL chromosome (1). Accession 224 appeared to carry Lr1 together with a second gene that could be the same as the gene present in accessions 192, 198 and 211.

The synthetic hexaploids displayed various expressions of the genes present in the T. turgidum or T. tauschii parents. Genes conferring low IT ;2- in Altar 84 and accessions 192, 198 and 211 were suppressed in hexaploids involving these parents. However, the gene conferring IT ; to pathotype CBJ/QL and TBD/TM in Altar 84 was only partially suppressed. Synthetic hexaploids involving Altar 84 and accession 219 displayed high seedling ITs with all seven pathotypes, indicating that resistance in Altar 84 and accession 219 was suppressed. Synthetic hexaploids involving Altar 84 and the susceptible accession 221 displayed ITs similar to Altar 84. Resistance of Altar 84 was again suppressed in hexaploids involving susceptible accession 223. A gene thought to be Lr1 in accession 224 was expressed in the hexaploid involving Altar 84, however, the second gene in this accession and resistance of Altar 84 were suppressed. Resistance of accession 215 was expressed in hexaploids involving Chen. Genes conferring IT ; in Chen and 0; in accession 224 were expressed in the hexaploids, however, the second gene in accession 224 was suppressed. The gene conferring IT 0; (possibly Lr1) was expressed in hexaploids involving susceptible Laru. The gene conferring IT ; to pathotype CBJ/QL and TBD/TM in Cndo/R143//Ente/Mex was expressed in hexaploids involving accession 214, whereas, the other genes in both parents were suppressed. Hexaploids involving Cndo/R143//Ente/Mex and susceptible accession 221 displayed similar ITs as the tetraploid parents. The above results indicate that:

(1) Resistance gene-specific suppressors occurred in both T. turgidum and T. tauschii.

(2) Suppressors were absent in T. turgidum for certain genes present in T. tauschii.

(3) Suppressor genes were absent in T. tauschii accession 221, hence this accession should be used in transferring resistance genes from tetraploids to hexaploids.

Table 1 : Infection types displayed by the seedlings of Triticum turgidum and T. tauschii parents and derived synthetic hexaploids when tested with seven pathotypes of P. recondita tritici

Parents and synthetic hexaploids	Pathotype and infection type						
	BBB/ BN	LCJ/ BN	CBJ/ QL	KBB/ JP	TBB/ JP	MFB/ SP	TBD/ TM
T. turgidum parents:							
Altar 84	;2-	;2-	;	;2-	;2	;2-	;
Chen	3	3	;	3	3	3+	;
Laru	3+	3	3	3	3	3+	3
Cndo/R143//Ente/Mex	3	2	;	;2-	;2=	2-	;
T. Tauschii parents:							
192	2	2	;12-	;1	;12=	;2=	;2-
198	2	12	;12-	;1	;12=	;2-	;1-
211	2	12	;12-	;1	;12=	;2-	;1-
214	12	23-	;1	3-	3-	3-	12
215	0;	0;	0;	0;	0;	0;	0;
219	2	2	12	1+3-	1+3-	1+3-	12
221	3	3	3	3	3	3	3
223	3	3	3	3	3	3	3
224	0;	2	0;	0;	12	;1	12
309	0;	3	0;	0;	3	3	3
Syn. hexaploids:							
Altar 84/192	3	3	;12	3-	3-	3	12
Altar 84/198	3+	3	12	3-	3c3	3	12
Altar 84/211	3	3	;12	3	3	3-	12
Altar 84/219	3	3	3	3	3	3	3
Altar 84/221	;2-	;2=	;	;2-	12-	;12-	;
Altar 84/223	3+	3	3	3	3	3c3	3c
Altar 84/224	0;	3	0;	0;	3-	3-	3-
Chen/215	0;	;	;	0;	;	0;	;
Chen/224	0;	3	0;	0;	3	3+	;1-
Laru/309	0;	3	0;	0;	3	3	3
Cndo/../Mex/3/214	3	3	;	3	3	3	;
Cndo/../Mex/3/221	3	;12	;1-	;12	;12-	;2-	;1-

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