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Short Communication

Genetics of crinkled leaf in *Triticum aestivum* L. and hairy peduncle in triticale

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Morphological markers are useful in basic and applied genetic studies and for constructing linkage maps. However, for constructing linkage maps, a sufficiently large number of distinct morphological traits are required. Several morphological characters for various plant parts, such as leaf. stem, spike, kernels, peduncle etc. have been reported in wheat and triticale [1]. Yet only a few genetic markers at morphological level are known [2]. Induced mutagenesis has been effectively used in several crops to produce mutant phenotypes. however, the frequency of induced mutagenesis is not very high in wheat (*Triticum aestivum* L.) and triticale both being hexaploids.

In our breeding materials we came across a unique morphological character in the genotype Selection (Sel.) 126 derived from HW 2041 × WR 95 in which the flag leaf gets twisted at its base. Initially the surface of flag leaf becomes marked with wrinkles and the leaf margin turns irregular at the base and on one side of leaf margin, the leaf gets slightly constricted and shortened. The shrinking or constriction of leaf probably leads to the twisting and turning to opposite direction from mid region (Fig. 1). The phenotype has been described as crinkled leaf in this communication.

Triticale is an allopolyploid having genomes of wheat and rye (*Secale cereale* L.). It can be octoploid (2n = 8x = 56) or hexaploid (2n = 6x = 42) depending on whether it has been synthesized from hexaploid wheat (*Triticum aestivum* L. 2n = 6x = 42) or tetraploid wheat (*Triticum durum* Desf. 2n = 4x = 28). Most present day triticales are hexaploid with genome AABBRR. Division of Genetics is maintaining a large collection of triticale germplasm, which show variability for various traits. In our collection, we have most of the triticales with hairy peduncle (pubescent), however, there are a few genotypes which do not have hairs on peduncle (non-pubescent). Since triticales possess full genome of rye (RR), they also carry many useful traits from rye such as disease resistance and stress tolerance. Both, crinkled leaf in wheat and hairy peduncle in triticale are true breeding traits. The segregating generations were simultaneously grown in rows of 5 m length 30 cm apart with plant to plant distance of

Fig. 1. Flag leaf with twist and crinkle at the base (left) and normal leaf

Fig. 2. (L to R): TR 903 hairy peduncle, F_1 hybrid with hairy peduncle and TR 995 with non-hairy peduncle

10 cm during 2004-2005 at IARI farm. The data were recorded for presence and absence of twisted leaf in wheat and pubescence on peduncle in triticale in all the generations.

Inheritance of crinkled leaf: The genetic variation for crinkled leaf has presumably descended from WR 95, a derivative of Kalyansona/ Gigas//HD 1999/ Sonalika*2/ *T. carthlicum*. Genetic analysis was carried out to understand the mode of inheritance of crinkled leaf. Sel. 126 was crossed with common wheat genotypes. HD 2329 and Agra Local, both producing normal leaf. The F_1 hybrids were backcrossed to both the parents as well as selfed to obtain BC_1-F_1 and F_2 generations. The F_1 plants in both the hybrids produced crinkled flag leaf indicating that crinkled leaf is dominant over normal leaf shape. In F_2 generations of both the crosses plants with twisted crinkled flag leaf and normal leaf segregated into 3:1 ratio with non-significant χ^2 value (Table 1) indicating that the character crinkled leaf is controlled by a single dominant gene. Test cross F_2 populations segregated into 1:1 ratio for crinkled and normal flag leaf with non-significant χ^2 value, supported the proposed hypothesis of single gene dominance. The hypothesis was further supported by the backcross population from F_1 × Sel. 126 which did not segregate into two classes (Table 1). These results clearly demonstrated that crinkled twisted leaf in Sel. 126 is controlled by a single dominant gene. The gene symbol *Crk* is proposed for crinkled twisted flag leaf.

Table 1. Segregation for crinkled flag leaf in F_2, B_1 and B_2 generations in two crosses

Parents/cross	Generation	Flag leaf of individual plants scored			Expected ratio	χ^2	P value
		Crinkled	Normal	Total			
Sel. 126	P_1	15	0	15			
HD 2329	P_2	0	12	12			
Sel. 126 × HD 2329	F_1	62	0	62			
	F_2	472	160	632	3:1	0.033	0.80-0.90
F_1 × HD 2329	B_1	35	43	78	1:1	0.82	0.50-0.30
F_1 × Sel. 126	B_2	68	0	68			
Agra local	P_3	0	12	12			
Sel. 126 × Agra local	F_1	56	0	56			
	F_2	289	106	395	3:1	0.709	0.50-0.30
F_2 × Agra local	B_1	46	37	83	1:1	0.976	0.50-0.30
F_1 × Sel. 126	B_2	57	0	57			

Table 2. Segregation of hairy and non-hairy peduncle in F_2 and backcross generations

Cross	Generation	No. of plants			Expected ratio	χ^2	P-value
		Hairy peduncle	Non hairy peduncle	Total plants			
TR 903/TR 995	F_1	10	-	10	-		
	F_2	153	38	191	3:1	2.65	0.20-0.10
TR 903/TR 995//TR 903	BC_1	48	-	48	-		
TR 903/TR995//TR995	BC_2	36	28	64	1:1	1.00	0.50-0.30
TR 903/TR 973	F_1	10	-	10			
	F_2	147	59	206	3:1	1.46	0.30-0.20
TR 903/TR 973//TR 903	BC_1	52	-	52	-	-	
TR 903/TR 973//TR 973	BC_2	33	24	57	1:1	1.42	0.30-0.20
TR 958/TR 995	F_1	10	-	-	-	-	
	F_2	117	29	146	3:1	2.06	0.20-0.10
TR 958/TR 995//TR 958	BC_1	36	-	36	-	-	
TR 958/TR 995//TR 995	BC_2	34	25	59	1:1	1.98	0.20-0.10
TR 958/TR 973	F_1	10	-	10			
	F_2	220	75	295	3:1	0.028	0.90-0.80
TR 958/TR 973//TR 958	BC_1	25	-	25			
TR 958/TR 973//TR973	BC_2	32	27	59	1:1	0.42	0.70-0.50

Inheritance of hairy peduncle: True breeding genotypes TR 903 and TR 958 having hairy peduncle were crossed with TR 995 and TR 973 having non hairy peduncle. The F_1 hybrids were backcrossed with both the parents as well as selfed to produce F_2 seed. The F_1, F_2, BC_1 and BC_2 generations were grown together on the same piece of land at IARI Research Farm during *rabi* 2003-04. Observations were recorded at appropriate stage for presence or absence of pubescence on peduncle. The results are presented in Table 2. All the F_1 plants, in all the four crosses were hairy (pubescent) indicating the dominance of hairy peduncle over smooth or non hairy peduncle (Fig. 2). In F_2 generation in all the crosses, hairy and non hairy peduncle segregated into 3:1 ratio with non-significant χ^2 value suggesting monogenic control of the trait hairy peduncle in triticale. The results were confirmed in backcross generations where all backcrosses with recessive parents segregating into hairy and non hairy peduncle in 1:1 ratio. These results conclusively prove that hairy peduncle in triticale is controlled by a single dominant gene. The trait hairy peduncle in triticale seems to have been derived from rye (*Secale cereale*), which is one of the parents in triticale. The gene for hairy peduncle in *Secale cereale* has been located on chromosome 5R [3].

References

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