When citrus was brought as seed to Florida by the Spanish in the 16th century, it could only have been attacked by a few native generalist herbivores such as grasshoppers and “orange dog” caterpillars. Unfortunately, movement of citrus and other plant material into the state has brought with it an increasing roster of pests and their associated diseases. The majority of these have been managed by biological control and adjustments to production practices, at least in processed fruit.

All that changed with the advent of the Asian citrus psyllid (ACP), vector of greening disease. Increased insecticide use against this pest and increased use of copper to control citrus canker is impacting beneficial insects and mites, thereby increasing incidence and severity of secondary pests such as scales, rust mites and spider mites. It is therefore important now more than ever to recognize and continually assess populations of pest and beneficial insects and mites.

The objective of scouting is to obtain an estimate of true pest incidence based on a representative sample upon which to base a management decision. Time constraints require that only a small percentage of trees and even a smaller percentage of plant parts be actually examined. Therefore, it is important to avoid biased sampling that might give unrealistically high or low estimates. Bias can be avoided by distributing the sampling effort evenly over trees and blocks while varying each time the sampling pattern or starting location.

A measure of the economic impact of a pest is the sum of yield losses and control costs. By that criterion, ACP is fast supplanting citrus rust mite and the related pink rust mite as the worst pest in Florida. Another pest that has increased in importance is citrus leafminer, due to its role in accelerating the spread of citrus canker. Scale insects and spider mites are making a comeback due to factors mentioned above, and Diaprepes root weevil continues to spread in Florida and other states. Scouts should be on special lookout for these pests and their natural enemies.

ASIAN CITRUS PSYLLID (ACP)

Psyllids or jumping plant lice are sucking insects related to aphids. They differ from aphids by the presence of jumping legs, the absence of cornicles (“tail pipes”), and the presence of eggs and winged males in all generations. Like aphids, they inhabit young flush, secreting honeydew and causing leaf distortion. However, ACP adults are stronger fliers than aphids and can survive without fresh flush.

Search for the orange-colored eggs and small nymphs in the tiniest feather flush. Larger nymphs will be found nearby on partially expanded leaves. Larger aggregates will be attended by ants feeding on honeydew secreted by the nymphs in white wax tubes extending from the anus.

Adults will be on flush if available, or on expanded and even hardened leaves if not. They can be counted as they fall onto a sheet of white paper placed under foliage that is gently tapped.

Natural enemies of psyllids include larvae of ladybeetles, syrphid flies and lacewings, adult ladybeetles, spiders of all sizes, and the tiny wasp, Tamarixia radiata. Mum-mies of large psyllids attacked by Tamarixia can be recognized by their dull brown appearance, tiny silk strands staking down the host margin, or a single emergence hole on the host dorsum.

CITRUS LEAFMINER (CLM)

Phyllocnistis citrella

The CLM adult is a tiny inconspicuous and nocturnal moth. The minute dewdrop-like egg is laid most often next to the midvein of unexpanded leaves. The larva bores directly through the leaf cuticle and initially mines adjacent to the leaf vein. The serpentine mine turns back on itself several times as the larva works its way to the leaf margin, which it
DIAPREPES ROOT WEEVIL (DRW)
*Diaprepes abbreviatus*

Despite being a robust snout-nosed beetle, 0.5 to 0.7 inches in length and strikingly marked with longitudinal black stripes interspersed with pink, tan, or in some places yellow, DRW is surprisingly inconspicuous.

Adult feeding activity can be recognized by roughly semi-circular scoops removed along the margins of expanded flush. Stringy, dark-green fecal matter may also be seen on recently fed-upon foliage. Eggs are laid in a sticky mass between two hardened leaves close to the feeding site.

“Neonate” larvae drop to the ground after egg hatch where they fall prey to fireants and other ground-dwelling predators. Those that escape may be later attacked by specialized fungi or nematodes as they feed on successively larger roots in their quest to complete development in from four to 15 months.

Beetles are most abundant in late spring or early summer and sometimes again in fall. They are more likely to be caught feeding early in the morning or late in the afternoon, preferring to retreat into the canopy during the heat of the day. Their habit of dropping to the ground when disturbed can be used to advantage by holding an umbrella under suspect flush that is then beaten to dislodge the insects.

**CITRUS RUST MITE (CRM)**
*Phyllocoptruta oleivora*

**PINK CITRUS RUST MITE (PCR)**
*Aculops pelekassi*

These tiny, wedge-shaped mites are similar in appearance and in the injury to citrus fruit caused by feeding on the epidermis (top layer) of the peel and also on leaves. Cells killed by this feeding are replaced with corky tissue that expands with growth of the fruit. Therefore, damage to small fruit becomes rough to the touch while recent damage is smooth and even shiny and black.

A 10x to 14x hand lens is required to see rust mites. Population density is usually reported in lens fields, although the actual area encompassed will depend both on the lens and the distance held from the eye.

Rust mites reproduce rapidly and population densities may double in less than two weeks. Therefore, it is important to scout frequently, every 10 to 14 days in fresh fruit blocks where an average of 2 CRM/ cm² lens field = 43 percent infested lens fields is considered a threshold for fresh fruit. Process fruit can withstand much higher numbers.

The Florida Pest Management Guide recommends 20 sample sites per 10-acre block, four fruit per stop and one lens field per fruit. Fruit should be chosen in different parts of the canopy and from both swale and middle. Trends over time are often more informative than the counts themselves, so it is important to scout regularly and keep good records.

Rust mite natural enemies include predaceous “phytoseid” mites which are large, fast-moving and tear-drop shaped, and a tiny black ladybeetle called *Stethorus*. Rust mites are also attacked by the fungus *Hirsutella tompsoni* which produces fine mycelia spreading like a spider web from the dried-up carcass of the mite.

**SCALE INSECTS**

There are two main types of these largely immobile sucking insects: soft scales and armored scales. Soft scales are generally larger, produce honeydew, which is later colonized by sooty mold, and have the scale cover attached to the body. Younger stages tend to occur in the outer canopy, but use their limited mobility to migrate toward the inner canopy.

Armored scales produce no honeydew and have a scale cover that can be readily detached from the body. Females and immature males are totally immobile once settled, but males turn into gnat-like insects that search out the wingless females. Eggs of both scale types hatch under the mother to produce tiny legged crawlers that strike out on their own in search of a spot to settle.

Scale insects include the black scale *Sassatiara spp* that is a lighter color as a young nymph, but can be recognized in any stage by the raised “H” pattern on the back. They are most prevalent in young blocks, perhaps because this habitat is less favorable to the wasp *Sculistela cyania*. The maggot-like larva of this parasitoid can be found devouring eggs under the body of mature females, mostly on scaffold limbs in late winter and early spring.

Green scale (*Coccus viridis*) and brown scale (*C. hesperidum*) also produce copious honeydew and tend to cluster on the upper midrib, pedicels and small stems. They are attacked by parasitic wasps that turn the body black and ladybeetles, such as metallic blue ladybeetle *Curinus coerulescus* and the no-name ladybeetle, *Azya orbignya*.

The most common armored scale insects attacking citrus in our state include Florida red scale (*Chrysomphalus aonidum*), chaff scale (*Parlatoria pergandii*), purple scale (*Lepidosaphes beckii*) and snow scale (*Unasips citri*). All but the latter cause their most significant damage infesting fruit, although purple scale causes considerable dieback as well. Snow scale infests mostly trunks and scaffold limbs, although the related lesser snow scale *Pinnaspis strachani* extends farther out in the canopy. Both cause bark cracking and generally debilitation.

Armored scales are preyed upon by ladybeetles such as *Chilocus stigma* and *C. circumdatus*, the latter specializing on snow scales. However, parasitic wasps, especially *Aphytis* species, are chiefly responsible for controlling the other armored scale species, leaving round exit holes in the dorsum as evidence of their activity.
SPIDER MITES

Spider mites are considerably larger than rust mites, though smaller than the phytoseids that are their most voracious natural enemies. Spider mites move haltingly, usually over the top surface of the foliage upon which they feed to a greater depth than do rust mites, removing cell contents down to the mesophyll. The resulting injury is called “stippling,” though from a distance, it gives the foliage a gray, dull appearance.

Sufficient stress from feeding, often compounded by drought or cold, can lead to “mesophyll collapse” and leaf desiccation or “firing.” Drought conditions are also conducive to spider mite population growth.

Two species are common in Florida citrus, the citrus red mite, *Panonycus citri*, and the Texas citrus mite, *Eutetranychus banksi*. The former is a deep red color as an adult, with a few thick hairs protruding from thick tubercles scattered over the back. Eggs are round and shiny red, with a silk mast extending from the top to which are attached four slender “guy wires” of silk, attached preferentially to the upper leaf base.

The Texas mite tends toward a dull greenish color. Its eggs are button-like squat cylinders which are also found preferentially toward the center and base of the upper leaf surface amongst mites and refuse of cast skins and fecal material.

Dense webbing typical of other familiar species such as the two-spotted spider mite is not present with either of these citrus mites. Males tend to be somewhat oblong and have longer legs compared to the more oval females. A preponderance of nymphs and females is indicative of population on the rise whereas a preponderance of males purports imminent crash.

Spider mites can be scouted for simultaneously with rust mite monitoring, although action threshold levels for both pests will determine how many samples need be taken for a given level of accuracy. At each stop, sample one leaf from each quadrant of the tree. An average of five to 10 mites per leaf may indicate the need to treat, depending on conditions.

Population trends and weather patterns can help decide what threshold to use. A predominance of younger stages and females in dry weather coupled with drought stress could foretell imminent firing. Contrary conditions warrant greater tolerance coupled with continued vigilance.

WHAT ELSE TO WATCH OUT FOR?

**Young trees:**
- Orange dogs, fire ants, grasshoppers, aphids

**Fresh fruit:**
- Orchid thrips (grapefruit)

**Fresh and process fruit:**
- Grasshoppers, stinkbugs

And remember, footprints are the most important thing to put in your grove!

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