

Leafminer control update

By Lukasz Stelinski

The citrus leafminer (CLM) has become a major problem for many Florida citrus growers over the past few years. Many factors influence annual leafminer population density, including weather and grove management practices. The abundance of citrus leafminer is closely tied to the availability of young, flushing foliage needed for development of the larval stage.

Adult females will typically lay their eggs on leaves that are less than half an inch in length. Generally, the incidence and intensity of leaf mines greatly increase during late spring and early summer flush, and can begin to peak anytime between early June to late July. Given that adult leafminers overwinter without significant resources for egg-laying, cultural practices or weather events that pro-

mote off-season flushing can increase populations of citrus leafminer.

Leafminer damage typically occurs on leaves and can be observed on young, tender shoots as well. Only rarely will leafminer form mines on fruit. Another small moth species, called the citrus pealminer, is more typically found mining within the fruit peel. Citrus pealminer does occur in Florida and current insecticide-based management tools should work equivalently for both pests simultaneously.

Heavy infestations of leafminer can stunt growth of young trees. In limes, it has been demonstrated that heavy infestations can have a negative impact on fruit production.

CLM AND CANKER


In addition to this direct damage, wounding of the leaf tissue caused by larval mining facilitates the spread of citrus canker. A recent study published in the December 2010 issue of *Florida Entomologist* by scientists from the




Citrus leafminer on foliage

USDA-ARS lab in Fort Pierce clearly demonstrated that leafminer damage increases incidence and intensity of citrus canker lesions in Florida. Also, leafminer control on five varieties of young citrus trees using soil-applied imidacloprid reduced incidence and severity of canker. Another field study conducted in a block of young bearing Valencia showed similar results with an imidacloprid drench. Sprays every three weeks with an insecticide rotation provided the same level of CLM control, but did not exert a significant effect on canker. This result would indicate that the protective action of imidacloprid against canker is not solely due to CLM suppression.

Biological control of leafminer can be highly effective. In Florida, there were native biological control agents that attacked citrus leafminer after its introduction in 1993, and other natural enemies were introduced, such as *Agelaius citricola*. The complex of natural enemies attacking leafminer in Florida, including ants and spiders, can cause up to 90 percent mortality of leafminer larvae and pupae. However, it is possible that intense use of insecticides for control of Asian citrus psyllid may have led to increases in leafminer populations in recent years, as these biological control agents are also susceptible to and killed off by insecticides applied against the psyllid. Although this is yet to be documented experimentally for the current leafminer situation in Florida, outbreaks of secondary pests are known to occur in situations where heavy insecticide use is implemented to control a primary pest. Unfortunately, given the differing biology and habits of citrus leafminer and Asian citrus psyllid, not all insecticide applications directed at the psyllid will have much effect on leafminer. However, a number of available tools that have multi-pest activity are available for



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Table 1. Selected available insecticides for citrus leafminer control

Insecticide	Rate/Acre	Application Method	Impacts on other pests
Agri-Mek 0.15 EC + oil	5 oz. + min 1 gal oil	Foliar	Asian citrus psyllid immature stages Aphid immatures Citrus rust mites
Micromite 80WGS + oil	6.25 oz. + 2% v/v*	Foliar	Asian citrus psyllid immature stages Citrus rust mites Root weevils
Delegate WG + oil	6 oz. + 2% v/v*	Foliar	Asian citrus psyllid adults and immatures
Admire Pro	7-14 oz.	Soil-applied systemic	Asian citrus psyllid adults and immatures
Platinum 75SG	1.8-3.7 oz.	Soil-applied systemic	Asian citrus psyllid adults and immatures
Intrepid 2F + oil	8 oz. + 2% v/v*	Foliar	

* volume/volume

leafminer management (Table 1). For a more complete list and description of currently recommended insecticides for leafminer control, please see the 2011 Florida Citrus Pest Management Guide (<http://edis.ifas.ufl.edu/in686>).

As shown in Table 1, there are a number of possible options for multi-pest control with leafminer. For non-bearing small trees, soil applications of either of the neonicotinoid insecticides (Admire Pro or Platinum 75SG) will provide multi-week simultaneous control of citrus leafminer and Asian citrus psyllid. However, it is important to remember that these two different insecticide formulations share the same mode of action. Therefore, foliar sprays of neonicotinoids such as Provado or Actara should be avoided where the same active ingredients are

being used as soil drenches because this would hasten development of resistance to these important tools.

Certain other insecticides shown in Table 1 that are effective against larval leafminer will also have some impact on immature stages of the psyllid or other pests. For example, well-timed applications of Agri-Mek or Micromite during the summer can be useful in simultaneously managing citrus rust mite and leafminer populations. Also, some newly registered products for use in Florida citrus are mixtures of two insecticide modes of action that also allow for simultaneous leafminer and psyllid control. For example, Agri-Flex combines the active ingredient of Agri-Mek with the active ingredient of Actara (a neonicotinoid) into a single formulation. Therefore, this product

will simultaneously kill both leafminer larvae and psyllid nymphs and adults. However, it is again important to carefully consider appropriate rotation of pesticide modes of action when using these new multi-mode-of-action formulations. Specifically, successive applications of the same mode of action, whether it is in a single or multi-mode-of-action formulation, should be avoided. Whether citrus leafminer populations in Florida currently exhibit any level of pesticide resistance is an open question that is being investigated. IFAS researchers at the Citrus Research and Education Center at Lake Alfred have conducted some baseline investigations in 2010 and plan to continue monitoring insecticide susceptibility levels in citrus leafminer populations in Florida over the next several years to answer this important question.

TIMING

Effective timing of pesticide application is critical to optimize leafminer management. Given that the recommended insecticides for leafminer control are larvacides, it is important to time them appropriately with flushing cycles. Although some insecticides targeting psyllid adults will have some impact on populations of adult leafminers as well, it is apparent from experience over the past several years that leafminer populations can remain abundant in groves and even increase where intense psyllid management is practiced.

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 be made around 13 days after budbreak, and the very latest applications should be approximately 30 days after budbreak. The duration of control will likely be compromised and last a much shorter interval if a heavy flush occurs soon after the foliar application is made. Soil-applied systemic insecticides can be applied up to two weeks prior to a leaf flush because it takes time for lethal concentrations of the insecticide to build up within the tree.

PHEROMONE ALTERNATIVE

IFAS researchers in Lake Alfred have been collaborating with USDA-ARS researchers in Fort Pierce over the past few years to develop pheromone-based insecticide alternatives for citrus leafminer control. These control techniques either disrupt the

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mating behavior of leafminer adults, preventing egg-laying, or attract males to kill stations, removing them from the population with minute amounts of insecticide per acre. One formulation for mating disruption of citrus leafminer has been registered for use in Florida citrus, and it is called SPLAT-CLM. It is manufactured and distributed by ISCA Technologies, which also sells pheromone traps for monitoring citrus leafminer.

There are several hurdles currently that must be overcome before mating disruption can become an economically viable tool for control of the citrus leafminer. First, the active ingredient is very expensive, and thus the currently produced formulation is more costly than standard insecticides.

Research is under way to develop a cheaper way to synthesize the pheromone to make the formulation cost-competitive with current insecticides. Also, development of an effective technology for better large-scale application of this formulation is needed. A collaboration between International Fly Masters Inc., USDA-ARS, and IFAS has led to the development of a prototype device that will be further tested in 2011, although 2010 results were promising.

There are several advantages to using pheromone-based mating disruption to control citrus leafminer:

- 1) it has no negative impact on biological control,
- 2) it has no negative impact on the environment, and
- 3) it prevents mating, thus controlling the pest before it damages the leaf.

However, one of the main attributes of the technology (pest specificity) is also its main Achilles' heel. Given the pest specificity, it has no impact on other pests such as Asian citrus psyllid. Given the need for management of the psyllid and greening, investment in a tool specific to leafminer may not yet be economically attractive. Although many recent tests conducted by IFAS and USDA-ARS researchers in a collaborative effort have shown promising results, ramping up scale of production did result in sub-optimal formulations along the way, and we've needed to get several "bugs" out. Ultimately, the potential large-scale use of this pesticide alternative technology will depend on whether the companies that are currently developing these formulations can bring cost-effective products to the market.

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Florida Citrus Mutual Busy in D.C.



By Michael W. Sparks

Florida Citrus Mutual recently completed a very successful fly-in to Washington, D.C., where growers were able to meet with members of Florida's congressional delegation to talk about citrus issues. This was nuts-and-bolts lobbying at its best. Let me give you a rundown of a handful of the initiatives we discussed and Mutual's position on them.

National Citrus Research Trust Fund: U.S. Sen. Bill Nelson and a coalition of senators from citrus-producing states are putting forth legislation whereby a portion of the duties collected on imported citrus products would be directed into a Citrus Research Trust Fund to finance invasive pest and disease research. *FCM Position: We actively support this legislation.*

Citrus Health Response Program (CHRP): For fiscal year 2012, it will be very important to maintain the current funding levels for this program. Florida's CHRP activities total nearly \$20.0 million and include multiple pest surveys and regulatory efforts to contain pest and diseases. *FCM Position: We support maintaining the current funding level.*

Immigration Reform/H-2A: Mutual believes immigration reform is a FEDERAL issue and Congress must create an effective guest-worker program that brings workers in, keeps track of them while they are here and then sends them home when the season is over. *FCM Position: We have not taken an official position on federal legislation, but have identified improvements to the existing H-2A program.*

USDA-ARS ACP/HLB Research Funding: Fiscal year 2012 will be a trying year for earmarks to fund Florida's citrus research labs; however, FCM will again seek financial support. *FCM Position: We support maintaining the current funding level.*

Support of Market Access Promotion Funds: The Florida Department of Citrus utilizes funds from the USDA/IFAS Market Access Promotion (MAP) Program to supplement its international marketing programs. Last year the FDOC received \$5.2 million. *FCM Position: We support maintaining the current funding level.*

Tariff/Dumping: The Federal tariff on imported citrus products is a vital part in maintaining the viability of the domestic citrus industry. In addition, FCM has always monitored potential orange juice dumping to ensure foreign exports are following U.S. trade law. *FCM Position: Protect the citrus tariff at all costs and pursue anti-dumping suits to enforce the regulations of the U.S. trade law.*

Federal lobbying by educating elected officials about citrus is a big part of what we do at Mutual. Through constant and clear communication, our industry is having a profound impact on the Hill. Please do not hesitate to contact me if you have any questions or concerns.

Michael W. Sparks is the Executive Vice President/CEO of Florida Citrus Mutual, the state's largest citrus grower organization.



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