# Researchers identify protein target to halt citrus tree disease

June 7 2017

University of Florida researchers may have come a step closer to finding a treatment for a disease called Huanglongbing, or citrus greening, that has been decimating citrus trees in the state. In work published this week in *mSphere*, an open access journal from the American Society for Microbiology, the investigators describe identifying a small protein from one bacterium living in Asian citrus psyllids—the flying insects that spread the disease as they feed on the trees—that can "cross-talk," moving to another bacterium within the insects to silence so-called "prophage genes" containing viral material in the second bacterium, helping prevent an insect immune reaction that would likely be detrimental to both bacteria.

The protein, from the *Wolbachia* bacterium, could serve as a potential target to develop spray treatments to protect trees against the psyllids, and could potentially help the trees themselves fight off bacterial invasion, said senior study author Dean W. Gabriel, Ph.D., a professor of Plant Pathology at the University of Florida in Gainesville. *Wolbachia* is a natural bacterium present in up to 60 percent of all insect species. (image: citrus greening disease on mandarin oranges, wikimedia commons)

"In this case, one bacterium is doing a favor to the whole bacterial community living within the psyllid by shutting down a potential threat to survival of insect host," Gabriel said.

Gabriel and colleagues had been looking for ways to interrupt citrus

greening, a disease process caused when psyllids carrying but not affected by a bacteria called *Candidatus Liberibacter* feed on healthy trees and inject this bacteria into the trees' phloem, a tubular system normally used to transport sugars produced during photosynthesis from the leaves of a plant to the rest. The bacterium suppresses the plants' defenses as it moves, Gabriel said: "It's like a little cunning burglar sneaking in under the radar." It impacts the tree from its roots to its shoots, he said, and has a long incubation period: "By the time disease is detected in one tree, the entire grove is thoroughly infested and much more difficult to treat."

Citrus greening causes a severe decline in the trees—leaves turn a blotchy, mottled yellow color, the fruits produced are smaller and have an off-taste, and fruit yield is much reduced. The disease has devastated Florida over the last 10 or so years, Gabriel said. As a result, the state's overall citrus production has declined by about 60 percent over the last six years. Scientists have been desperately seeking a cure.

In a series of laboratory experiments, Gabriel's team discovered that expression of proteins that help drive the spread of the *Candidatus* bacteria were suppressed when they were treated with extracts from the psyllids. Further studying the process, they identified a fragment of the protein doing part of suppression as encoded by the *Wolbachia* strain and secreted into the insect. This protein could move within the insect into the *Candidatus* bacteria causing greening, bind itself to a genetic region that would normally promote prophage activity, and repress these genes.

Gabriel's group has a grant from the U.S. Department of Agriculture to grow the *Candidatus Liberibacter* bacterium in culture, a process that has been difficult because, once removed from its host, the bacterium historically has destroyed itself. Now that a protein target has been identified, it can be commercially synthesized and added to culture media, where the bacterium may be more likely to grow, Gabriel said.