Role of salicylic acid in growing citrus under endemic HLB

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What is the research?

In areas wherein HLB is endemic (nearly 100% of citrus trees are infected), slowing the spread of HLB is no longer needed. The main grower concern is producing a profitable yield under existing conditions. Replicated trials have proven that suppression of Asian citrus psyllid (ACP) populations causes a measurable boost in citrus yield, even when all trees are infected. Yet, the need for ACP management in areas where HLB is endemic is questioned, given the associated costs. In this research, we explore the interactions among the HLB bacterium, the ACP vector and sweet orange to determine a possible mechanism by which reducing vector populations benefits the health of citrus under endemic HLB conditions.

Plants defend themselves against attackers by activating their innate immunity system. Damage caused by phloem-feeding insects, such as ACP, and plant pathogenic bacteria are recognized by plants and trigger defense responses that are regulated by plant hormones, including salicylic acid (SA). The objective of this research was to describe the biological function of a set of genes associated with the synthesis of SA and its metabolites to determine how their accumulation in plant tissues regulates defense responses to both the HLB bacterium and damage caused by the ACP vector. The long-term goal of this research is to boost natural defenses of citrus against the HLB pathogen and ACP vector.

Figure 1. *Representative sweet orange seedings after: 1) 270 days of continuous inoculation by CLas-infected psyllids, 2) nine 7-day periods of CLas inoculation by psyllids occurring monthly, or 3) one 7-day CLas inoculation by psyllids at the onset of the experiment.*

How does SA improve HLB management?

We found that in the absence of coincident ACP feeding damage, citrus trees could mount a defense response against the HLB bacterium by activating the SA pathway. Repeated, monthly 'pulses' of ACP feeding led to pronounced stimulation of the cellular machinery that makes SA and this was coincident with lower bacterium titers in plants. However, continuous and/or long-term (≥ 270 d) ACP feeding shut down defense responses against the bacterium (**Figure 1**).

Our results provide a mechanism explaining how vector suppression contributes to maintaining the health of cultivated citrus in areas where HLB is endemic. Also, specific gene targets were identified that may yield novel genotypes expressing tolerance against C*L*as after appropriate manipulations.

Who is working on the project?

Drs. Lukasz L. Stelinski, Freddy Ibanez, and Mamoudou Sétamou conceived, designed, and carried out this research. Stelinski and Ibanez are located at the University of Florida's Citrus Research and Education Center in Lake Alfred, Florida. Dr. Setamou is with the Texas A&M Department of Entomology, and he is at the Kingsville Citrus Center in Kingsville, TX.

What are the challenges and opportunities?

Our results point to specific gene targets that may yield novel genotypes expressing tolerance against C*L*as. For example, decreasing expression of certain transcription cofactors (NPR3/NPR4) may enhance tolerance to C*L*as and is currently being explored.

Our results also provide a mechanism that explains how vector suppression contributes to the health of citrus cultivated in areas where HLB is endemic. Reducing stress caused by vector feeding allows trees to better defend themselves against the consequences of pathogen infection. Therefore, the cost of vector suppression is worth the investment, even when HLB is endemic. However, employing genetic engineering as a method to overcome HLB will depend on effectively informing consumers regarding the safety of such produce and their accepting that assurance.

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