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EXPRESSION OF NECROSIS IN THE HYBRIDS OF AMPHIPLOIDS *TRITICUM DURUM-HAYNALDIA VILLOSA* AND *HORDEUM CHILENSE TRITICUM DURUM* WITH SOME BREAD WHEAT CULTIVARS

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ABSTRACT

Two amphiploids *Triticum durum-Haynaldia villosa* (A1) and *Hordeum chilense-Triticum durum* (A2) were crossed reciprocally with 11 bread wheat accessions. Out of 44 cross combinations, 18 crosses showed severe necrosis, 8 moderate and the remaining 18 were found to have weak necrosis. The degree of necrosis in the hybrids varied greatly due to multiple allelism of Ne_1 and Ne_2 genes.

Key words: Hybrid necrosis, wheat, amphiploids. *T durum-Ha. Villosa, H. Chilense-T. durum.*

Hybrid necrosis is a physilogical disorder and results when two dominant complementary genes, Ne_1 and Ne_2 are incorporated into a single genotype. The genes for necrosis Ne_1 and Ne_2 are located on 5 BL and 2BS chromosomes, respectively [1]. Hybrid necrosis, which leads to early death of the F_1 hybrids, is a severe barrier and is frequent in the wide hybrids of wheat [2]. These genes have several alleles acting in different combinations to cause variable degree of necrotic symptoms in wheat hybrids, like seedling lethality (strong), subnormal plants bearing shrivelled seeds (moderate) and nearly normal plants with leaf yellowing and normal grains (weak) and have a widespread occurence [3, 4]. The necrotic effect of these genes is also influenced by the environment [5]. The presence of these genes limits hybridization between the Ne_1 and Ne_2 carriers. Cataloguing of the information about necrosis genes in different wheat strains is necessary for formulating effective hybridization programme [6]. The present study was, therefore, undertaken to investigate the degree of necrosis and cataloguing the bread wheat genotypes for necrotic genes in their reciprocal crosses with the amphiploids *T. durum-Haynaldia villosa* and *Hordeum chilense-T. durum.*

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MATERIALS AND METHODS

Two amphiploids, *Triticum durum- Haynaldia villosa* (AABBVV) and *Hordeum Chilense.-T. durum* (AABBH^{ch}H^{ch}) were crossed with 11 varieties of bread wheat during Rabi 1990-91 and 1992-93. All the F_1's and parents were grown during Rabi 1992-93 and 1993-94 at Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The F_1 plants were observed critically at germination, seedling and maturity stages for necrosis. The manifestation of the necrosis varied from severe to weak (0-8). The necrosis was graded severe (6-8) where either the seeds did not germinate or the plants died at seedling, tillering or heading stage, moderate (3-6) where 50% or more plants died before maturity and, weak (0-3) where less than 50% plants died before maturity [3].

Table 1. Perentage of amphiploids and wheat cultivars used for crossability studies

Cultivars	Parentage/place
Amphiploids	
T. durum - Ha. villosa	*T. durum* desf. cv. "Creso"/*Ha. villosa* (L) Schur
H. chilense - T. durum	*H. chilense/T. turgidum* conv. *durum* cv Cocorit (COC)
Wheat cultivars	
RL 68	UPTO 74303/Sonalika
Sonalika	II 54, 38/AN/YT 54/NIOBII LR 64
HS 240	AUII KAL/Bb/WOP's'/PVN's'
CPAN 1796	NPO/TOB's'/BI 56/3/KAL/136
HPW (DL) 30	HI 784/DL 99-7
HD 2380	HD 2255/HD 2257
CPAN 1922	(Ore F 1158-F d 1 × Mexi pen 's'/Tib 63 2 (Ocaraque 75)
C 306	REAGENT 1974/CSK 3/12* C 591/3/P 19/C 281
VL 421	S 64XY 50E-Gto
HPW 42	VEE's'/4/PVN's'/CBB/Cno'S'/3/JAR/ORZ's'
HS 295	CQT/A 2/IAS 55/ALD'S'/3/ALD's'/NAFN/H

RESULTS AND DISCUSSION

Out of 44 possible cross combinations, 18 crosses were found to be severe necrotic where no seed is produced. i.e. either the seeds did not germinate or the plants died at seedling, tillering or heading stage; 8 crosses were moderate in necrosis and the remaining 18 cross combinations were found to have weak necrosis, where normal seeds were produced. The reciprocal crosses of the amphiploids *T. durum-Ha.*

villosa (A1) and *H. chilense- T. durum* (A2) with HS 240, CPAN 1796, HPW (DL) 30 and HD 2380 showed severe necrosis which possesed strong alleles of Ne_1, Ne_2 [7] where all or more than 50% of the plants died before maturity. The crosses viz, RL 68 × A1, A1 × Sonalika, A1 × HS 295, A2 × Sonalika, A2 × HPW 42 and reciprocal crosses of A2 with RL 68 showed moderate necrosis. This might be due to the strong combination of Ne_1 alleles (in dominant form) present in A1 and A2 with these wheat cultivars.

Table 2. Manifestation of necrosis at different stages of plant growth

Parent/Cross	Seeds sown	Seeds germinated	Plants died before maturity at			Total	Plants matured	Hybrid necrosis
			Seedling stage	Tillering stage	Heading stage			
T. durum-Ha. villosa (A1)	20	16	-	-	-	-	16	Weak
A1 × RL 68	17	16	11	1	-	12	4	Weak
RL 68 × A1	5	2	1	-	-	1	1	Moderate
A1 × Sonalika	5	3	1	-	-	1	2	Moderate
Sonalika × A1	9	4	2	1	-	3	1	Severe
A1 × HS 240	5	4	4	-	-	4	0	Severe
HS 240 × A1	20	20	20	-	-	20	0	Severe
A1 × CPAN 1796	5	3	3	-	-	3	0	Severe
CPAN 1796 × A1	5	3	3	-	-	3	0	Severe
A1 × HPW(DL)30	28	20	12	2	-	14	6	Severe
HPW(DL) 30×Aq	5	4	4	-	-	4	0	Severe
A1 × HD 2380	5	4	4	-	-	4	0	Severe
HD 2380 × A1	5	0	0	0	0	0	0	Severe
A1 × CPAN 1922	8	7	1	-	-	1	6	Weak
CPAN 1922 × Aq	8	7	0	0	0	0	7	Weak
A1 × C306	10	8	-	-	-	0	8	Weak
C 306 × Aq	10	9	1	-	-	1	8	Weak
A1 × VL 421	6	4	-	-	-	0	4	Weak
VL 421 × A1	5	4	2	-	-	2	2	Moderate
A1 × HPW 42	10	8	2	-	-	2	6	Weak
HPW 42 × A1	16	15	3	2	-	5	10	Weak
A1 × HS 295	5	3	1	-	-	1	2	Moderate

(Table 2 contd.)

HS 295 × A1	5	4	1	-	-	1	3	Weak
H. chilense-T. durum (A2)	20	13	2	-	-	2	11	Weak
A2 × RL 68	5	2	1	-	-	1	1	Moderate
RL 68 × A2	5	3	1	-	-	1	2	Moderate
A2 × Sonalika	5	2	1	-	-	1	1	Moderate
Sonalika × A2	5	2	1	1	-	2	0	Severe
A2 × HS 240	3	0	0	0	0	0	0	Severe
HS 240 × A2	50	28	12	7	2	21	7	Severe
A2 × CPAN 1796	8	0	0	0	0	0	0	Severe
CPAN 1796 × A2	5	4	3	1	-	4	0	Severe
A2 × HPW(DL)30	15	0	-	-	0	0	0	Severe
HD 2380 × A2	5	4	3	1	-	4	0	Severe
A2 × CPAN 1922	10	8	2	-	-	2	6	Weak
CPAN 1922 × A2	10	8	-	-	-	0	8	Weak
A2 × C 306	25	20	1	-	-	1	19	Weak
C 306 × A2	10	8	2	-	-	2	6	Weak
A2 × VL 421	25	20	3	2	-	7	13	Weak
VL 421 × A2	24	18	3	5	-	8	10	Weak
A2 × HPW 42	20	17	5	2	1	8	9	Moderate
HPW 42 × A2	5	3	1	-	-	1	2	Weak
A2 × HS 295	20	12	2	4	-	6	10	Weak
HS 295 × A2	20	12	2	1	-	3	9	Weak

Though most of the tetraploid wheat parents are the carriers of Ne_1 gene, some are non-carriers also [6]. The amphiploids involved in the present study might have acquired the Ne_1 from the *durum* parent involved in its synthesis, whereas the crosses showing necrosis has attained Ne_2 from bread wheat. Same opinion was reported by Gregory [8] while working with crosses of bread wheat with triticale. Therefore, the F_1 generation of the crosses between the amphiploids and hexapliod wheat can obtain both the necrotic genes. For this reason, the necrosis might have occurred in the hybrids of a number of crosses mentioned earlier. However, the amphiploids A1 and A2 in reciprocal crosses with CPAN 1922, C 306, HPW 42, HS 295 and VL 421 showed weak necrosis. This can be attributed to the weak combination (in reciprocal form) of Ne_1 present in *T. durum- Ha. villosa* and *H. chilense-T. durum* with these wheat cultivars.

In the cross combination A1 × Sonalika,. hybrid necrosis was observed in one plant, whereas the other was non-necrotic. Similar findings were also reported by Randhawa [9] indicating that Sonalika contains some non-carrier plants of Ne_2 gene. Therefore, one seed might have acquired Ne_2 gene from Sonalika but not the other one in the present study. This also might be due to the cryptic variability in the gametes of the parents and/or chromosomal loss/gain, which generally occurs in wide hybrids [10].

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