

Ladybeetles and lacewings for Asian citrus psyllid-focused citrus pest management

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

Citrus is attacked by several insect and mite pests, most of which are controlled by a wide range of natural enemies including specialist parasitic wasps and specialized or generalist predators. For example, scales, mealybugs, citrus blackflies and whiteflies are suppressed by a complex of parasitic wasps, and in some situations, are aided by specialized

ladybeetles such as the vedalia beetle *Rodolia cardinalis* and the mealybug destroyer *Cryptolaemus montrouzieri*.

In contrast, biological control of aphids relies on a wider range of predaceous insects that includes ladybeetles, lacewings and hoverfly larvae. Citrus rust mites and spider mites are attacked by several species of naturally occurring predatory mites and also by

tiny *Stethorus* ladybeetles.

The commercially available predatory mite *Amblyseius swirskii* is used in vegetables to control broad mite and whitefly and also feeds on Asian citrus psyllid (ACP) eggs and neonates.

Citrus leafminer (CLM) is suppressed by predators such as ants and spiders, aided by several species of native and introduced parasitoids.

Management of huanglongbing (HLB) or citrus greening disease spread by ACP depends largely on vector control. Biological control has always been an important component of citrus pest management in Florida and therefore a thorough understanding of its contribution and enhancement to the mortality of ACP and other pests is important. Like other currently available options to control ACP, biological control alone may not sufficiently mitigate the impact of HLB, but it does contribute significantly to ACP suppression in commercial groves as well as in other habitats such as urban settings where chemical control is not appropriate. Studies have shown significant contributions from several biological control agents to the mortality of ACP and other citrus pests in Florida.

NATURALLY OCCURRING BIOLOGICAL CONTROL OF ASIAN CITRUS PSYLLID

Studies conducted soon after the invasion of ACP in Florida reported a wide range of predators attacking ACP. Populations of the native southern two-spotted ladybeetle, *Olla v-nigrum*, were seen to increase on Florida citrus in response to early infestations of ACP. Other ladybeetle species that were found attacking ACP were multicolored Asian ladybeetle *Harmonia axyridis*, blood-red ladybeetle *Cycloneda sanguinea*, and little red ladybeetle *Exochomus childreni*. Additional contributions to the mortality of ACP were noted from predatory groups such as lacewings, spiders and hoverflies. Follow-up studies showed that a diet of ACP nymphs supported successful larval development of the metallic blue ladybeetle *Curinus coeruleus*, as well as *E. childreni*, *H. axyridis*, *O. v-nigrum* and *C. sanguinea*, and that the adults of all but *C. sanguinea* reproduced on a diet of ACP nymphs.

We estimated a net reproductive

2012 MT565D LEASE RETURNS



Special 0%
Financing Available



Great Deal on these "Sugar Cane Tractors" **No PTO or three point hitch use!** These tractors were used for pulling Sugar Cane harvest wagons. Units carry remaining warranty of: 42 months or 4000 hours. Specifications: 150 PTO Horse Power, four wheel drive, Power Shift Dyna 6, 16.9R28 radial front tires, 20.8R38 dual radial rear tires, full set of front weights, radio and fenders and instructors seat.

PART WORKHORSE. PART SHOWHORSE.

See The Edge of Farming starring the MT5000

Whether it's a field test or screen test, our MT5000 tractor delivers a standout performance. The MT5000 cab is perhaps the roomiest, quietest and most technologically advanced cab we've ever created - putting operator comfort at a premium. See for yourself by scheduling a demo through your Challenger dealer or catch the MT5000 in action at TheEdgeOfFarming.com

Challenger is a worldwide leader in AGCO Corporation.
© 2012 AGCO Corporation. AGCO is a registered trademark of AGCO. Challenger is a registered trademark of Challenger Inc.
and used under license by AGCO. All rights reserved. AGCO, 400 River Street, Piquette, CA, 95474. 01-2012-003



www.TheEdgeOfFarming.com




(239) 693-9233 Ext. 329

Garry_Anderson@kellytractor.com
Garry's Cell: (239) 438-2477

rate of ACP during 2006–2007 up to 27-fold; lower in colonies exposed to natural enemies compared to colonies protected from predation by sleeve cages. The ladybeetles *O. v-nigrum*, *C. coeruleus*, *H. axyridis* and *C. sanguinea*, the Asian cockroach *Blattella asahinai*, lacewings *Ceraeochrysa* sp. and *Chrysoperla* sp., and spiders were most often encountered visiting these colonies. However, incidence of attack by the specialized parasitoid *Tamarixia radiata* seen in these experiments and another statewide study was low in spring and summer, indicating a need to bolster populations of the wasp early in the season. A separate article focusing on augmentation and contribution of *T. radiata* to the mortality of ACP was published in the June 2012 issue of *Citrus Industry*.

Insecticide use to control ACP increased after the advent of HLB. Foliar sprays may depopulate the grove of beneficial non-targets responsible for control of several citrus pests. As a consequence, outbreaks of secondary pests such as mites, scales and CLM have become common. For example, *Ageniaspis citricola*, an introduced parasitic wasp specific to CLM and once abundant in Florida citrus, is now detectable only at very low levels. Similarly, abundance of *Tamarixia*, ladybeetles and lacewings had decreased from earlier estimates, possibly due to insecticide use. Unfortunately, these species are not available commercially to reinforce natural populations by mass release. Therefore, commercially available predators never tested before are also being evaluated against ACP to investigate their potential role in citrus pest management.

**CONVERGENT LADYBEETLE
HIPPODAMIA CONVERGENS**

This native ladybeetle is abundant in many parts of the United States and is collected in the mountains of California where it hibernates en masse. The cost is low, but the hungry beetles coming out of hibernation are programed to disperse and do not seem to like staying in citrus groves. Nevertheless, they can develop and reproduce successfully on diets of ACP, as well as brown citrus aphid and green citrus aphid.

**TWO-SPOTTED LADYBEETLE
ADALIA BIPUNCTATA**

This species (Figure 1) is distributed throughout Asia, Europe and North America and is being used in many countries to control aphids, but

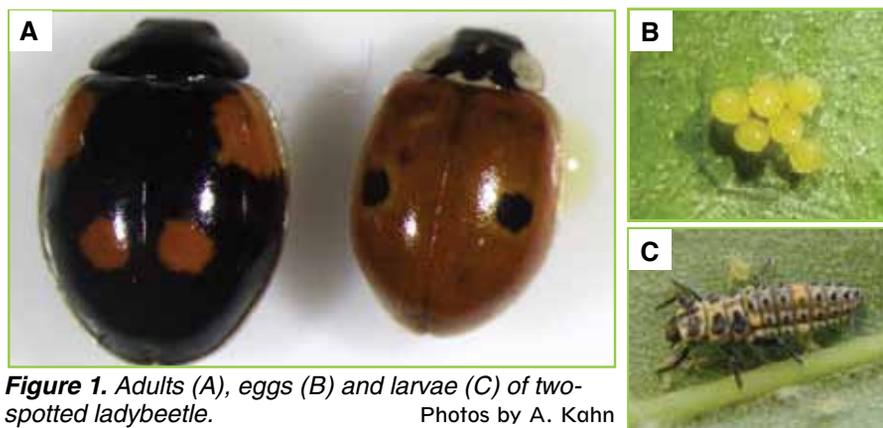


Figure 1. Adults (A), eggs (B) and larvae (C) of two-spotted ladybeetle. Photos by A. Kahn

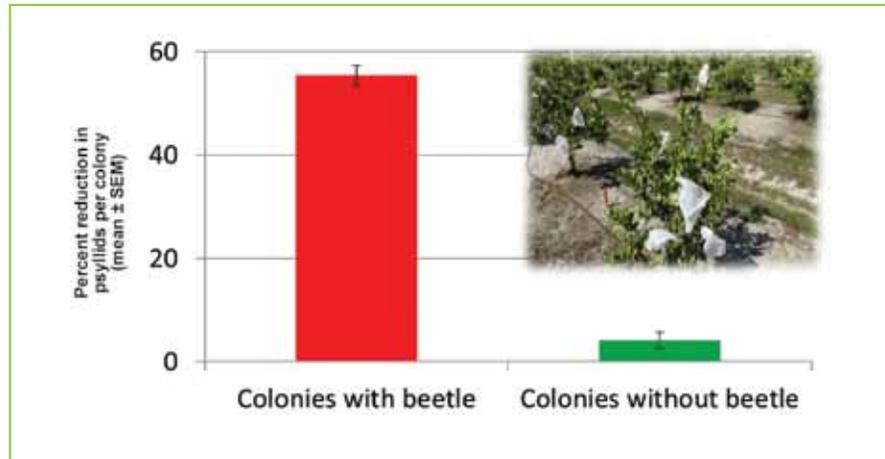


Figure 2. Reduction of ACP nymphs in the colonies with and without two-spotted ladybeetles (SEM stands for standard error of the mean).

Carden & Associates, Inc.
We Keep You Growing

Citrus Crop Insurance Specialists
25+ years experience
Florida's largest citrus crop insurance provider
Knowledgeable and Professional Service

Carden & Associates
Toll Free: 888-296-7533
info@cardeninsurance.com Winter Haven, Florida

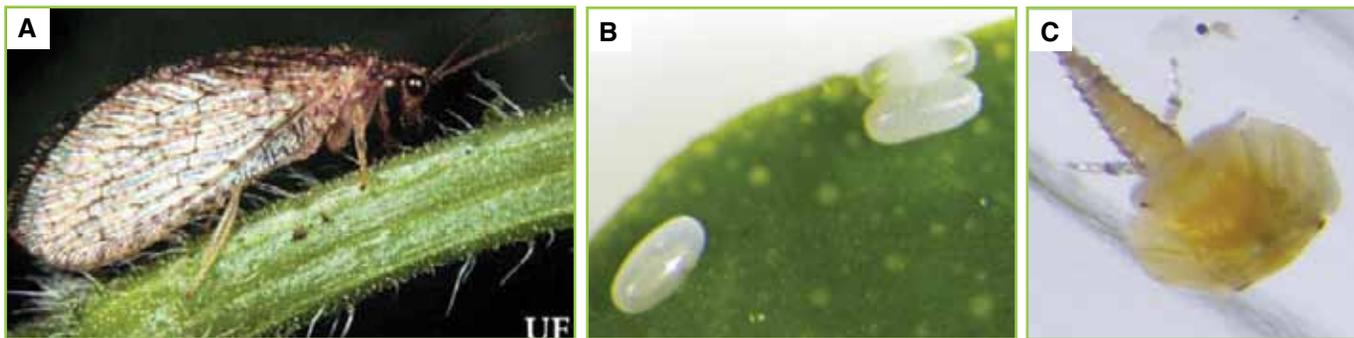


Figure 3. Adult (A) and eggs (B) of brown lacewing and larvae (C) feeding on ACP nymphs.

Photo (A) by University of Florida; photos (B) and (C) by A. Khan

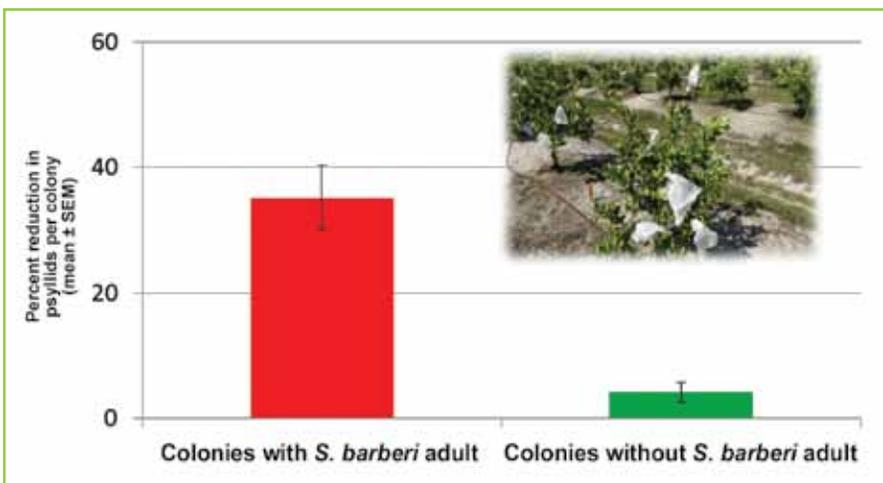


Figure 4. Reduction of ACP nymphs in the colonies with and without brown lacewing (SEM stands for standard error of the mean).

was never before tested against ACP. Beetle larvae developed successfully on ACP nymphs as well as on corn leaf aphid *Rhopalosiphum maidis* and frozen eggs of the flour moth *Ephestia kuehniella*, with 93 percent to 100 percent surviving to emerge as adults. Reproduction and egg hatch was as good on ACP as on eggs of *Ephestia*. ACP colonies were reduced by 56 percent when caged with the beetles on citrus in the field (Figure 2, previous page), indicating potential usefulness for control.

BROWN LACEWING *SYMPHEROBIUS BARBERI*

Brown lacewings (Figure 3) have been used as natural enemies of several insect pests in classical biological control. *Symphorobius barberi* is commercially available and reported as an important predator of several insect pests from Asia, Europe and America, but was never tested against ACP. Again, *S. barberi* consumed equal numbers of eggs or nymphs of *D. citri* as *Ephestia* eggs under either light or dark conditions, and both diets were suitable for the development and reproduction of *S. barberi*. Although reproduction was not as great as observed for *A. bipunctata*, we expect it to improve under field conditions where more oviposition sites are available. Also, the lacewings caged with nymphal colonies reduced ACP by 35 percent in the field (Figure 4), indicating they could contribute to ACP control while also helping manage aphids. While costs and benefits have yet to be assessed, these results indicate the potential for augmentation of natural enemies as a tool for ACP management.

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

FOUR GENERATIONS of FLORIDA CITRUS NURSERIES

Now accepting orders for 2014-2015 delivery

EXCLUSIVE LIFETIME REPLACEMENT POLICY.
Every tree is hand nurtured and inspected. Swingle, Kuharske, Carrizo, Cleo and Sour rootstocks available. Other varieties are also available.

Call Chris at (407) 404-0355 or Paul at (407) 832-1010

Visit our exciting new website TODAY!
www.blue-heron-nurseries.com

BLUE HERON NURSERIES
WINTER GARDEN, FLORIDA www.blue-heron-nurseries.com Reg. # 48006420

WE HAVE SAVED TREES FROM GREENING!

C.S.S. Citrus Tree Disease Protection

Citrus Spray Solution (C.S.S.) offers protection from bacterial tree related diseases such as citrus canker and greening. It also protects against viral diseases such as tristeza. C.S.S. treats fungus, molds, rust, mildew, moss and leaf spots. C.S.S. also protects against such vectors as aphids, thrips, mites, and Asian citrus psyllid (ASP) carrying the greening bug as well as other harmful insects.

C.S.S. has successfully regenerated trees with: Citrus canker, greening, tristeza, molds, fungus and vectors. After proper treatment, a strong and healthy tree will flourish. In the case of canker disease the tree will lose all affected leaves and grow healthy new leaves without detriment to the existing fruit. C.S.S. can be used to replace any existing oils (including 405).

Our product is currently being used in Reese Groves
We are offering a FREE sample of C.S.S. for your company to use on a trial basis. Please take advantage of this opportunity. The results will speak for themselves!!

Environmentally friendly, made of vegetable based ingredients.
Sunbelt Research & Development Ph. 239-945-2478 www.sunbeltcitrus.com

WE HAVE SAVED TREES FROM GREENING!