

Measuring Effectiveness of Leaf Rust Resistance QTL using In-Planta Fungal Quantity by Chitin Assay in a Aus27506/Aus27229 RIL Population

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Leaf rust, caused by *Puccinia triticina* (Eriks & E. Henn) is an important disease of wheat. This pathogen was introduced into Australia by first migrant settlers. Since its introduction, rapid evolution of *P. triticina* (Pt) pathotypes in Australia has defeated many leaf rust resistance genes. Deployment of genetically diverse sources of resistance in wheat cultivars is the most cost-effective and eco-friendly means of rust control. Aus27506 collected from France by the English botanist Arthur Watkins, was susceptible to leaf rust at the seedling stage and expressed resistance at the adult plant stage. Aus27506 produced leaf rust resistant response 2 whereas Aus27229 exhibited moderately susceptible response 6 (on a 1-9 scale) across all data sets over three years. Adult plant leaf rust responses among RILs varied from 2 to 6 Wright's formula estimated the involvement of two to three genes (2.42, 2.38 and 2.42 leaf rust resistance loci in three locations 2014-LDN, 2015-KAR and 2016-HRU experiments, respectively). Leaf rust responses across seasons were significantly correlated and Pearson correlation co-efficient between data sets varied from 0.5 to 0.6 at $P < 0.001$. Three QTL (*Q_{Lr.sun-2D}*, *Q_{Lr.sun-1BL}* and *Q_{Lr.sun-2B}*) were observed conferring leaf rust resistance. To study the effectiveness QTL in-planta fungal biomass in the infected tissue was carried out. Leaf rust infected flag leaf of parents and representative RILs (carrying different QTL combinations) were collected and used for chitin assay. Results revealed significant difference in fluorescence units between parents Aus27506 (146438 Units) and Aus27229 (381498 Units). More chitin accumulation (55 %) was observed in Aus27229 in comparison to Aus27506. The RIL carrying two QTL (*Q_{Lr.sun-2D}* + *Q_{Lr.sun-1BL}*) contributed by Aus27506, produced significantly less fluorescence units (192397 Units). Although the dual combinations involving *Q_{Lr.sun-2B}*, contributed by Aus27229 and either of *Q_{Lr.sun-1BL}* or *Q_{Lr.sun-2D}* did not show significant reduction in disease severities compared to the RILs carrying these latter QTL individually. Combination of three QTL produced significantly less fluorescence (174785 Units) than RILs carrying dual QTL. This study demonstrated that fungal biomass accumulation in the infected tissue can be correlated with disease response in the field.

Keywords: APR, ASR, chitin assay, leaf rust, QTL