Biological Control of Huanglongbing by the Bacterium *Paraburkholderia phytofirmans* PsJN

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Year 1 of 3 (30% Complete)

Objectives

1. Optimize the delivery method for PsJN into citrus trees
2. Demonstrate the efficacy of PsJN to reduce CLas titers and slow down symptom formation on CLas-grafted citrus trees
3. Assess the impact of PsJN on Asian Citrus Psyllid (ACP)-mediated CLas infection
4. Quantify the effect of tree inoculation with PsJN on acquisition and transmission of CLas by ACP

Problem and Significance

Novel solutions are needed to protect California citrus growers from threats imposed by the state's ongoing huanglongbing (HLB) epidemic, caused by '*Candidatus* Liberibacter asiaticus' (CLas). In this project, which addresses CRB's high-priority area 3 ('develop tools to prevent CLas transmission or suppress HLB disease'), we probe the potential of the bacterium *Paraburkholderia phytofirmans* PsJN (PsJN) as a biocontrol agent of CLas.

Benefit to Industry

Demonstration of PsJN's capacity to suppress CLas and HLB opens a path for a practical solution for the current lack of resistance to HLB in citrus trees. Furthermore, showing that inoculation of trees with PsJN can curtail the ACP-dependent spread of CLas between trees has potential to benefit the California citrus industry by slowing down or preventing the introduction of CLas from residential into commercial areas.

Plans and Procedures

PsJN has a well-documented ability to confer tolerance to biotic and abiotic stresses in various plant species, including tree crops. PsJN grows endophytically (inside of the plant), where it induces plant behaviors that are beneficial to its host. In this project, different methods are tried in greenhouse experiments to see which one performs best in terms of delivering PsJN into trees. That method will be used to determine whether PsJN can protect citrus trees from a challenge with CLas, delivered either by graft or ACPs, or from ACP-mediated spread of CLas between trees.

Progress Summary

So far, we have shown that leaf infiltration is an effective way to deliver PsJN into citrus foliage. Using this method, we were able to achieve population sizes of approximately 100,000 bacteria per leaf on greenhouse-grown liners of Meyer lemon on Carrizo rootstock. These PsJN populations remained stable for about three weeks, then gradually declined in the course of the next three weeks to less than 1,000 bacteria per leaf. PsJN could not be recovered from the petioles of inoculated leaves, suggesting that PsJN did not move systemically, i.e. to other parts of the plant, with this method of inoculation.

We also observed that all PsJN-inoculated leaves showed signs of yellowing. This confirms that the trees recognized PsJN and were able to respond to it. As the project goes forward, we are keen to find out what this response is, whether it moves (unlike the bacterium itself) to other parts of the tree, and whether it offers protection from CLas or ACP. Also, we have started to compare leaf infiltration with other methods of delivering PsJN into the tree tissue, to see if they do a better job of getting higher loads of PsJN into more parts of the trees for longer periods of time.

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