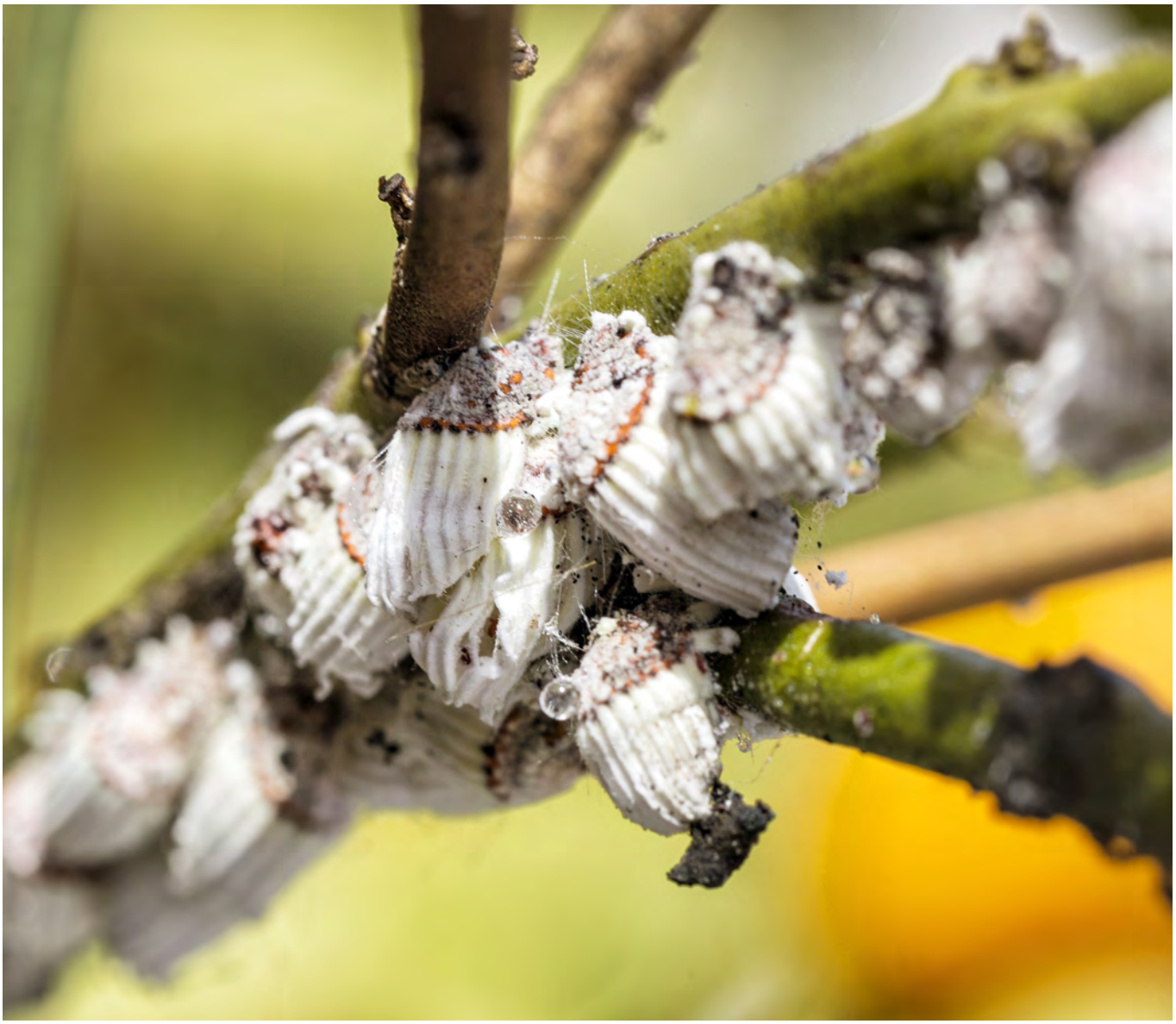

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Citrus mealybugs feast on a citrus tree.

Citrus pest management: More than just psyllids

By Lauren Diepenbrock

Non-psyllid, soft-bodied insects are common in Florida citrus. Their ability to cause damage varies by pest, pest population size, tree age and tree variety. Soft-bodied insects include scales, mealybugs, whiteflies and aphids, all of which are small and can be hard to detect until the telltale sign of sooty mold development appears on their excrement (honeydew) or damage is apparent. While most insect management in Florida citrus revolves around psyllids, it is important to remember other pests that can be problematic in the system, even with regular management in place.

Damage from soft-bodied insects is related to the local population size. Damage can include honeydew with sooty mold colonization; yellowing leaves; premature leaf drop; blemishes to branches, leaves, and/or fruit; and death of young plants. There is a long history of these pests being kept in check by a combination of native and introduced predatory insects, mites and fungi in Florida. Populations have been found to achieve damaging levels when they occur in areas where predators are not readily present, weather events disrupt biological control or natural enemy populations are reduced from repeated applications of broad-spectrum insecticides.

SCALES

Citrus trees are often home to both soft and armored scales.

Historically, Caribbean black scale (*Saisseta neglecta*), green scale (*Coccus viridis*), brown scale (*Coccus hesperidum*) and Florida wax scale (*Ceroplastes floridensis*) have been the most common problematic soft scales in Florida citrus. These species are known to prefer settling in the outer canopy of trees. They produce high amounts of honeydew, which can cover leaves and reduce the ability of those leaves to perform photosynthesis.

Photo courtesy of flickr.com/scotnelson

Ants protect green scale from lady beetles and other predators.

Snow scale (*Unaspis citri*), Florida red scale (*Chrysomphalus aonidium*), purple scale (*Lepidosaphes beckii*), Glover's scale (*Lepidosaphes gloveri*) and chaff scale (*Parlatoria pergandii*) are the most important of the armored scales found in citrus groves.

Most scales can be controlled with a well-timed application of horticultural oil to the crawler stage. To check for crawler activity on branches, tape traps made of white double-sided tape can be wrapped around branches near adults. When crawlers emerge and begin moving, they will get stuck on the trap and indicate the appropriate time to perform management. Tape traps should be checked and changed weekly, or debris will build up over time and decrease the effectiveness of the traps.

To determine crawler timing for citrus snow scale, bark should be brushed clean and checked weekly for new colonization. When applying oil

Research Projects Aim to Assist Growers

By Rick Dantzler, CRDF chief operating officer

The Citrus Research and Development Foundation (CRDF) recently awarded eight research grants. The funded projects place an emphasis on providing practical help to growers. The projects are:

1. A project will study the interactions between the causative agent of HLB, citrus parasitic nematodes and Diaprepes root weevil to help growers manage root damage.

2. Some growers are still using antimicrobials, so CRDF has funded a project to determine which commercial adjuvants achieve systemic delivery of antimicrobials.

3. While the phytophthora root rot/HLB interaction has been well documented, the economic benefit of managing phytophthora on HLB-affected trees is currently unknown. Therefore, CRDF has funded a project to determine new guidelines, based on economic analyses, for treating trees with low, medium and high levels of phytophthora.

4. Whether a grower sprays aggressively to kill psyllids or not, we can all agree that a spray program should not include insecticide applications that don't produce more economic benefit than they cost. CRDF has funded a proposal that will ground-truth what these thresholds are believed to be, providing guidance to growers on when they *don't* need to spray.

5. Metabolites are the molecule products of metabolism. Metabolism converts food to energy to run cellular processes for synthesis of proteins, lipids, nucleic acids and certain carbohydrates. Metabolomics is the study of the unique chemical fingerprints that these cellular processes leave behind. University of Florida (UF) researchers have developed a platform that enables metabolomics profiling which will, hopefully, allow them to identify the metabolites that are present with HLB-tolerant citrus cultivars. If this can be perfected, new cultivars can be identified as HLB-tolerant without the need for years of field observation. CRDF has funded a project to do this.

6. HLB impacts on fruit can result in rejection by packinghouses and juice processing facilities because of inadequate size and poor quality. There are HLB-tolerant sweet orange/mandarin cultivars which, when blended with Valencia juice, make a very flavorful product. Whether the industry wishes to move in this direction remains to be seen. In case it does, CRDF has funded a project to analyze sensory and consumer acceptance, identify more HLB-tolerant cultivars with juice that resembles the quality of Valencia juice, and determine a chemistry definition of consumer-accepted orange juice.

7. HLB-tolerant trees have less root damage than non-tolerant trees. What is the mechanism of tolerance in the rootstock that prevents root loss, and could it be related to tolerant scions? CRDF has funded a project to answer this question.

8. An Israeli company has a biocontrol agent that has markedly reduced Liberibacter in carrots. Working with a UF researcher, the company has proposed testing the agent on Liberibacter in citrus. CRDF has agreed to fund preliminary work to see if this holds promise.

Still under consideration are research needs for nutrition and irrigation.

CRDF Grower Dollars at work for you

Column sponsored by the Citrus Research and Development Foundation

or insecticides for scales, coverage is key to suppressing populations. Sprays need to penetrate the canopy, not just cover exterior portions as psyllid sprays generally do.

Photo by Juanita Popenoe

***Aschersonia sp.* fungus attacks immature whiteflies.**

WHITEFLIES

Common whitefly pests in Florida citrus include citrus whitefly (*Dialeurodes citri*), cloudy-winged whitefly (*Singhiella citrifolii*), woolly whitefly (*Aleurothrixus floccus*) and citrus blackfly (*Aleurothrixus woglumi*). Whiteflies are only known to be active when flush is present and are generally controlled by natural enemies including parasitoids, predators and fungi. Like many soft-bodied insects, whiteflies produce honeydew, which can lead to sooty mold buildup. Rarely do populations of whiteflies in a grove get high enough to warrant management actions.

APHIDS

Green citrus aphid (*Aphis spiraecola*), cotton aphid (*Aphis gossypii*) and brown citrus aphid (*Toxoptera citricida*) are often found in low numbers in most citrus groves. Their populations are generally kept low by natural enemies. Brown citrus aphid is the primary vector for citrus tristeza virus, which is now rarely seen impacting trees as most growers no longer plant trees on sour orange rootstock. This rootstock is highly susceptible to the virus, and trees planted on sour orange are known to succumb to quick decline.

MEALYBUGS

Citrus mealybug (*Planococcus citri*) is the most commonly found mealybug in citrus, though several native species are often found feeding in citrus trees. More recently, the lebbeck mealybug (*Nipaecoccus viridis*) has joined the

Photo by Lauren Diepenbrock

A cluster of lebbeck mealybug ovisacs has hundreds of crawlers emerging.

suite of mealybug pests in Florida citrus. Mealybugs are often controlled by natural enemies. Their waxy coating, which can be hard to penetrate, and tendency to feed in concealed places on trees make them particularly challenging to manage with insecticides. Mealybugs secrete a large amount of honeydew on which sooty mold will quickly colonize.

In the spring of 2019, lebbeck mealybug was found causing fruit, leaf and stem damage in Central Florida. Unlike the common mealybugs found in citrus, this species injects a toxin as it feeds, causing fruit and leaves to become distorted. This distortion can lead to fruit drop in addition to physical blemishes on fruit.

In initial insecticide trials, application timing and coverage were key. Materials that showed promise include acetamiprid, buprofezin, chlorpyrifos and spirotetramat. All materials were applied at their labeled rate for mealybugs at 125 gallons per acre with 3 gallons of 435 oil per acre using a power blast sprayer. The power blast sprayer applied material with enough force to physically remove most mealybugs from trees. Therefore, data were taken on recolonization of plants over a period of five weeks. Laboratory trials are currently being conducted to provide more data to add to field findings.

It should be noted that in other regions of the world where lebbeck mealybug has caused problems, natural enemies have done a better job at controlling populations than insecticides. Chemical management is being used only on occasion to knock back heavy infestations.

Author's Note: All current knowledge on non-psyllid, soft-bodied pests and their management is based on open-air groves. It is likely that this information will change as new production practices are incorporated.

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