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Functional analysis of nematode secreted proteins to devise innovative approaches for plant resistance against nematodes

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Approximately 1 billion dollars in soybean yield loss is caused annually in the US by a microscopic parasite known as the soybean cyst nematode (SCN; Heterodera glycines). My research is focused on studying cyst nematode parasitism genes. Cyst nematodes secrete proteins that originate from two sets of gland cells (dorsal and subventral) through a stylet (hollow feeding tube) directly into root tissues to facilitate plant parasitism and induce a feeding cell that is necessary to sustain nematode growth and development. Stylet-secreted proteins are encoded by nematode parasitism genes. My project specifically involves a SCN parasitism gene called Hg2D01. Hg2D01 is a secreted protein with an unknown function that is specifically expressed in the dorsal gland. Hg2D01 encodes a 186 amino acid protein with a signal peptide. Hg2D01 maintains greater than 90% nucleotide and amino acid identity with the Hs2D01 gene from the closely related beet cyst nematode (Heterodera schachtii), a parasite of Arabidopsis. Through quantitative real-time PCR I have determined that Hg2D01 is expressed in all life stages throughout the 30 day life cycle of the nematode, excluding non-feeding stages such as eggs, juveniles, and adult males. The fact that Hg2D01 is only expressed in feeding life stages suggests that it likely plays an important role during nematode feeding cell formation. To test this hypothesis, we are conducting a number of studies to determine the function of Hg2D01 that include generating constructs for ectopic expression in Arabidopsis and utilizing an in-planta based RNAi approach to knock-out Hg2D01. Plants expressing dsRNA (double-stranded RNA) specifically targeting Hg2D01 have been infected with nematodes and effects on parasitism are being assessed. These studies are providing important insight into the mechanisms of nematode pathogenesis of plants and will contribute essential knowledge to our long-term goal of developing nematode-resistant crop plants.