



Photos by D. Sprague

**Figure 1.** Citrus leafminers create larval mines on leaf undersides.

# Control methods for major pests of cold-hardy citrus

By Xavier Martini and Danielle Sprague

**C**old-hardy citrus, that is, citrus grown above the 30th parallel north, is a blooming industry. In less than 10 years, the acreage in North Florida has gone from almost nonexistent to approximately 1,000 acres. Growers in the region plan to plant more in the coming years. In Georgia, there are approximately 2,000 acres across 42 counties, involving over 100 growers with two commercial packing sheds.

Citrus grown in the cold-hardy region is primarily for fresh market fruit production. The overwhelming majority of plantings are Satsuma mandarins.

Fortunately for growers in this

region, the major pest and disease threatening citrus, the Asian citrus psyllid and citrus greening, have been geographically isolated. The majority of cases are in residential citrus plantings along the Gulf of Mexico and the Atlantic Coast (Martini et al., 2020). Although not present currently in commercial plantings, growers in the region should remain aware of the pest/disease complex and continue to monitor for psyllids and signs of citrus greening.

The main insect pests facing growers are citrus leafminers, as well as rust mites and scales that alter fruit appearance.

## CITRUS LEAFMINERS

The citrus leafminer (*Phyllocnistis citrella*) is a small white moth, about 2.4 millimeters in length. It is most easily detected during the larval stage by the serpentine larval mines (trails of feeding damage) on the underside of new leaves (Figure 1). The larvae feed on the new growth or flush of citrus, causing serpentine mines to form under the leaf cuticle. The feeding injury results in leaf curling and distortion.

As citrus is an emerging industry in North Florida, a significant number of plantings in this region are young, non-bearing trees. This stage is particularly sensitive to leafminer injury, as young trees produce more flush than bearing trees. Leafminer infestations can significantly impact growth and delay tree maturity if not controlled.

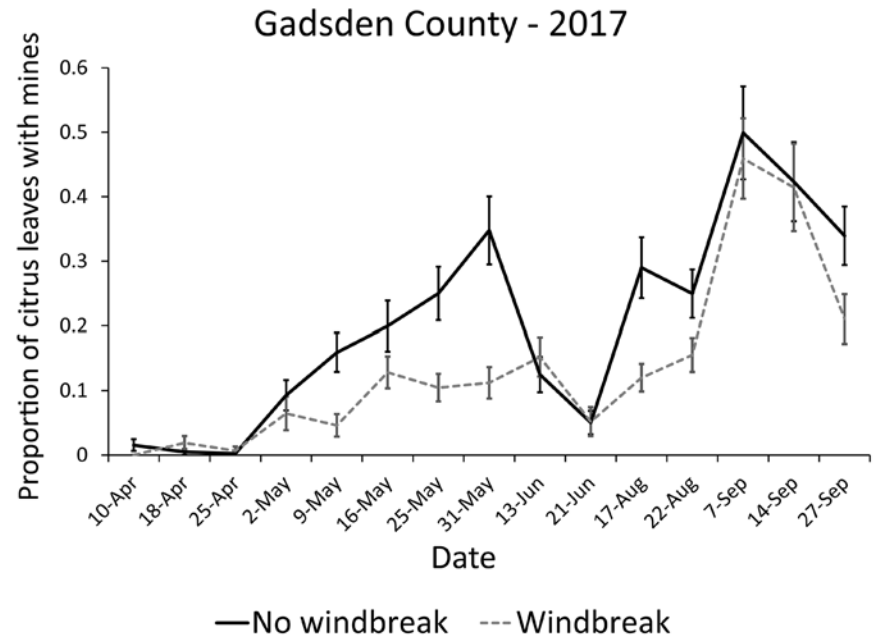
Another threat is that the leaf mines provide an opening for citrus canker. In areas with citrus canker, control of citrus leafminer becomes more critical.

For young (less than 4 years old), non-bearing citrus trees, the most effective means of preventing leafminer damage is the use of

soil-drench insecticide applications. Soil-drench applications have limited effect on natural enemies and provide the longest-lasting control of citrus leafminer.

Currently, there are three Insecticide Resistance Action Committee (IRAC) group 4A mode of action neonicotinoid insecticides (clothianidin, imidacloprid and thiamethoxam) and one IRAC group 28 mode of action insecticide (cyantraniliprole) labeled for soil applications. It is important to note that all the neonicotinoids share the same mode of action. Repeated exposure to the same mode of action can result in the development of insecticide resistance.

Soil applications should be made two weeks prior to flushing to allow time for the insecticide to move from the roots into the canopy. To avoid leaching of insecticide away from the root zone, time soil applications to avoid rain events within a 24-hour period. With increasing concerns about potential effects of neonicotinoids on pollinators, be sure to make applications to young trees after bloom and avoid



**Figure 2.** Combined data from three different fields in Gadsden County shows the proportion of leaves with mines on the edge of citrus groves, with the presence or absence of windbreaks.

spraying surrounding weeds that may have a different flowering time.

Soil applications of neonicotinoids are not effective on mature citrus trees, so the only products labeled for use on mature trees are foliar sprays.

Refer to the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) 2020–2021 Florida Citrus Production Guide for a full list of labeled insecticides.

Foliar applications should be timed

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**Figure 3.** Rust mite feeding can result in sharkskin damage.

with the appearance of the first visible leaf mines. Foliar applications provide a shorter duration of protection, so timing is critical for optimal control. To kill the maximum number of leafminers, foliar sprays should be applied when

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the flush is about halfway expanded. It is not recommended to spray neonicotinoids if a soil application already has been made. Be sure to read the label and follow all the directions.

For organic growers or those who wish to reduce the use of insecticides to control citrus leafminer, pheromone-based mating disruption is now an option. Pheromone disruption consists of releasing a high quantity of the citrus leafminer's sex pheromone to reduce mating between male and female. A reduction in mating results in a reduction of fertilized eggs and resultant damaging larvae.

An attract-and-kill system has also been developed and proven to be effective. This system combines a pheromone attractant with an insecticide within a device that concentrates the toxicant into a small point source and thus reduces the rate of active ingredient per area of crop.

Other control practices include removing the suckers from below the graft union that can serve as a host for leafminers. Additionally, data shows that the presence of a windbreak slightly reduced the number of mines on the edge of the grove, especially during spring and summer (Figure 2, page 21).

## RUST MITES

Since the majority of citrus grown in the region is marketed as

fresh fruit, rust mites are of particular importance. The citrus rust mite (*Phyllocoptura oleivora*) and the pink citrus rust mite (*Aculops pelekassi*) are the two species present in Florida. Both are microscopic and only observable with a 10x lens.

Rust mite damage to fruit includes sharkskin and bronzing. Sharkskin is the damage that occurs when feeding by rust mites is before fruit maturity. The epidermal cells are destroyed, resulting in smaller fruit. As the fruit grows, the epidermal layer fractures, causing a form of russetting known as sharkskin (Figure 3). Bronzing damage, on the other hand, occurs when mites feed on mature fruit but do not destroy the epidermal layer, resulting in a polished look. Damage from rust mites does not alter the taste of fruit but can significantly reduce grade and marketability.

Scouting for mites at the beginning of the fruiting stage is recommended to avoid problems during the formation of the fruit. Begin scouting leaves and fruit in early April and continue to monitor every 10 to 14 days throughout the fruit season. When damage is apparent, it is often too late to provide a significant reduction with treatment. An action threshold of two rust mites/cm<sup>2</sup> per fruit is set for fresh fruit production. There are several different miticides labeled to control rust mites. For a list, refer to the UF/IFAS 2020–2021 Florida Citrus Production Guide.

## SCALES

The two scales of concern in North Florida are the cottony cushion scale (*Icerya purchasi*) and the Florida red scale (*Chrysomphalus aonidum*). While cottony cushion scale can invade and damage the whole tree including fruit, red scales are mostly an issue on fresh fruit where their presence decreases the marketability of the product.

Most of the time, scales are controlled quite well by natural enemy populations. For cottony cushion scale, this includes lady beetles. The vedalia beetle (*Rodolia cardinalis*) is the most efficient beetle against cottony cushion scale and has recently been found in North Florida, although it remains scarce. The dominant lady beetle species found in North Florida citrus groves is the Asian lady beetle (*Harmonia axyridis*), which is a predator of cottony cushion scale.

Scales are difficult to control during their adult stage as they are protected against insecticide penetration by their protective cover. The better time to control scales with chemical application is during the stage of mobile first instar larvae, known as crawlers. The presence of crawlers can be monitored by placing double-sided tape around the branch of a tree. Outside the crawling period, application of 2 percent horticultural oil has shown some efficacy in reducing the number of scales.

## CONCLUSION

North Florida is the only region in the state where commercial groves are still relatively free of Asian citrus psyllids and citrus greening. However, growers should be aware and continue to monitor for the presence of psyllids and greening.

While psyllids are not common in North Florida commercial groves, growers still face other insect pest challenges and have lower action thresholds as the fruit is destined for the fresh market and must look perfect. Therefore, some pests that are of less concern in Central Florida are of high importance in North Florida. 🍊

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