Leaf rust resistance gene \textit{Lr1}, isolated from bread wheat (\textit{Triticum aestivum} L.) is gene dosage dependant

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In hexaploid wheat, leaf rust resistance gene \textit{Lr1} is located at the distal end of the long arm of chromosome 5D. This gene was cloned by map-based cloning. A high resolution genetic map of the \textit{Lr1} locus was constructed using microsatellite, resistance gene analog (RGA), BAC end (BE), and low pass (LP) markers. A physical map of the locus was constructed by screening a hexaploid wheat BAC library from cultivar Glenlea that is known to have \textit{Lr1}. The locus comprised three RGAs (RGA567-5, RGA567-7 and RGA567-8) from a gene family related to RFLP marker Xpsr567. \textit{Lr1} segregated with RGA567-5 while recombinants were observed for 567-7 and 567-8. Transformation of the susceptible cultivar Fielder with RGA567-5 demonstrated that it corresponds to the \textit{Lr1} resistance gene. In addition, the candidate gene was also confirmed by virus-induced gene silencing. Twenty \textit{T\textsubscript{1}} lines from resistant transgenic line \textit{T\textsubscript{0}}-938 were grown and tested for leaf rust resistance. A segregation ratio of 3 fully resistant, 10 partial resistant, and 7 susceptible was observed fitting a 1:2:1 ratio for a single hemizygous insertion. Transgene presence and expression correlated with the phenotype. Fully resistant \textit{T\textsubscript{1}}-938 lines were homozygous for \textit{Lr1}, partially resistant \textit{T\textsubscript{1}}-938 lines were hemizygous and susceptible \textit{T\textsubscript{1}}-938 lines had lost the transgene. The resistance phenotype expressed by \textit{Lr1} seemed therefore to be dependant on the zygosity status. \textit{T\textsubscript{3}}-938 sister lines with and without the transgene were further tested with 16 virulent and avirulent rust races. Rust reactions were all as expected for \textit{Lr1} thereby providing additional evidence toward the \textit{Lr1} identity of RGA567-5. Sequence analysis of \textit{Lr1} indicated that it is not related to the previously isolated \textit{Lr10} and \textit{Lr21} genes.