Durable rust resistance in wheat is effective against multiple pathogens

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Stem rust resistance gene *Sr2* and leaf rust resistance gene *Lr34* provides durable, broad spectrum rust resistance globally. *Sr2* was fine mapped to a small genetic interval on chromosome 3BS in a cross between 'Chinese Spring' (*Lr31*) and Chinese Spring with 3B chromosome substitution from 'Hope' (*Sr2,Lr27*). Previously, complementary race-specific leaf rust resistance genes *Lr27* and *Lr31* were positioned on 3BS and 4BS, respectively and the presence of *Lr27* was associated with *Sr2* in many cultivars. A high resolution *Sr2* mapping family was derived from over 3000 gametes and scored for *Lr27*. Seedling leaf rust resistance with *Lr27* specificity cosegregated with *Sr2* suggesting that a single gene may confer race specific leaf rust and non-race specific, adult plant stem rust resistance in wheat.

Tight linkage was reported previously between *Lr34* and stripe rust resistance gene *Yr18* and powdery mildew resistance gene *Pm38*. We recently demonstrated that *Lr34* was also tightly linked to adult-plant stem rust resistance using a high resolution mapping family in the 'Thatcher' background. Seed of the near-isogenic Thatcher line RL6058 carrying *Lr34* were treated with sodium azide. Twelve mutants susceptible to leaf rust and stripe rust in the field were recovered. These mutants were also susceptible to stem rust and powdery mildew in the adult plant stage. Allelism tests between some of the mutants confirmed that the mutation events occurred at the *Lr34* locus suggesting that a single gene confers resistance to three rust pathogens and powdery mildew. Because several wheat cultivars carrying *Lr34* are susceptible to stem rust, we hypothesise that *Lr34* interacts with unlinked gene(s) to confer stem rust resistance in 'Thatcher' and *Sr2* interacts with unlinked *Lr31* to confer leaf rust resistance. The future isolation of *Sr2* and *Lr34* will provide insights into the molecular mechanisms of durable resistance and how it might lead to resistance to multiple pathogens.