Management of Asian citrus psyllid in organic citrus groves

By Jawwad A. Qureshi, Azhar A. Khan, Moneen Jones and Philip A. Stansly

Figure 1. *Lady beetles capable of feeding on ACP and reducing its population*

WHAT IS "ORGANIC PRODUCTION?"

In principle, "organically grown" food is food grown and processed using no synthetic fertilizers or pesticides. However, there are numerous exceptions. In the United States, the National Standards on Organic Agricultural Production and Handling (NOP rule) issued on Dec. 21, 2000 by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service requires that agricultural products labeled as organic originate from farms or handling operations certified by a state or private agency that has been accredited by USDA. Certification generally takes three years of conformance to the NOP rule. The Organic Materials Review Institute (OMRI) provides an independent review of products intended for use in certified organic production, handling and processing. See https://www.omri.org/omri-lists for a list of approved products.

ASIAN CITRUS PSYLLID AND HUANGLONGBING

The Asian citrus psyllid (ACP) is the vector of huanglongbing (HLB) or citrus greening disease, which has spread throughout Florida and is now in Louisiana, Texas and California. Management of this vector-disease complex in all habitats is critical to prolonging the life of citrus trees and sustaining production.

Biological control, either by conservation or augmentation, can help to reduce vector populations and ultimately reduce the spread of HLB. However, experience in Florida has shown that biological control alone was not sufficient to prevent the disease from spreading. Therefore, insecticidal control of the ACP is recommended in commercial citrus to reduce incidence and severity of HLB.

How then will it be possible to manage ACP and thus HLB in organic groves? Unfortunately, there is too little information available to provide a good answer to this question. All we can do now is recommend some tools available to the organic grower.

BIOLOGICAL CONTROL

Predaceous insects, particularly the lady beetles *Olla v-nigrum*, *Curinus coeruleus*, *Harmonia axyridis* and *Cycloneda sanguinea* (Figure 1), have been observed to impose a 5- to 27-fold reduction in psyllid populations in southwest Florida commercial citrus. While these specific species are not presently available commercially, others that also feed on psyllids — like *Hippodamia convergens* and *Adalia bipunctata* — are available for purchase (Figure 1). Additional biological control agents — such as lacewings and the predaceous mite *Amblyseius swirskii* (Figure 2, page 8) — that feed

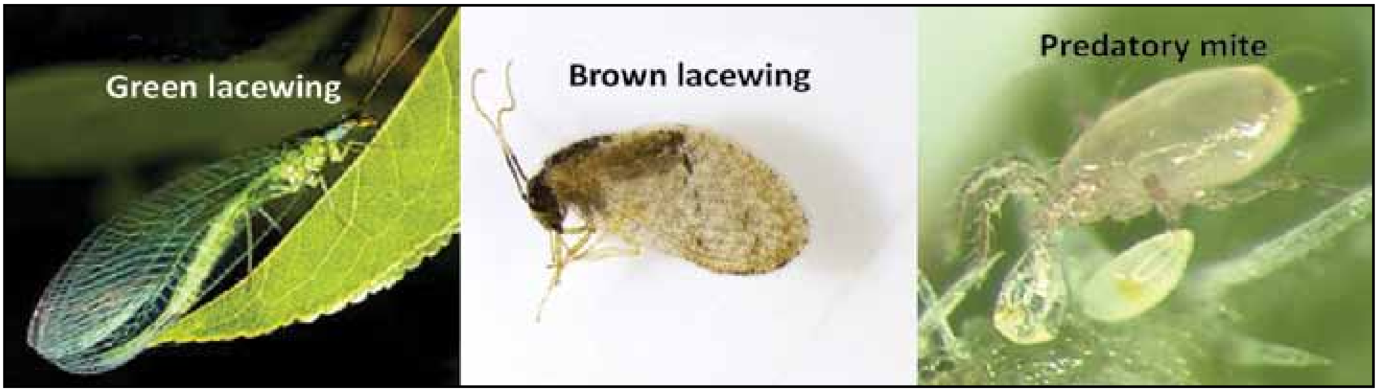

Figure 2. *Lacewings and the predatory mite, Amblyseius swirskii, are all commercially available and feed on ACP with potential to reduce its population.*

on ACP are also available. Finally, the parasitic wasp, *Tamarixia radiata* (Figure 3), established in Florida since 2001, will soon be produced in a new facility in Dundee constructed by the Florida Department of Agriculture and Consumer Services's Division of Plant Industry. California is starting a similar program. Release of these biological control agents to control ACP may augment the effect of natural enemies already present, although the effectiveness of such programs is still relatively untested.

Figure 3. *The parasitic wasp, Tamarixia radiata, is being mass produced and released to control ACP in Florida, California and Texas.*

ORGANIC INSECTICIDES

We have done some limited testing of OMRI-approved insecticides against ACP, and there is some information available in the literature (Table 1). In the laboratory, cumulative mortality of adults with insecticidal soap M-Pede® and dish-washing detergent Dawn 2% v/v (not OMRI approved; v/v is the rate of product [percent] in the application volume) averaged 91 percent and 93 percent, respectively, within 72 hours after application (Figure 4, page 10). Organic JMS Stylet Oil® alone killed 80 percent of adults whereas the combination of M-Pede® + Organic JMS Stylet Oil® provided 97 percent mortality, which was better than either product alone. Entrust® (spinosad) provided 87 percent mortality accumulated over 72 hours. Microthiol 80 DF® and Aza-Direct® provided only up to 25 percent adult mortality through 72 hours.

Effects of all products were more pronounced against nymphs. Another OMRI-approved product, Sucrose octanoate — a synthetic analog of natural sugar esters found in leaf trichomes of wild tobacco, *Nicotiana gossei* Domin — was evaluated against ACP at the USDA-Agricultural Research Service U.S. Horticultural Research Laboratory in Fort Pierce. More than 90 percent of nymphs and adults were controlled when treated with spray solution containing 2 percent formulated product in the lab and field.

Under field conditions, we observed significant reduction of nymphs and adults of ACP for up to 24 days using Grandevo® applied with Hyper-Active or FL 435-66 oil (Figure 5, page 10). FL 435-66 oil by itself, Sil-Matrix and M-Pede + Addit (a vegetable oil adjuvant) suppressed ACP for 10 to 17 days. Effects of sprays are generally more marked and longer lasting on adults than on nymphs. This may be because eggs and young nymphs inside

Table 1. The Organic Materials Review Institute (OMRI)-approved products tested against ACP under laboratory or field evaluations.

OMRI Approved Products Tested					
Pesticide Group	**Active Ingredient**	**Product**	**Lab Tested[1] (Product/liter H_2O)**	**Field Tested[2] (oz./acre) or %v/v******	
				Low	**High**
Horticultural Mineral Oil	Petroleum based oil	FL 435-66	x	2%	3%
		Organic JMS Stylet oil®	20 ml	x	x
Plant Extracts	Neem extract	Aza-Direct®	2.4 ml	8	8
Soap	Potassium salts of fatty acids	M-Pede®*	20 ml	2%	2%
Mineral products	Sulfur	Microthiol 80 DF®	11.8 g	x	x
	Potassium silicate	Sil-Matrix®	x	128	128
Bacterial cultures or extracts	Spinosad	Entrust®	1.2 g	x	x
	Chromobacterium substugae	Grandevo®**	x	32	256
Others	Sucrose octanoate***	SucraShield	x	0.4%	2%

x = not evaluated in lab or field
** Tested with vegetable oil Addit (1.5%) in the field*
*** Tested with hyperactive (0.125%) and FL 435-66 oil (2%)*
**** McKenzie CL, Puterka GJ. 2004. Effect of sucrose octanoate on survival of nymphal and adult Diaphorina citri (Homoptera: Psyllidae). J Econ. Entomol. 97(3): 970-975*
***** v/v is the rate of product (percent) in the application volume.*
[1]Results in Fig. 4, page 10
[2]Results in Fig. 5, page 10

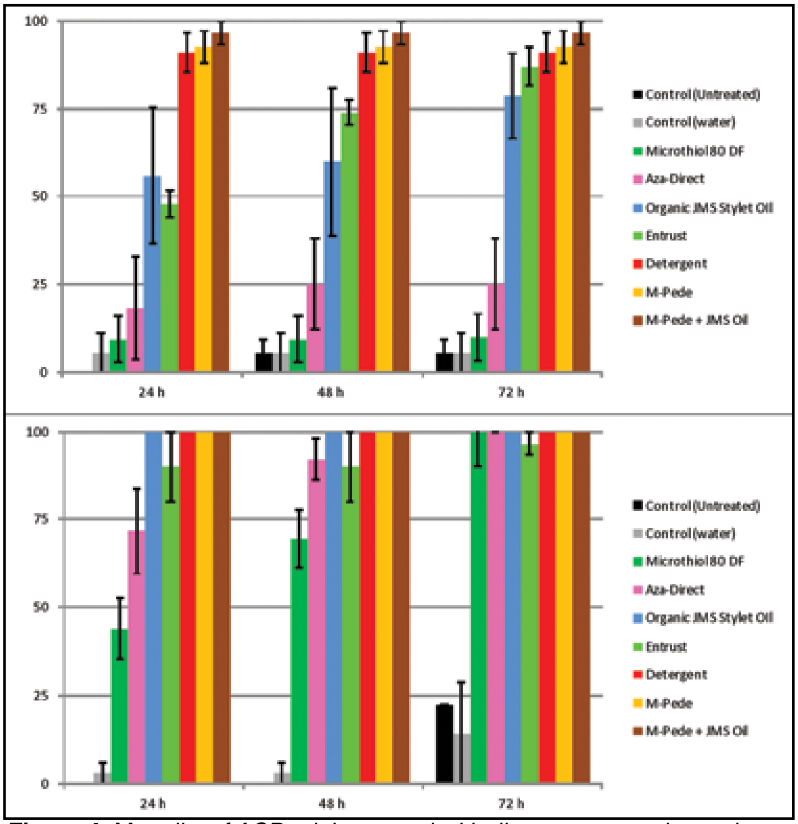

Figure 4. *Mortality of ACP adults treated with direct sprays and nymphs dipped in solutions of insecticides at 24, 48 and 72 hours after exposure in the laboratory*

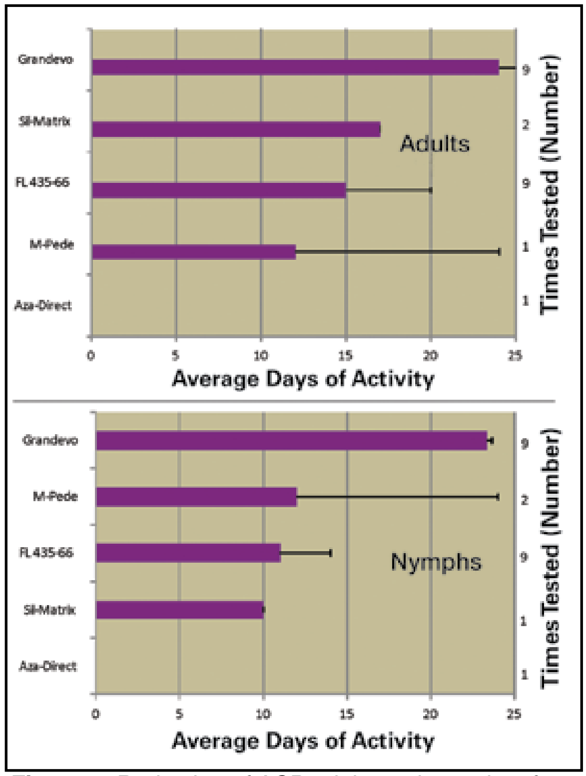

Figure 5. *Reduction of ACP adults and nymphs after application of a foliar spray, ranked by mean (± SEM) number of days that adult or nymphal counts were significantly less in the treated trees compared to untreated trees in the field. One-time test used a randomized complete block design, four replicates and 20 trees.*

unexpanded leaves are inaccessible to most insecticides, and also that new shoots growing after the application are not protected. However, new shoots are also colonized by natural enemies which target eggs and nymphs of ACP.

The good news is that OMRI-approved insecticides generally cause less disruption of natural enemies than conventional insecticides and are more compatible with conservation and augmentation biological control.

The bad news is that they are generally less effective compared to synthetic insecticides. Thus, OMRI-approved insecticides will probably have to be sprayed more often to give comparable results to conventional product. For example, we sprayed 2 gallons of 435 horticultural spray oil per acre every two weeks, either alone or with 2 gallons of water using a low-volume (Proptec) sprayer. Results after two years showed significant reduction of ACP (1.4 compared to 2.3 adults/100 taps), although even fewer (0.96 adults/100 taps) were found in the grower standard.

Mature citrus trees are dormant during winter and do not produce new growth upon which the psyllid depends for reproduction. Thus, overwintering adult populations are in continual decline and vulnerable to foliar applications of insecticides. Foliar sprays of broad-spectrum insecticides are used to kill overwintering psyllids and to reduce vector pressure in conventional citrus. An analogous tactic of foliar sprays of horticultural spray oils and other OMRI-approved products targets adult psyllids during the dormant season or prior to anticipated new growth during other times of the year. Assessment of these and other tactics for maintaining productivity of organic citrus in the face of HLB requires further research.

Jawwad A. Qureshi (jawwadq@ufl.edu) is a research associate professor of entomology, Philip A. Stansly is a professor of entomology and Moneen Jones is a post doctoral associate, all with the University of Florida-IFAS at the Southwest Florida Research and Education Center at Immokalee. Azhar A. Khan is a scholar visiting from the University of Sargodha, Pakistan.