UF/IFAS RESEARCH DISCOVERIES

UF | IFAS Research UNIVERSITY of FLORIDA

NATURAL RESOURCES

HUMAN SYSTEMS

AGRICULTURE

CITRUS DISEASES

UF/IFAS is at the forefront of battling the biggest threat to our state's $9 billion citrus industry — citrus greening. From mapping the citrus genome and pinpointing the bacterial cause to developing resistant rootstock to making psyllids greening-bacteria resistant, our scientists are leading the way to finding a long-term solution to this devastating disease.

In addition, researchers continue their work on another virulent disease, citrus canker, which has seen the destruction of 16.5 million citrus trees throughout the state since 1995.

UF/IFAS researchers work in established facilities in Gainesville and the heart of Florida citrus country. The UF/IFAS Citrus Research and Education Center (REC) in Lake Alfred was established 97 years ago, has 225 employees and is situated on 600 acres. The UF/IFAS Indian River REC in Fort Pierce and the UF/IFAS Southwest Florida REC in Immokalee also have a strong focus on citrus. In Apopka, a new state-of-the-art greenhouse, concentrating on citrus nursery research, opened in 2014.

UF/IFAS researchers are working with the citrus industry to ensure the post-greening/canker grove is more profitable for growers and produces a better product for consumers.

Ongoing Research

GREENING BIOLOGICAL CONTROL

A UF/IFAS research team led by Kirsten Pelz-Stelinski, an associate professor with the UF/IFAS Citrus REC, is pursuing a unique solution to the citrus greening epidemic that would thwart the bacterium believed to be responsible for the disease, *Candidatus* Liberibacter asiaticus. Currently, that bacterium is spread by an invasive insect, the Asian citrus psyllid, when it feeds on citrus trees. The team is examining the psyllid and related insects, searching for symbiotic bacteria that could interfere with the greening bacterium. If successful, the project would ultimately lead to release of these "neutralized" psyllids. The psyllids and their offspring would be unable to transmit the disease-causing microbe.

INDUCED DEFENSE

A UF/IFAS research team led by Lukasz Stelinski, an associate professor of entomology, demonstrated specific mechanisms through which a *Candidatus* Liberibacter asiaticus induces plant responses that modify behavior of its insect vector, the Asian citrus psyllid. The citrus greening pathogen induced release of a volatile chemical, methyl salicylate, which increased attractiveness of infected trees to the psyllid, causing the pests to initially prefer infected trees. However, psyllids later dispersed to non-infected trees as their preferred location for prolonged settling, because infected plants typically offer sub-optimal nutritional content. Thus, the insects tend to move from infected to uninfected citrus trees, spreading the disease as they go.

CANKER SUSCEPTIBILITY

A group of researchers that included Jeffrey Jones, a professor of plant pathology, discovered a gene, known as the susceptibility or "S" gene, that makes citrus trees susceptible to citrus canker. The disease is caused by the bacterium *Xanthomonas citri*. The discovery puts scientists a step closer to finding a possible cure for the disease, which cost the citrus industry an estimated $1 billion and led to the destruction of 16.5 million citrus trees between 1995 and 2012. Researchers have already identified several genes that they believe could be engineered to obtain broad-spectrum plant resistance to most kinds of citrus canker.

Research with Impact

CITRUS GENOME

Scientists, including Professor Fred Gmitter of the UF/IFAS Citrus REC, sequenced and compared the genomes of eight citrus varieties, including sweet orange, sour orange, clementine and several other mandarins, and pummelos. These sequences are expected to help scientists unravel the secrets behind citrus diseases, such as greening, to understand the evolution and relationships among modern citrus varieties, as well as aid those working to improve fruit flavor and quality. The genome sequences were the result of at least four years' worth of study and $3.5 million invested by several countries. Some other possible outcomes from the research include citrus trees with more beautiful fruit, better disease resistance, more phytonutrients, and greater tolerance for salt, bad soil or extreme temperatures.

RESISTANT ROOTSTOCK

UF/IFAS researchers including Jude Grosser of the UF/IFAS Citrus REC identified 17 rootstocks that show a lower rate of infection from and more tolerance to citrus greening. Growers use rootstocks — a part of a plant that includes the roots — as a foundation for new trees, which are created by grafting a hardy rootstock together with the above-ground portion of a different citrus variety. The results are promising. Trees grown on experimental rootstocks show 10-20% infection after four years, compared to 70% of conventional trees. Large-scale trials have been established and selected rootstocks are available to growers.

GREENING BACTERIUM

Eric Triplett, a professor and chairman of the UF/IFAS Department of Microbiology and Cell Science, leads a research team that's demonstrated citrus greening disease is almost certainly caused by one lone species of bacterium, *Candidatus* Liberibacter asiaticus, and is not caused by a combination of bacterial or viral pathogens, a possibility that some had feared. DNA analysis of the inner bark from Florida citrus trees infected with citrus greening showed no other suspect, viral or bacterial. The genetic analysis was difficult because, thus far, scientists have been unable to culture the bacterium. The discovery could help lead to treatments, as well as new, quick and inexpensive testing methods for the disease.

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