

Interactions of Soybean *Rsv* Genes and *Soybean mosaic virus*

by

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(ABSTRACT)

Soybean mosaic virus (SMV; Genus *Potyvirus*; Family *Potyviridae*) is one of the most widespread viruses in soybean (*Glycine max* [L.] Merr.). Hutcheson, a cultivar developed in Virginia, is resistant to the common strains of SMV. However, new resistance-breaking (RB) isolates of SMV have emerged in natural infections to break the resistance of Hutcheson containing the *Rsv1^y* allele. These RB isolates are SMV-G5 and G6-like based on the differential reactions on soybean cultivars with the *Rsv1* locus, and are more G6-like based on the amino acid sequence of the coat protein (CP). The CP of the RB isolates is diverse at the amino and carboxy termini and highly conserved in the core region. RB isolates reduce the yield of susceptible cultivars and cause mottling of the seed coat. Dual infection of soybeans with SMV and BPMV increased the severity of symptoms, including plant stunting and SMV titer in comparison to single SMV inoculations. The reactions of Hutcheson and herbicide-tolerant Hutcheson RR were similar with or without herbicide application. Resistance to SMV is controlled by single dominant genes at three distinct loci, *Rsv1*, *Rsv3* and *Rsv4*. The mechanisms of resistance at the *Rsv3* and *Rsv4* loci were investigated by tracking virus accumulation and movement over time using leaf immunoprints. The mechanisms of *Rsv3* resistance include extreme resistance, hypersensitive response, or restriction to virus replication and movement, which are strain specific. The *Rsv4* gene was found to function in a non-strain specific and non-necrotic manner. The mechanisms of *Rsv4* resistance involve restricting both cell-to-cell and long distance movement of SMV. The *Rsv1*, *Rsv3* and *Rsv4* resistance genes exhibit a continuum of SMV-soybean interactions, and include complete susceptibility, local and systemic necrosis, restriction of virus movement (both cell-to-cell and long distance), reduction in virus accumulation, and extreme resistance with no detectable virus. Cultivars containing two genes for resistance, *Rsv1* and *Rsv3* or *Rsv1* and *Rsv4*, were resistant to multiple strains of SMV tested and show great potential for gene pyramiding efforts to ensure a wider and more durable resistance to SMV in soybeans.

Dedication

To My Parents Charif and Nahla

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