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Cytogenetic and molecular characterization of durum wheat chromosome transfers with 1D-associated gluten protein genes and their pyramiding

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Gluten quality of bread wheat is known to be mainly associated with high- (HMW-GS) and low- (LMW-GS) molecular weight glutenin subunits encoded by *Glu-1* (L arm of group-1 chromosomes) and *Glu-3* (S arm of group-1 chromosomes) genes, respectively, with the 1D alleles of such genes having the major impact on bread making properties.
On the other hand, durum wheat, mostly used for pasta production, is also used to prepare different types of bread worldwide. A positive effect on gluten quality was observed when durum wheat group 1 chromosomes, particularly 1A, were substituted by 1D of bread wheat. Hence, transfer to durum of 1D storage protein genes has been looked at as a means of assessing the impact of separate gene products on gluten properties, and as a possible strategy to widen the spectrum of potential end uses of durum wheat.
Transfer of chromosomal segments containing the *Glu-D1* and *Gli-D1*/*Glu-D3* loci was successfully achieved in a number of instances resorting to chromosome engineering.
Using this strategy, we isolated two 1A-1D recombinant lines, in which the *Gli-D1*/*Glu-D3* genes and the *Glu-D1d* allele (HMW-GS "5+10") were separately transferred into the 1AS and 1AL arm, respectively, of recipient durum wheat lines (named PS and PL, respectively). The recombinant nature of both transfers was initially ascertained by use of endosperm protein markers and FISH with a D-genome repeated DNA sequence as probe.
More recently, the physical structure of the recombinant chromosomes was reinvestigated by preannealing-GISH, which confirmed the terminal location and size of the 1DS segment (17% of 1AS of line PS), while showed the 1DL segment to be intercalary and subterminally located on 1AL of line PL, with a length (16% of the arm) corresponding to nearly half of the previous estimate.
Also, a detailed genetic map of both recombinant chromosome arms was developed by means of RFLP, SSR and EST markers. Some such markers were usefully employed in a further step of the work, aimed at pyramiding the 1DS and 1DL segments into the same 1A chromosome of durum wheat. Stable PS + PL double-recombinant lines have been obtained as a result of homologous recombination in the 1A portions shared by the two recombinant chromosomes present in PS x PL hybrids. Preliminary quality tests suggest that the *Glu-D3* + *Glu-D1d* combined presence could determine a slight increase of gluten quality parameters over those associated with *Glu-D1d* alone.