Citrus blight research update

By William Schneider, Avijit Roy, John Hartung, Jonathan Shao and Ron Brlansky

With HLB now occurring throughout Florida citrus groves, citrus blight has been getting less attention, even though the problem still exists. In fact, the combination of HLB and citrus blight has compounded the problem that the citrus industry is facing with decreased yields, small fruit size and tree loss. The presence of both diseases in groves, and even in the same trees, is now a common occurrence. Both diseases cause severe decline in the health and productivity of trees, although the symptomology differs.

Over the last two years, our research on citrus blight, funded by the Citrus Research and Development Foundation, has shown the presence of virus sequences in blight-affected trees and even in some HLB-affected trees and in non-symptomatic citrus species. The virus sequences were discovered using a method of sequencing nucleic acids commonly called next-generation sequencing.

In 2014, our group published a paper that described the virus sequences that were inserted into the genetic material (genome) of the Carrizo rootstock. Analysis showed these sequences are very similar to those of known endogenous pararetroviruses. Plant viruses of this particular type have been found inserted into the genome (endogenous) of many plants without causing any noted diseases. The virus remains dormant in the host DNA, much like the viruses that cause cold sores in humans.

However, when some of these plants with sequences in their genome are exposed to certain stresses such as drought, pruning, changes in light intensity or even flowering, virus sequences may be activated, beginning infections that generate active virus genomes and sometimes identifiable virus particles. When this happens in these known pararetrovirus systems, the plant reacts to the virus with symptom production. It is quite possible this is also the case for the citrus blight pararetrovirus. However, we actually don't know this yet; the virus is just tightly correlated with citrus blight symptoms. The trees may be reacting to something completely different. However, we will study this with our ability to detect virus sequences in the plant genome as well as activated virus sequences in conjunction with stresses that might cause the generation of active virus.

VIRUS FOUND IN LEAVES AND ROOTS

We have continued to identify virus sequences both in the genome as well as outside of the genome of blight-affected plants, consistent with the presence of an active pararetrovirus. In the spring of 2015, we took 250 samples from 50 blight-affected and healthy trees in groves in three different citrus-growing areas (north, central and south) of Florida. Trees were identified as having citrus blight using the syringe injection method that shows the complete blockage of the xylem by a plugging material that does not allow the passage of water through the trunk (Photo 1). In 2014, when we first identified the pararetrovirus sequences in the genomes in blight-affected trees, we only assayed roots, since root-graft transmission experiments previously had shown that the unidentified causal agent could be transmitted this way and cause typical blight symptoms including the plugging of the xylem. This year, we also have been able to detect the virus sequences in leaf samples of blight-affected trees. In the 250 samples, active pararetrovirus was

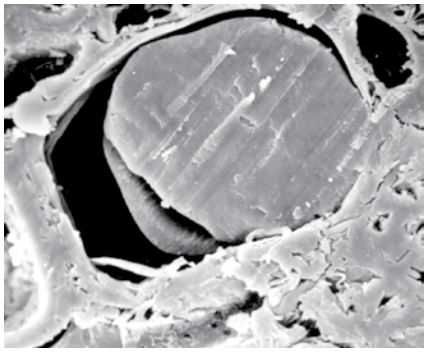

Photo 1: Plugging material in the xylem of a blight-affected tree that causes reduced or lack of water flow.

MANAGING THE ASIAN CITRUS PSYLLID AND HUANGLONGBING

Three years of Florida field studies show ongoing success using Surround® WP Crop Protectant

By Kurt Volker, Ph.D.

Use of SURROUND Crop Protectant to suppress the Asian citrus psyllid (*Diaphorina citri* Kuwayama, or ACP) — and the Huanglongbing (HLB) citrus greening disease the insect spreads — is rapidly gaining popularity among citrus growers in Florida.

Ongoing research at the Citrus Research and Education Center at the University of Florida is centered on the protection of young citrus trees from HLB citrus greening disease.

Results from three years of field study indicate the patented calcined kaolin protective film layer that SURROUND provides can suppress ACP, the vector of HLB, in addition to delivering protection from sunburn and heat stress.

Developed in conjunction with the United States Department of Agriculture, SURROUND Crop Protectant is an EPA-registered, patented insecticide specially formulated with calcined kaolin to suppress insect activity.

SURROUND particle film also protects plants from sunburn and heat stress. Treated trees stay cooler, enabling photosynthetic activity to continue helping plants achieve their full yield potential.

Surround®
Agricultural Crop Protectant

Three-Year Study Results:

SURROUND-treated leaf surfaces inhibit the ability of the ACP to maneuver and grasp the leaf surface in order to feed. This prevents the spread of HLB, which is transmitted by ACP as it feeds on citrus leaves.

Reliance on foliar insecticides or soil-applied systemic insecticides alone can result in increased rates of HLB due to the development of insecticide resistance by ACP.

Neonicitinoid systemic insecticides, plus a rotation of either foliar insecticides or SURROUND, kept trees HLB-free for 15 months after planting.

Proper insecticide rotation is vital to help prevent resistance and achieve the level of HLB protection needed to ensure a return on the investment in new tree plantings.

OMRI Listed

For more information visit our new mobile-friendly website at novasource.com/AsianCitrusPsyllid or send your question to: info-novasource@tkinet.com.

Tips to Maximize Effectiveness

Apply thorough coverage of SURROUND during initial applications to maximize the practical effective rate.

- Use the proper amount of water volume per acre to achieve near-drip.
- Don't apply if the foliage is wet. Establish a full coating by applying spray in the opposite direction of the previous application at a ground speed of ≤2 MPH.
- SURROUND can be tank-mixed with most pesticides.

Download the complete label at novasource.com.

NovaSource® Tessenderlo Group

Photo 3: Decline/death of a citrus tree co-infected with citrus blight and HLB.

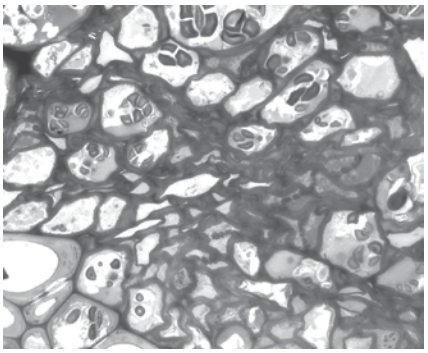

Photo 2: Phloem necrosis and plugging of a phloem sieve element in an HLB-affected tree that causes the reduction in movement of photosynthetic products.

found in the leaves and roots of all of the blight-affected trees, but in none of the healthy trees.

BLIGHT AND HLB

We have also analyzed the sequence data sets of trees known to be affected by HLB and blight as compared with sequence data from healthy trees. We have identified a number of genes that are expressed at high levels in blight-affected trees, but not in healthy or HLB-affected trees. We are testing these preliminary results against this larger set of 50 trees sampled in the spring of 2015. Further sampling similar to that done earlier in 2015 was scheduled for November 2015.

Some blight-affected trees also were identified as HLB-affected. Co-infection with these two diseases has severe consequences, with the blockage of water and soluble mineral nutrient flow (caused by the xylem plugging due to blight) as well as the blockage of photosynthetic product flow to non-photosynthetic parts (caused by phloem plugging and necrosis due to HLB) (Photo 2). Trees might decline faster when both diseases are present. Trees affected with citrus blight and HLB often die (Photo 3) since the xylem is blocked by solid plugs and the phloem is undergoing degradation and blockage. Hence, the trees can't move water or photosynthetic materials. Citrus blight continues to cause tree decline and reduced yields in Florida citrus groves.

In conclusion, we believe that we are making progress in our research on the role of a pararetrovirus in the cause of citrus blight. We also will need to find what triggers the virus to cause it to move, to cause symptoms to be produced and to discover how it is transmitted to citrus plants.

William Schneider is a research plant pathologist and Avijit Roy is a research molecular biologist, both with the U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS) Foreign Disease-Weed Science Research Unit in Fort Detrick, Maryland. John Hartung is a research plant pathologist and Jonathan Shao is a bioinformaticist, both with the USDA ARS Molecular Plant Pathology Laboratory in Beltsville, Maryland. Ron Brlansky is a professor emeritus at the University of Florida, Citrus Research and Education Center in Lake Alfred.