Figure 1. Adult male citrus leafminer

Photo by Denis Willett, Agricultural Research Service

Traditional and alternative leafminer control methods

By Lukasz Stelinski

The citrus leafminer (CLM) remains a major pest of citrus throughout Florida. The adults are small, white/silver-colored moths about half the size of a typical mosquito (Figure 1). Adults are difficult to spot due to their small size and because they are active only in the evening (dusk) and early pre-dawn hours.

CLM adults can be monitored with sticky traps baited with commercially available pheromone lures. In this case, only male moths are captured because the lures contain the female-produced sex-attractant. This is an important part of the biology of this insect. Females release a very specific, long-range pheromone that allows the males to locate the females in the dark for mating.

After mating, females deposit eggs on young leaves, the most susceptible stage for infestation. The emerging larvae burrow into the leaves and feed and develop within galleries just beneath the leaf surface. This is the stage of the leafminer that is typically most visible. Unfortunately, this also is the stage when the damage is already taking place or has already been done. The damage can stunt growth of young trees.

It has been well documented that leaf wounding caused by CLM renders leaves more susceptible to infection with citrus bacterial canker. Essentially, the leaf mine is an open wound that can be readily colonized by the bacteria. The larvae eventually form pupae within the leaves. Following metamorphosis, new adults emerge to restart the cycle.

INSECTICIDAL CONTROL

Insecticides that kill larvae are currently the most important tools for control of this pest. The early larval stage is the most susceptible and best target to avoid injury as larvae emerge from the egg and begin to feed on flush. Young trees are often the most susceptible to CLM damage because they produce young flush frequently.

Soil applications of neonicotinoid insecticides (e.g., Admire Pro, Platinum 75SG or Belay 2.13 SC) can provide multiweek control of CLM in non-bearing trees. An application should be made up to two weeks prior to a leaf flush to allow lethal concentrations of insecticide to accumulate in the foliage and to control Asian citrus psyllid (ACP).

It is important to remember that

all neonicotinoid insecticides share the same mode of action, so back-to-back applications of these insecticides may hasten development of insecticide resistance in both CLM and ACP, which must be avoided. Foliar applications of neonicotinoids will also exacerbate resistance if applied back-to-back with soil applications and are generally less effective than soil applications. Insecticides recommended for leafminer control can be found on pages 121–124 in the 2020–2021 Florida Citrus Pest Management Guide.

Proper timing of foliar sprays to coincide with flushing cycles is critical to optimize CLM management. The goal is to kill larvae as soon as they begin mining. Although broad-spectrum insecticides targeting ACP adults may kill adult CLM, typically populations rebound in groves soon after foliar sprays of organophosphate or pyrethroid insecticides. Populations may even increase under intense ACP management due to suppression of natural enemies.

Applications of foliar insecticides should be made during a window when CLM larvae hatch and begin feeding to maximize larval kill. In general, the earliest applications should occur between 13 and 30 days after budbreak. The duration of control may be shorter if a heavy flush occurs soon after the foliar application. It may be advantageous to target spring flush, even though CLM damage is not evident, to prevent buildup of populations that will cause damage later in the year.

ATTRACT-AND-KILL

As the name implies, the attract-and-kill tactic combines a potent attractant with a lethal toxicant into a single formulation. It is applied to the crop as discrete point sources to manage pests.

Pheromones are ideal types of attractants for such formulations. Pheromones are species-specific and will not affect non-target organisms; are highly potent, attracting male moths from hundreds of yards away; and they exploit a critical behavior for the survival of the species — mate finding prior to reproduction.

An attract-and-kill formulation called MalEx CLM from Alpha Scents Inc. is commercially available and

registered for use in Florida against citrus leafminer. The formulation has been tested in Florida and shown to provide roughly equivalent activity to standard insecticide applications against this pest, when applied at the label rate and reapplied every three weeks (Figure 2).

The advantages of attract-and-kill are that there are no insecticide residues left on fruit, no effects on non-target organisms or beneficials, no re-entry or preharvest intervals, and no concerns about drift of the applied material. The species-specific nature of the attractant can be viewed as both an advantage (no harm to biological control agents or bees) or disadvantage (no effect on other pest species such as psyllids or mealybugs).

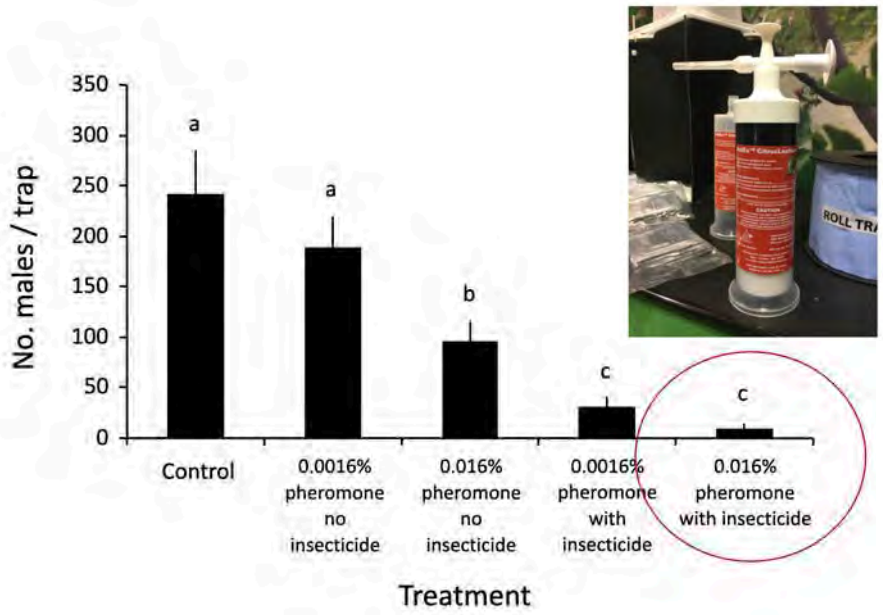

Figure 2. Applications of the MalEx attract-and-kill formulation were made every three to four weeks for citrus leafminer control.

MATING DISRUPTION

Another alternative management tactic for CLM that incorporates the pheromone that some growers have tried in Florida is the mating disruption technique. This is a method by which large quantities of the leafminer's pheromone are released into the crop, which interferes with the males' ability to find females. The idea is to disrupt the males so they cannot find females, leaving females unmated. This protects the crop from infestation by the larvae because no viable eggs are laid within the treated area.

Triangular "delta" traps baited with pheromone are typically used to monitor effectiveness of mating disruption. If few or no male moths come to the traps, it is assumed that mating is being disrupted.

This technology was investigated

in Florida for nearly a decade. Most recently, a product called DCEPT™ was produced by ISCA Technologies. This dispenser of pheromone is hand-applied onto branches of citrus trees and has been commercially available. This technology removes the need for a mechanical applicator, but the acreage that can be treated by hand is limited by the availability of labor.

In Florida citrus, annual treatment with this product at one point reached approximately 4,000 acres. There were cases of success where control was achieved without insecticide applications, and cases where protection required supplemental use of insecticides. Therefore, the product was not a consistent replacement for insecticides, despite 14 to 20 weeks of potential protection. As has been observed with other pests in other crops, mating disruption against the CLM works best when treatment is applied to large contiguous areas.

CONCLUSIONS

Traditional insecticide treatments remain the main tools for managing CLM. Many are highly effective. Systemic insecticides for young tree protection are especially effective and generally have a longer duration of efficacy than foliar-applied larvicides. Foliar applications must be made to flush in a timely manner to achieve adequate control. One may expect the possibility of two to four weeks of control with a foliar larvicide or up to six to eight weeks of control with a soil-applied neonicotinoid or Cyazypyr. Length of control depends on application timing, tree size and weather conditions.

Alternative methods that exploit the pheromone of CLM exist. These alternatives may in some cases cost more than traditional insecticides and require application by hand. However, the benefits some growers in Florida have observed, including long-lasting efficacy with mating disruption and no impact on beneficial organisms, are considerations when planning an annual management program for CLM.

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