

Comparative Genomics: Insight into Evolution of Plant Innate Immunity in Solanaceae

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Wild *Solanum* species, including the allohexaploid *Solanum demissum* and diploid *S. bulbocastanum*, have been the source of several important disease resistance traits introduced into cultivated *S. tuberosum*. We investigated the structural, functional and evolutionary properties of three pathogen disease resistance loci of *S. demissum* using comparative genomics. Our studies focused on understanding features of clustered arrays of R gene sequences and the identification of other sequences common to resistance hotspots for specifying qualitative and quantitative resistance and generating novel pathogen disease resistance genes. We physically mapped (~15Mb total) and sequenced (~3.5 Mb total) portions of each of the three *S. demissum* resistance hotspots on Chromosome 5 (R1, Nb region), the lower arm of Chromosome 11 {R3a, R3b and R5-11 region, termed the Major Late Blight locus (MLB)} and the upper arm of Chromosome 11 (Rmci, N region) (see: <http://www.potatogenome.org/nsf5/> and http://www.tigr.org/tdb/potato/disease_db.shtml). We found that these three resistance gene clusters exhibit variations in overall length and number of resistance gene copies between haplotypes of *S. demissum* and that resistance gene homologues clustered at each of the three hotspots belong to either the fast-evolving Type I R-genes or slow evolving Type II R-genes. Our comparative analyses suggests that a common mechanism could account for both the differentiation of Type I and Type II groups and differentiation of related Type I R-gene groups at each locus.

Comparative analyses of the R-gene loci among Solanaceae genomes also revealed the presence of several families of miniature inverted repeat transposable elements (Sol-MITEs). The structural, functional and evolutionary impact of these transposons with respect to pathogen defense and resistance and evolution of diversity among the Solanaceae will be discussed.

The NSF Potato Genome Project conducts research on Solanaceae biology and has generated structural and functional genomic resources (see: <http://www.potatogenome.org/nsf5/> and <http://www.tigr.org/tdb/potato/>)