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Short Communication

Major genes involved in chlorophyll synthesis in bread wheat (*Triticum aestivum* L.) cultivars

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The yield of wheat has reached to a plateau and therefore concerted efforts are being made by several wheat researchers world over to increase the yield of wheat. Studies on photosynthetic capacity (Pmax) in *Triticum* species have shown that wild species have higher Pmax than hexaploid wheat [1, 2, 3]. It is therefore, desirable to identify the genes responsible for high photosynthetic efficiency in wild diploid wheat species and transfer these to bread wheats for increasing their yielding ability. The present report describes the genetics and chromosome location of genes involved in chlorophyll synthesis in nine hexaploid wheats, so as to facilitate the efficient and selective gene transfer from wild species to bread wheat.

In the present study the monosomic line for chromosome 3A of the cv. Pb. C 591 was used to examine the location of genes involved in chlorophyll synthesis. Seeds of monosomic 3A of cv. Pb. C 591 and nine bread wheat cultivars, Kalyansona, Sel. 212, Sonalika, C306, NP 4, NP 839, NP 876, NP 880 and Veery were planted in the field. The 3A monosomic plants were identified at first meiotic metaphase and crossed with all the nine cultivars as female parents. A sufficient number of crossed seeds (ranging from 15 to 20 seeds) were obtained in each cross and F_1 hybrids were raised. All F_1 hybrids from each cross were analysed cytologically at first meiotic metaphase and their monosomic(2n = 41, 20" + 1') and disomic (2n = 42, 21") nature was determined. Seeds were harvested from all the selfed identified plants separately.

Enough number of seeds (see Table 1) of monosomic 3A (Pb. C591), 9 cultivars and from their F_1 hybrids (monosomic as well as disomic) were germinated in the petridishes. After 70h of germination the number of green seedlings and albino seedlings was counted. Data pertaining to the frequency of albino seedlings are presented in Table 1. All the disomic plants (2n = 42) from selfed monosomic 3A produced only green seedlings, while the monosomic plants (2n = 41) gave an albino frequency of 10.5%. The frequencies of albino seedlings in different crosses were as follows:

As evident from the data (Table 1), the disomic hybrids derived from all the crosses, produced only green seedlings revealing the presence of chlorophyll synthesis gene allelic to the gene located on chromosome 3A of cv. Pb. C 591. However, the monosomic F_1 hybrids of all the crosses segregated for albino and green seedlings, confirming the presence of allelic gene in these cultivars. The segregation, broadly could be grouped into two distinct classes. The first group showing 8.3% and 8.0% albino seedlings, very similar to the frequency of 10.5% albino seedlings observed in case of monosomic 3A of cv. Pb. C 591, revealing the control of chlorophyll synthesis in cvs. Kalyansona and Sel. 212, by a single dominant gene (like cv. Pb. C 591).

In the second group, the occurrence of albino seedlings ranged from 2.4% (in cv. Veery cross) to 3.9% (in cv. C 306 cross). These frequencies were nearly one fourth of the albino occurred in monosomic 3A of cv. Pb. C 591 (10.5%). This indicates that the occurrence of albino seedlings in the F_2 progenies of monosomic F_1 hybrids involving cvs. Sonalika, C 306, NP 4, NP 839, NP 876, NP 880 and Veery, were reduced by the presence of another gene either located on chromosome 3B or chromosome 3D in these cultivars.

Based on the results it is suggested that cvs. Kalyansona and Sel. 212 carry single dominant gene for chlorophyll synthesis is located on chromosome 3A, while cvs. Sonalika, C 306, NP 4, NP 839, NP 876, NP 880 and Veery, carry two dominant genes for chlorophyll synthesis, out of these one is allelic to cv. Pb. C 591 which is located on chromosome 3A.

So far 16 cultivars have been analysed for

Table 1. F_2 segregation of albino seedlings from the crosses involving monosomic 3A (Pb. C 591) and 9 other wheat cultivars

Parents and crosses	No. of plants	No. of seedlings		Albino (%)
		green	albino	
Disomic (Pb. C 591)	.8	1521	0	
Monosomic 3A (Pb. C 591)	10	14373	162	10.5
Kalyansona	8	1431	0	
Sel. 212	6	1163	0	
Sonalika	8	1329	0	
C 306	7	1274	0	
NP 4	8	1349	0	
NP 839	6	1235	0	
NP 876	8	1265	0	
NP 880	8	1339	0	
Veery	8	1456	0	
F_2's				
Mono 3A × Kalyansona				
Disomic	1	332		
Monosomic	8	1663	152	8.3
Mono 3A × Sel. 212				
Monosomic				
Disomic	3	591	0	
Monosomic	11	1983	173	8.0
Mono 3A × Sonalika				
Disomic	5	1415	0	
Monosomic	2	572	18	3.1
Mono 3A × C 306				
Disomic	8	1934	0	
Monosomic	9	1109	45	3.9
Mono 3A × NP 4				
Disomic	4	686		
Monosomic	6	1255	44	3.4
Mono 3A × NP 839				
Disomic	6	1326	0	
Monosomic	10	1624	49	2.9
Mono 3A × NP 876				
Disomic	9	992	0	
Monosomic	11	1418	55	3.7
Mono 3A × NP 880				
Disomic	6	842	0	
Monosomic	12	3015	104	3.3
Mono 3A × Veery				
Disomic	11	1960	0	
Monosomic	7	1616	41	2.4

chlorophyll synthesis genes. Of these, cvs. Pb. C 591 [4], Kundan [5], Kalyansona and Sel. 212 (present study) were found to carry single dominant gene for chlorophyll synthesis. The monosomic 3A of these cultivars, therefore can be used as female and crossed with diploid species possessing high photosynthetic efficiency, to study the effect of chlorophyll synthesis. The detailed analysis of F_1 hybrids thus obtained would reveal the effect of chlorophyll synthesis gene of donor parents. The information generated could be utilized in conventional methods of plant breeding to enhance wheat yield.

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