

A Major QTL for Stem Rust Resistance in Italian ryegrasses explains 53 % of the Phenotypic Variation

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Stem rust caused by the ascomycete *Puccinia graminis* ssp. *graminicola* is one of the most important fungal diseases in Italian ryegrass (*Lolium multiflorum* Lam.). Increasing average temperatures due to climate change will lead to an even higher stem rust pressure on ryegrasses within the next years. The main disease symptoms usually occur late in the season, right before ripening of the seeds and have a negative impact on forage quality and seed yield. Therefore, breeding for stem rust resistance is imperative, and a detailed understanding of the inheritance of resistance is needed to enable efficient breeding strategies for this important trait.

In this study, we developed a biparental F₁ mapping population derived from a reciprocal cross between one genotype of the cultivar *Rabiosa* and one genotype of the cultivar *Sikem*. The population consists of 124 single plants which were phenotyped for stem rust resistance in replicates in three environments. Stem rust phenotypes from the field were scored on a 1-9 scale, where 1 is the absence of symptoms and 9 is highly infected. Both parental plants showed an intermediate stem rust resistance. A genetic linkage map, spanning a total of 785 cM over seven linkage groups, was constructed with 1,528 single nucleotide polymorphism markers produced by genotyping-by-sequencing. First quantitative trait locus (QTL) analysis revealed a major QTL on linkage group 7, which explained 53% of the phenotypic variation for stem rust resistance. These results indicate the presence of a major resistance gene for stem rust. Candidate genes for resistance will now be identified and validated using the recently established high quality genome assembly for the parental cultivar '*Rabiosa*'. Moreover, a nested associated mapping population was established and will be used additionally for fine mapping. Already now, the markers closely linked to the QTL provide a valuable resource for marker-assisted breeding of Italian ryegrass.