An Eco-friendly RNA Interference-based Insect Control for Management of Citrus Greening Disease using a Model System

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The goal of the project was to develop an RNA interference (RNAi)-based, highly specific, bio-pesticide for the control of the psyllid vector of citrus greening disease. Citrus greening disease has killed over 50% of the trees in Florida and Brazil in ten years. Because of quarantine regulations and ease of experimentation, a tomato model system was used to demonstrate the efficacy of RNAi in effective control of the target psyllid. A developmental gene, abnormal wing disc (awd), from the tomato psyllid was cloned, sequenced and in vitro transcripts were synthesized. Nymphs treated with double stranded (ds) RNA and reared on tomato plants showed up to 80% mortality and abnormal wing phenotypes in surviving adults. Using real time PCR, a lower level of expression of the awd gene was recorded in dsRNA treated psyllids. Full length transcripts generated from an engineered tobacco mosaic viral vector with awd gene sequences in forward and reverse orientations were used to infect tomato plants leading to synthesis of abundant dsRNA of awd gene. Upon rearing of nymphs on these plants, the psyllids exhibited both high levels of mortality and abnormal adult wing phenotypes. Debilitating the wings and mortality of the psyllid nymphs would result in reduced spread of disease. At present, the management of citrus greening disease is mostly dependent on the use of extensive insecticidal sprays which may be harmful to beneficial insects (including honeybees), as well as human health and increase environmental pollution. Using a tomato model system, gene silencing was shown to be effective to specifically target the psyllid vector facilitating sustainable agriculture. An effective way of field application is demonstrated with the use of a viral vector.

Awards Won:

Second Award of $2,000