Altering the Asian citrus psyllid's beneficial bacteria to stop HLB spread

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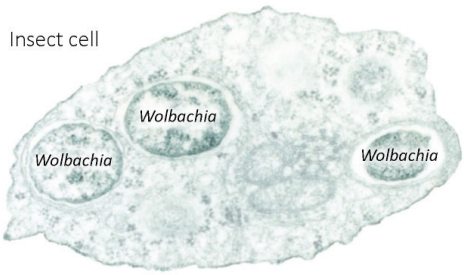
What is the technique?

The insect vector, Asian citrus psyllid, spreads the *C*Las bacterium that causes HLB when it feeds. So, if we can find ways to interrupt this transmission of *C*Las by the psyllid, we may be able to stop the disease. One way to stop transmission is to genetically alter the naturally occurring organisms (endosymbionts) in the psyllid bodies and use them as a vehicle to bring anti-*C*Las compounds into the psyllid. Then, we can replace the wild populations of psyllids with psyllids unable to transmit *C*Las.

How can manipulating symbionts reduce psyllid populations?

Cells of Asian citrus psyllids harbor at least three bacteria inside their bodies, including one called Wolbachia. These bacteria, are called endosymbionts, because they live inside the psyllid (endo) *(below)* and they help the psyllid live and grow



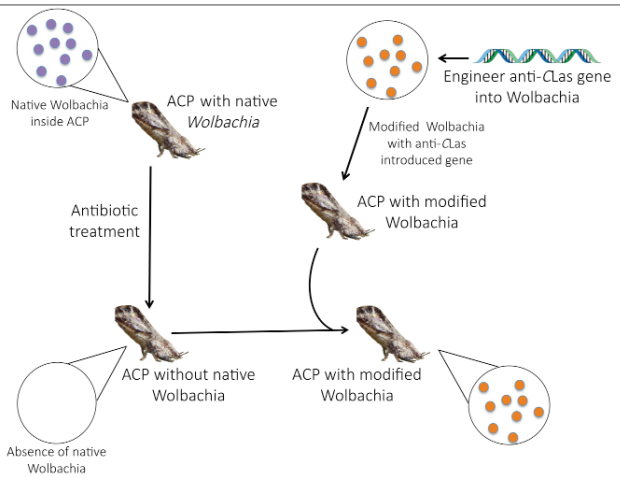
Cell from Asian Citrus Psyllid harboring Wolbachia bacterium

(symbionts). They seem to be unaffected by the presence of the HLB pathogen, *C*Las. This makes Wolbachia a candidate for modification.

If Wolbachia can be genetically modified so that it carries anti-*C*las compounds, and then introduced into Asian citrus psyllids *(above right)*, then it can be used as a vehicle for delivery of those compounds into the psyllid. The key to this strategy is to find a symbiont that has a harmonious relationship with the host psyllid and also can be genetically manipulated. If successful, the symbiont is converted into a biocontrol agent that causes the death of *C*Las. If the research program is successful, the plan is to release Asian citrus psyllids that contain Wolbachia that are making anti-*C*Las compounds that then interbreed with and displace the disease-transmitting psyllid populations, helping to stop HLB.

Disease management applications

This approach has been used in mosquitos, where a population of the mosquito was made incapable of transmitting



Introduction of modified Wolbachia into ACP

the Dengue virus, following its infection with a genetically altered Wolbachia bacterium. Mosquitos don't normally have Wolbachia in their bodies, and if mosquitos are infected with Wolbachia and released over a number of weeks, they mate with the wild mosquitoes and gradually the percentage of mosquitoes with Wolbachia increases. Mosquitoes with the Wolbachia are less able to transmit viruses to people and the outbreaks of Dengue are reduced.

Who is working on the Project?

Kirsten Pelz-Stelinski, an associate professor with the University of Florida, is leading the research efforts on exploiting Wolbachia endosymbionts within Asian citrus psyllids to disrupt the transmission of HLB. Collaborative research with other groups for development of large-scale cultures of such psyllids for future release as a management tool is ongoing.

What are the challenges and opportunities?

One of the biggest challenges in this approach is to keep the Wolbachia healthy and competitive after its genetic information has been altered to include the anti-*C*Las compounds, so that it can compete with the Wolbachia in the wild psyllid population. Understanding the mechanisms of the transmission process and then translating that understanding into mass culturing of psyllids for field release presents significant logistical and regulatory hurdles. However, if successful, the psyllids could be released in existing citrus orchards and reduce transmission of HLB, helping to save the citrus industry.

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