Leafminer control update

By Lukasz Stelinski and Stephen Lapointe

The citrus leafminer has become 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). The adults are difficult to spot because of their small size and because they are active only in the evening (dusk) and early pre-dawn hours.

The 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.

Figure 1. *Adult male citrus leafminer*
Photo by Dennis Willett, USDA-ARS

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 and unfortunately, this is the stage when the damage is already taking place or has already been done.

The damage can stunt growth of young trees, and it has been well documented that leaf wounding caused by citrus leafminer 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, and following metamorphosis, new adults emerge to restart the cycle.

Insecticides remain the most important tools for control of this pest. The majority of current insecticides that specifically target the leafminer are designed to affect the early larval stage as it emerges from the egg and begins to feed. These insecticides can be toxic to the mining larvae or prevent their normal feeding and growth, killing them through starvation or by preventing normal development.

For non-bearing young trees, soil applications of neonicotinoid insecticides (e.g., Admire Pro, Platinum 75SG or Belay 50 WDG) will provide multi-week, simultaneous control

of citrus leafminer and Asian citrus psyllid. However, 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 pests.

RECOMMENDED INSECTICIDES AND TIMING

Insecticides recommended for leafminer control can be found in the 2013 Florida Citrus Pest Management Guide. In addition to neonicotinoids, there are larvacides that kill leafminers by preventing normal development. For example, 8 ounces per acre of Intrepid 2F + 2% v/v (volume to volume) horticultural spray oil (435) is effective against larvae.

Proper timing of foliar sprays to coincide with flushing cycles is critical to optimize leafminer management. The goal is to kill the larvae as soon as they begin mining. Although broad-spectrum insecticides targeting Asian citrus psyllid adults may reduce populations of adult leafminers, our experience indicates that leafminer populations remain abundant in groves and even increase under intense psyllid management. This may be due to removal of the leafminer's natural enemies by frequent sprays for psyllid control under HLB conditions.

To maximize kill of leafminer larvae with foliar larvacides, applications should be made during a window when leafminer larvae hatch and begin feeding. Applications can be timed relative to budbreak of new flush. 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. Soil-applied systemics on young trees should be applied up to two weeks prior to a leaf flush in order to allow lethal concentrations of insecticide to accumulate in the foliage.

There are opportunities for combining control of citrus leafminer with that of other pests. Well-timed summer applications of Agri-Mek or Micromite can be useful to manage citrus rust mite and leafminer populations. Some newly registered insecticides for use in Florida citrus are mixtures of two modes of action that allow for simultaneous leafminer and psyllid control. Agri-Flex combines the active ingredient of Agri-Mek with that of Actara (a neonicotinoid) in a single formulation to target leafminer larvae and psyllid nymphs and adults. Bear in mind that any consecutive application

of an insecticide employing the same mode of action, whether it is a single or dual mode of action, increases the probability of insecticide resistance developing in the target pests. Fortunately, there is at least one new insecticide on the horizon. Cyazypyr from Dupont Crop Protection, highly effective against citrus leafminer and psyllids, should be registered for use in Florida soon.

SPLAT

Recently, some growers have also begun to use the mating disruption technique for managing citrus leafminer in Florida. 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 can't find females, leaving females unmated and thus protecting the crop from infestation by the larvae because no viable eggs are laid within the treated area.

We have been conducting research and development (R&D) on this technology for the past several years. As frequently occurs in R&D, we are often at the mercy of events beyond our control. While this might seem like an obstacle to progress, it is often the unforeseen challenges that move a project forward. This has certainly been true in the development of SPLAT CLM™, a new product from ISCA Technologies Inc. that delivers the sex pheromone of the citrus leafminer in a slow-release matrix.

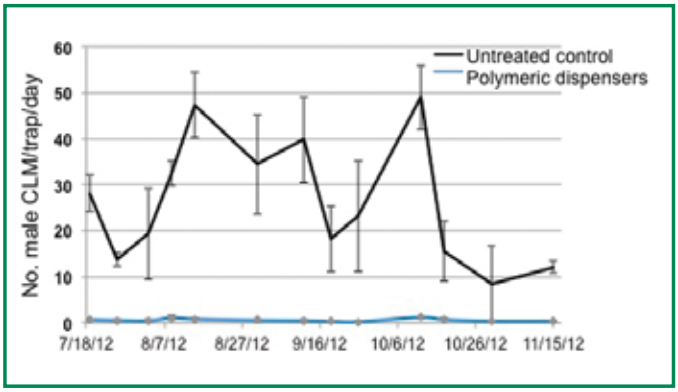

Figure 2. *The number of male citrus leafminer (CLM) moths captured in traps baited with the complete CLM sex pheromone in untreated plots and plots where every tree received a polymeric solid dispenser of the triene component of the sex pheromone. This measure of trap catch disruption is used to estimate the degree of mating disruption occurring in treated plots.*

During 2012 field trials, it became evident that a component of the most recent formulation of SPLAT was interfering with the chemical stability of the pheromone, resulting in reduced longevity of the product in the field as compared with what we were observing in the initial years of R&D with this technology.

Reacting to this unexpected problem, our collaborative research team in Florida and staff at ISCA immediately developed an alternative delivery device that consists of a polymeric solid dispenser formulated with citrus leafminer sex pheromone. These were deployed in July by hand at two sites in St. Lucie and Charlotte counties with impressive results. Greater than 95 percent trap catch disruption (an indirect measure of mating disruption) was achieved for 17 weeks (Figure 2).

The knowledge gained in 2012 has resulted in the announcement of DCEPT™, a new product from ISCA. This new solid dispenser is designed to be placed by hand on branches of citrus trees and should be available soon. This removes the need for a mechanical applicator, but limits the acreage that can be treated by hand to the availability of labor. On the positive side, the DCEPT dispenser allows for positive and precise placement, less waste and superior longevity compared with SPLAT CLM.

We feel there is still a need to develop a capability to deliver the pheromone to large groves and, to that end, a new formulation of SPLAT CLM that eliminates the problem of pheromone degradation is being developed for testing in the field this year alongside the DCEPT dispensers.

An ongoing discussion among citrus leafminer researchers has involved the question of whether the "natural" blend of leafminer pheromone or a partial blend provides the best disruption of mating and control of mining. Last year, polymeric solid dispensers containing either the natural 3:1 blend of the two major pheromone components of the citrus leafminer (a triene and a diene) or the triene component only were compared at a site in St. Lucie County. To our satisfaction, this experiment confirmed previous results that suggested the triene component by itself provides the best disruption of pheromone communication for this pest, resulting in a better and less expensive product.

Additional experiments conducted in 2011 and 2012 suggest that it may not be necessary to treat every row in a grove with pheromone to achieve disruption across the entire area. Skipping rows and leaving coverage gaps within a treated grove can achieve significant savings in the cost of the pheromone product. The exact ratio and pattern of treated to untreated rows will be the subject of field trials to be carried out during this year.

Lukasz Stelinski is an assistant professor of entomology at the Citrus Research and Education Center in Lake Alfred; Stephen Lapointe is a research entomologist at the U.S. Horticultural Research Laboratory at Fort Pierce.