Figure 1. A phytoseiid mite (left) feeds on a female citrus red mite (right).

Predatory mites in citrus under protective screen

By Emilie Demard

Managing the Asian citrus psyllid (ACP), a vector of huanglongbing (HLB), is critical for reducing disease incidence and improving tree health. Growing citrus under screened structures, referred to as citrus under protective screen (CUPS), protects trees from ACP and HLB. CUPS provides an opportunity to produce premium-quality fresh fruit by preventing psyllids and HLB from infecting the trees.

However, while CUPS effectively keeps psyllids away, pests smaller than the 50-mesh (0.3 millimeter) screen can enter the structure and damage trees and fruit. Leafminers, scales, mealybugs, thrips and mites are observed in CUPS. Moreover, large natural enemies such as ladybeetles, lacewings or spiders are excluded, which prevents natural biological control from functioning, as observed in outdoor systems.

Yet, predatory mites can enter and establish in CUPS. Predatory mites represent essential natural enemies that can control several citrus pests by feeding on their eggs or immatures. Those in the family Phytoseiidae, also called phytoseiids, can feed on spider mites (Figure 1), rust mites and small soft-bodied insects such as thrips, whiteflies and psyllids. To further understand their benefits, phytoseiid populations were studied over a period of two years in CUPS and traditional open-air production systems for abundance and species assemblage. Knowledge from such studies helps develop sustainable strategies for managing pests in CUPS.

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STUDY SETUP

An experimental commercial-scale trial was established in 2013 at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Indian River Research and Education Center (IRREC) in Fort Pierce. The setup consists of four enclosed screen houses (30.5 meters wide by 36.5 meters long by 4.3 meters tall) and four open-air systems (23 meters wide by 27.5 meters long each) as controls. Ray Ruby grapefruit on two rootstocks (sour orange and US-897) were planted in two systems (in-ground and potted) at a density of 1,957 trees per hectare. Each CUPS was planted with 128 trees and the control with 96 trees, for a total of 896 trees.

MONITORING AND IDENTIFICATION

Phytoseiids were sampled with the tap sample method once per month from August 2018 to July 2020. Twenty randomly selected trees from each CUPS or control were sampled. Two tap samples per tree and 40 tap samples per CUPS and control were conducted. A 22- by 28-centimeter black clipboard was used to conduct tap sampling. The clipboard was held horizontally under branches selected at random, which were struck three times with a short piece of PVC pipe.

Mites were counted and collected from the clipboard using a soft camel hairbrush and placed in vials containing 80 percent ethanol and later in 60 percent lactic acid overnight. Specimens were mounted on slides in Hoyer's medium and identified in collaboration with the taxonomist Ismail Döker.

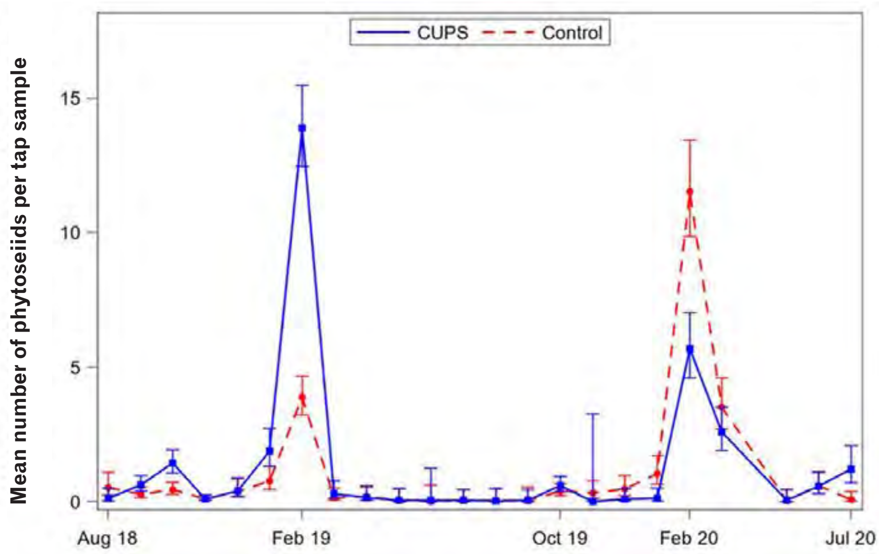

Figure 2. Seasonal abundance of phytoseiids in citrus under protective screen (CUPS) and in the control from August 2018 to July 2020

SEASONAL ABUNDANCE AND SPECIES ASSEMBLAGE

Overall, there was no significant difference in phytoseiid abundance between CUPS and the control. An average of 0.25 to 0.27 phytoseiids per tap sample were collected.

Two major population peaks were observed in both systems in February of each year (Figure 2). In 2019, the numbers in CUPS were significantly higher than in the control (13.90 and 3.88 per tap sample, respectively). This trend reversed in February 2020 when more phytoseiids were observed in the control than in the CUPS (11.53 and

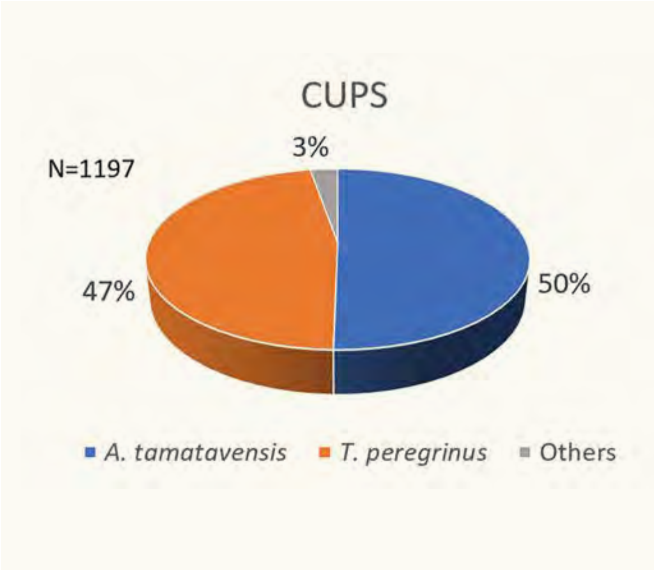

Figure 3. Relative abundance of phytoseiid mites in citrus under protective screen (CUPS)

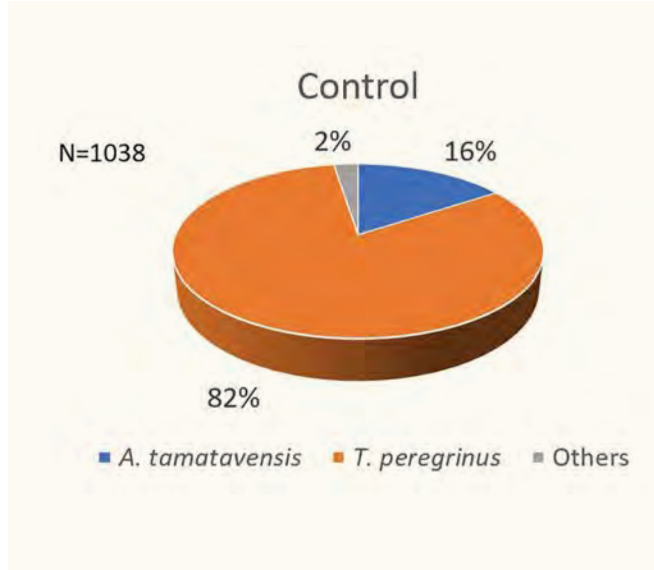

Figure 4. Relative abundance of phytoseiid mites in the control

5.68 per tap sample, respectively). This increase in the phytoseiid population coincided with the bloom period, suggesting that citrus pollen may be an alternative food for these arthropods, which may be useful for their biological parameters, such as reproduction. The high incidence of phytoseiids in both systems is encouraging, notably when those systems also received insecticide sprays to manage pest mites and insects.

Two dominant species of phytoseiids were identified from the CUPS and the control (Figure 3 and Figure 4). *Typhlodromalus peregrinus* was the most abundant species (63.1 percent of the specimens collected) followed by *Amblyseius tamatavensis* (34.2 percent). While *A. tamatavensis* was more abundant in CUPS (50 percent) compared to the control (16 percent), *T. peregrinus* was more abundant in the control (82 percent) than in the CUPS (47 percent). Other species including

Typhlodromips dentilis, *Proprioseiopsis mexicanus* and *Amblyseius aerialis* were 2.7 percent of the total complex.

IMPLICATIONS FOR BIOLOGICAL CONTROL

Finding equal or better levels of phytoseiid mites in CUPS rather than in the open-air system is encouraging. Both species are generalist predators that can feed on mites, small insects (thrips, whiteflies) and pollen.

T. peregrinus is native to Florida. This species had been found in the canopies of citrus groves at different Florida locations. *T. peregrinus* is known to feed on the citrus red mite and the citrus rust mite, two pest species that are common in CUPS and open production systems.

The first report of *A. tamatavensis* in Florida was on tomatoes in 2018. *A. tamatavensis* feeds on the citrus red mite, but its potential against the citrus rust mite is not known.

Releasing predatory mites in CUPS could suppress mite and insect pests and reduce the need for insecticides.

The environment in CUPS is warm and humid compared to open-air systems. It seems that both *A. tamatavensis* and *T. peregrinus* were able to survive in that environment; however, *A. tamatavensis* was more abundant in the CUPS than in the open-air system. The spike in populations during bloom indicates that the provision of alternate foods such as pollen could maintain the predatory mite populations in CUPS. Pests such as mites, mealybugs, scales and sooty mold may have served as additional food sources to sustain the phytoseiid populations.

UF/IFAS work with *A. swirskii*, a commercially available species, showed that it fed, developed and reproduced on cattail and olive pollen, as well as the citrus red mite. Further studies are needed to evaluate the potential of phytoseiids such as *A. tamatavensis* and *T. peregrinus* to control pest mites and other small insects.

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