

Fine structure mapping of a gene-rich region of wheat carrying *Ph1*, a suppressor of crossing over between homoeologous chromosomes

Sidhu GK¹, Rustgi S¹, Shafqat MN², von Wettstein D², Gill KS²

¹Department of Crop & Soil Sciences, Washington State University, Pullman, WA 99164; ²Department of Environmental Sciences, COMSATS Institute of Information Technology, Abbottabad, Pakistan

The wheat gene-rich region (GRR) '5L0.5' contains many important genes including *Ph1*, the principal regulator of chromosome pairing. Comparative marker analysis identified 32 genes for the GRR controlling important agronomic traits. Detailed characterization of this region was accomplished by first physically localizing 213 wheat group 5L-specific markers using group 5 nulli-tetrasomics, three *Ph1* gene deletion/insertion mutants, and nine terminal deletion lines with their breakpoints around the '5L0.5' region. The *Ph1* gene was localized to a much smaller region within the GRR (*Ph1* gene region). Of the 61 markers that mapped in the four sub-regions of the GRR, nine mapped in the '*Ph1* gene region'. High stringency sequence comparison ($e < 1e^{-25}$) of 157 group 5L-specific wheat ESTs identified orthologs for 80% sequences in rice and 71% in *Arabidopsis*. Rice orthologs were present on all rice chromosomes although maximum (34%) were on rice chromosome 9 (R9). No single collinear region was identified in *Arabidopsis* even for a smaller region such as '*Ph1* gene region'. Seven of the nine '*Ph1* gene region' markers mapped within a 450kb region on R9 with the same gene order. Detailed domain/motif analysis of the 91 putative genes present in the 450kb region identified 26 candidates for the *Ph1* gene, including genes involved in chromatin reorganization, microtubule attachment, acetyltransferases, methyltransferases, DNA binding, and meiosis/anther specific proteins. Five of these genes shared common domains/motifs with the meiosis specific genes *Zip1*, *Scp1*, *Cor1*, *RAD50*, *RAD51* and *RAD57*. Wheat and *Arabidopsis* homologs for these rice genes were identified.