Update on citrus LEPROSIS

By R. H. Brlansky

Citrus leprosis is one of the most important new invasive viral diseases in South America and Central America, and is very likely to be introduced into the United States. The disease has been on the move in Central America. It was originally reported in Brazil, Argentina and Venezuela and later in Colombia, Panama, Guatemala, Nicaragua, El Salvador and Mexico (reported in 2005 in Chiapas and Tabasco states, Mexico).

The disease is currently known to be caused by two different viruses; one is found in the nucleus of the infected cells and one is located in the cytoplasm of the cells. Both viruses are transmitted by a species of *Brevipalpus* (flat) mites. Flat mites are present throughout all areas of the Caribbean Basin and in most citrus-producing areas of the United States.

The plant host range of the mites is very broad. In 1958, there were more than 65 hosts of *Brevipalpus* mites, but in 2004, it was reported that there may be 1,000 hosts. Hosts for the mites include some commonly known plants such as gardenia, hibiscus, holly, ligustrum, lemon, lime, orange, grapefruit, pecan and viburnum. More recently, reports showed *Swinglea glutinosa*, Chinese hibiscus (*Hibiscus rosa-sinensis*), Turk's Turban (*Malva-viscus arboreus*), southern silky oak (*Grevillea robusta*), achiote (*Bixa orellana*), benghal day-flower (*Commelina benghalensis*) and *Solanum violaefolium* as new non-citrus hosts for cytoplasmic citrus leprosis virus. Many of these plant species are common in Florida.

The cytoplasmic type of citrus leprosis is the main one on the move through Central America while the nuclear type has only been reported from Brazil and Panama. Because citrus leprosis has advanced quickly from

Fig. 1 (far left). *Leprosis twig death on multiple branches*

Fig. 2 (left). *Leprosis twig death*

Fig. 3 (below). *Leprosis lesions on mature (left) and immature fruit (right)*

Fig. 4 (right). *Leprosis lesions on leaf*
Fig. 5 (below). *Leprosis-infected fruit that have dropped off tree*

South America into Central America and Mexico, it is of quarantine importance and poses a major threat to all citrus industries in the Caribbean, Florida, Texas and California where *Brevipalpus* mites are also found.

Trees are not often killed by leprosis, but young trees can be killed due to expanding lesions that girdle limbs of the tree (Figures 1, 2). The main damage from the disease is the spots or lesions on fruit (Figure 3) and leaves (Figure 4) that may leave the fruit unmarketable and may cause excessive fruit and leaf drop (Figure 5).

Mites must be continually controlled. Multiple applications of acaricides are expensive and can result in the development of mite tolerance to the pesticides. In some countries, management for the disease includes pruning of symptomatic tissue from the trees at least twice a year.

Diagnosis of citrus leprosis has been difficult; it is often confused with other problems. It is very poorly mechanically transmitted, poorly graft transmitted since it is not a systemic disease, and is often poorly transmitted experimentally with mites. For years, transmission electron microscopy (TEM) was the only available method for positive diagnosis, and this takes time to perform.

Recent research from Brazil and Florida on the characterization of the causal virus has characterized the causal cytoplasmic citrus leprosis virus (CiLV-C), and improved detection methods are now available with more currently being developed. Rapid, reliable detection methods for citrus leprosis, especially a method that could be performed without expensive reagents and equipment, would facilitate diagnostic/quarantine measures in the Caribbean and at U. S. ports of entry. This is being done by our group with funding by the USDA, APHIS.

Transmission experiments with endemic *Brevipalpus* mites from Florida have been initiated in quarantine facilities at the USDA, ARS at Fort Detrick, Md. where work with an exotic disease such as this and its potential vectors can be safely done. This work is funded by a grant from the Citrus Research and Development Foundation and is being done by Ron Brlansky, Avijit Roy, William Schneider, Vernon Damsteegt and Colombian cooperator Guillermo Leon of CORPOICA. For more photos for the diagnosis of citrus leprosis, see http://www.idtools.org/id/citrus/diseases/factsheet.php?name=Leprosis

R. H. Brlansky is a professor at the University of Florida's Citrus Research and Education Center in Lake Alfred.

A look at HLB research directions after four years

By Harold Browning

As we close in on three years since establishment of CRDF, and four years of concentrated effort against HLB in Florida, we can reflect on the elements that mobilized Florida citrus growers and allied partners to establish this unprecedented response. The industry organized existing research resources to develop HLB strategies based on new knowledge of the disease and how the pathogen infects citrus trees. This approach was documented through the research plan which has guided the last four years of research.

Initial information on new citrus diseases came from experience in other areas where citrus diseases have been resident and methods developed to manage them. Scientific literature also provided guidance on what is known and summarized successes in other areas in field-testing management tools. It was immediately obvious that research was needed to identify dynamics of the disease under Florida conditions, and how HLB will behave under our blend of climate, soils, cultivars and growing practices. This is often the first response to a new disease.

Following HLB discovery in Florida, global experience with HLB and its vector Asian citrus psyllid (ACP) provided initial guidelines for limiting spread in southern Florida, and these guidelines were widely publicized:

- Pursue aggressive vector control to limit spread between and within groves
- Manage disease inoculum through scouting and removal of infected trees
- Replant citrus with disease-free stock

Even while ACP management was implemented with increasing rigor, HLB managed to spread rapidly through the state, increasing both percentage of infected groves and within-grove rates of infection. Difficulty in detecting the disease and the latent period complicated efforts to slow spread and to coordinate management practices within the Citrus Health Management Areas. Within a relatively few years, growers with higher incidence of HLB lost confidence in the recommendations from other citrus areas of the world, and adopted alternative management tactics to manage infection while still attempting to manage psyllid populations.

Four years since these first efforts began, the portfolio of CRDF research is focused on developing alternative approaches to HLB management, given that scouting and tree removal is not the grower's preferred practice in mature plantings. This research direction has evolved logically from the experience in Florida, as well as emerging research results. Goals that are now pursued along parallel tracks include:

- Immediate solutions to limit injury and loss from large-scale infection of mature groves, the mainstay of the citrus supply stream
- Intermediate therapies that provide opportunity to reverse symptoms of infection and reduce disease impact in existing groves. These strategies will reverse effects of CLas infection of citrus trees and sustain productivity until other solutions emerge
- Enhancements to psyllid management for use across the industry in mature and new plantings
- Methods to protect new planted trees as resets and solid new blocks. It is essential that new trees reach productive age before being infected
- Development of cultivars tolerant of or resistant to HLB. While no natural resistance is known, broad-ranging research is focused on creating resistant trees

These broad areas represent goals of the approximately 140 research projects currently under way. This experience with HLB also will be useful as we address other diseases which threaten Florida, including citrus black spot, CVC, and leprosis.

To learn more about research results emerging from your investment, we encourage you to attend industry seminars and educational events, and to visit www.citrusrdf.org

Harold Browning is Chief Operations Officer of CRDF. The foundation is charged with funding citrus research and getting the results of that research to use in the grove.

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