ENY811

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Aphid Pests of Florida Citrus[1]

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Description and Identification

Aphids are easily recognized by the characteristic pear shape of their fragile soft bodies. In Florida, several species of aphids are economically important as citrus pests. Colonies form on new growth and persist on the backs of leaves as shoots harden off. Virtually all citrus aphids in Florida are females that give birth to living young. Males are not needed for reproduction except for production of cold hardy, overwintering eggs that occur in cold climates. Persons interested in identifying aphids to species should use the excellent key developed by the Florida Department of Agriculture and Consumer Services Division of Plant Industry (DPI). This key is available from the brown citrus aphid publication on the Featured Creatures WWW site at http://entomology.ifas.ufl.edu/creatures/.

Spirea Aphid

The spirea aphid (Figure 1), *Aphis spiraecola* Patch, is small, approximately 1.8 mm long and light green. It is almost identical to the color of a young citrus leaf. Winged forms have a dark brown thorax with a green abdomen. Spirea aphids were first discovered in the Tampa area in 1923 and have since spread throughout the state.The spirea aphid has an overwintering cycle on spirea and infests a wide variety of plants in the summer. In Florida, it can remain on summer hosts all year.

Figure 1. Spirea aphid.

Melon Aphid

The melon aphid (or cotton aphid) (Figure 2), *Aphis gossypii* Glover, is essentially the same size as the spirea aphid. It varies in color among different hosts, however non-winged individuals found on citrus are usually a dark grey or dull black.

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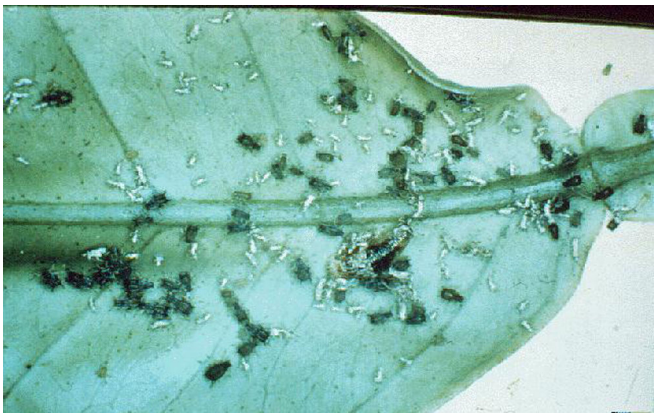

Figure 2. Melon aphid.

Figure 11. Adult wingless form (apterae) and nymphs of brown citrus aphid, *Toxoptera citricida* (Kirkaldy). Credits: Division of Plant Industry

Black Citrus Aphid

The black citrus aphid, *Toxoptera aurantii* (Boyer de Fonscolombe), is the second largest of the major citrus aphid pests, reaching about 2.1 mm in length. Immatures are reddish brown in color, and adults are dull black. Antennae and legs are striped.

Brown Citrus Aphid

The brown citrus aphid (BrCA), *Toxoptera citricida* (Kirkaldy), is one of the world's most serious pests of citrus. Although BrCA alone can cause serious direct damage to citrus, it is even more of a threat to citrus because of its efficient transmission of citrus tristeza closterovirus (CTV). One of the most devastating citrus crop losses ever reported followed the introduction of BrCA into Brazil and Argentina: 16 million citrus trees on sour orange rootstock were killed by CTV which was spread by BrCA.

BrCA was first detected in Florida in November, 1995 in Dade and Broward counties. The majority of infested trees were in dooryard situations. However, several months after detection, infestations were discovered in the commercial lime production area, indicating a range expansion about 15 miles south of the area delimited by the original survey. A rapid spread throughout Florida is occurring.

BrCA is larger (3.2 mm) than other species occurring on citrus. Adult wingless forms are very shiny black, and nymphs are dark reddish-brown. However, field identification of BrCA can be difficult because most of the regularly collected species can be dark in color, and all colonize new growth. Additionally, mixed colonies of two or more species are common. Winged forms (Figure 3) of BrCA are distinctive and can be recognized by the conspicuous black antennal segments I, II and III. Antennae of wingless forms (Figure 4) are pale near the base and have one black band at mid-length.

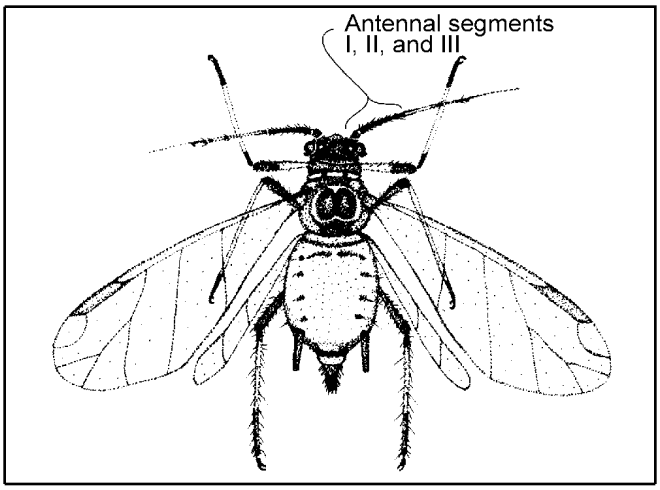

Figure 3. Brown citrus aphid, winged form.

Populations of BrCA increase very rapidly under favorable conditions. Nymphs mature in six to eight days at temperatures of 20° C or higher. A single aphid could produce a population of over 4,400 in three weeks in the absence of natural enemies.

BrCA is much more efficient at transmitting CTV than other aphids that infest citrus. It is six to 25 times as efficient as the melon (or cotton) aphid, the most efficient vector of CTV in Florida prior to 1995.

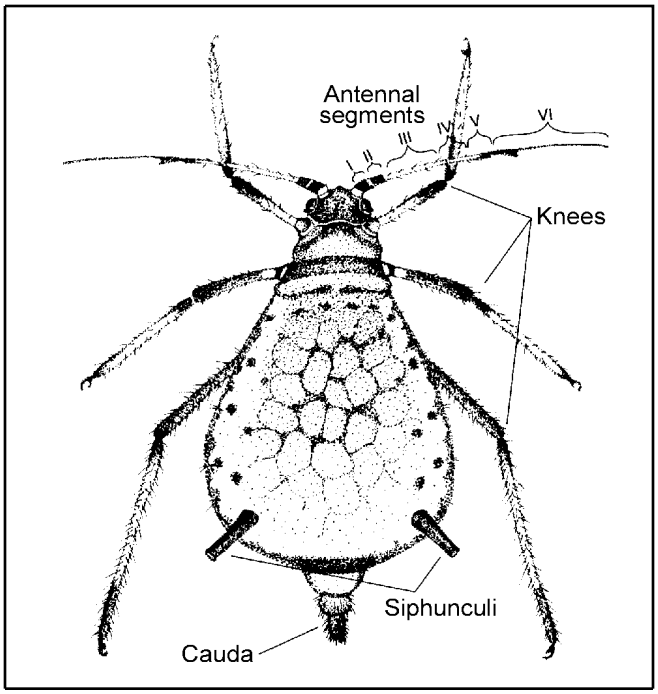

Figure 4. Brown citrus aphid adult, wingless form.

BrCA also transmits some strains of CTV that are not transmissible by other species. This increases the likelihood that there will be a gradual increase in severity of citrus tristeza in Florida. Besides this ability to efficiently transmit CTV, two other factors contribute to the important vector status of BrCA: its relatively narrow host range and tendency to produce winged forms as colonized new growth matures. BrCA, because of its narrow host range, is most likely to feed on another citrus tree, potentially infecting it with CTV. The synchronized development of colonies with citrus flush cycles ensures that winged forms are often produced. CTV spreads as winged forms disperse and colonize other citrus trees.

The University of Florida and the DPI have issued detailed publications concerning the appearance, distribution and control of BrCA. Information on BrCA and the melon aphid is also available on the Featured Creatures WWW site at http://entomology.ifas.ufl.edu/creatures/.

General Life History of Citrus Aphids

Each female aphid produces a large number of females which mature in as little as five days. As a result, aphid populations can increase dramatically within a short period of time. When populations become too dense on the host, or flush matures, winged females develop and disperse to new host plants to begin new infestations. There can be as many as forty-seven generations a year in Florida.

Injury to Crop

Aphids injure citrus by feeding on young growth and causing the leaves to become curled and twisted (Figure 5). Curled leaves are inefficient energy producers and the distortion is permanent. This distortion as well as sooty mold, which grows on copious honeydew secreted by the aphids, provide excellent protection for scale insects. In addition, sooty mold reduces leaf efficiency and diminishes the quality of the crop. Aphids feeding on young 'Temple' foliage stunt the terminals. Specific damage caused by the economically important aphid pests in Florida is outlined below:

Figure 5. Curled and twisted leaves.

1. Spirea aphids cause tightly curled leaves that are smaller than usual.

2. Melon, or cotton, aphids can cause serious injury, although not usually to the extent of spirea aphids. Leaves damaged by melon aphids cup, curve and distort, but don't tightly curl. Melon aphids can also transmit CTV, though not as efficiently as BrCA.

3. Black citrus aphids also cause leaves to cup, curve and distort, but not to curl tightly.

4. For BrCA, patterns of colonization are somewhat distinct. BrCA prefers young flush, but persists on fully expanded and hardened flush, often covering leaf veins and stems. Other

aphids are more restricted to young flush, mostly dispersed over the underside of leaves. Although heavy populations of BrCA can cause serious leaf distortion, frequently there is no visible damage after aphids leave. The primary crop injury comes as a result of efficient transmission of CTV.

Economic Threshold

Determining an economic threshold for a CTV vector is extremely complex. Along with traditional considerations such as crop value, expected damage at given population levels and control costs, one must consider initial disease incidence, transmission efficiency of the vector, prevalent strains of the virus and citrus cultivars involved. Additionally, damage will depend on the end use of the crop. For example, much more damage may be expected if a registered scion grove beomes infested with infective aphids than if the same infestation occurs in a commercial production grove on CTV-tolerant rootstock.

Management Recommendations

Chemical Control

Several insecticides control aphids. However, in order for them to be effective, they should be applied to infested young growth before the leaves curl. It is not known whether controlling aphids will reduce spread of CTV in production situations, but insecticides may be beneficial in protecting nursery stock and valuable budwood sources. Some form of isolation (either physical or geographic) probably also will be necessary to protect valuable budwood source trees. Commercial growers should consult the latest copy of the Florida Citrus Pest Management Guide for recommended insecticides.

Biological Control

Aphids would be a greater problem if not for the many biological controls maintaining them at economical levels. While the BrCA is also affected by biological control, the degree to which natural enemies can suppress BrCA populations is not well known.

A fungus, *Neozygites fresensii*, is an important check on aphid populations during humid weather. There are a large number of predators of aphids. Lacewing (Figure 6) and syrphid fly larvae attack aphids in all stages of development.

Figure 6. Lacewing larva feeding on aphids.

Many lady beetle adults and larvae (Figure 7) feed upon aphids. The two most common are *Cycloneda sanguinea*, and the convergent lady beetle, *Hippodamia convergens*. *Cycloneda sanguinea* (Figure 8) is predominantly reddish-orange. The convergent lady beetle (Figure 9) has a black head and thorax ringed with white and red wings and has seven red spots on each side. Both lady beetles are about 9 mm long.

Figure 7. A common lady beetle larva.

Detailed information on lady beetles is available on the Featured Creatures WWW site at http://entomology.ifas.ufl.edu/creatures/.

Two families of hymenopterous (wasp) parasites use aphids as their host. Aphids parasitized (Figure 10) by the most common family of parasites swell up until they are almost spherical in shape

Figure 8. A common lady beetle adult.

Figure 9. Convergent lady beetle.

becoming a brassy brown in color. The wasp then emerges from a hole chewed in the aphid's abdomen. These greatly swollen aphids (mummies) with round holes in their abdomens are common sights in melon aphid colonies. Melon aphid populations are heavily parasitized by a minute wasp, *Lysiphlebus testaceipes*.

Figure 10. Parasitized aphids.

Cultural Control

It is clear that CTV-induced quick decline of citrus trees propagated on sour orange and other susceptible rootstocks has become a fact of life in areas where BrCA has become established. In Florida, strains of CTV that cause quick decline are widespread in citrus on CTV-tolerant rootstocks. The prognosis for citrus on sour orange rootstock in Florida is poor. Although some trees many persist for a number of years, most will succumb to CTV-induced quick decline in three to ten years. Citrus trees intended for planting in Florida should no longer be propagated on sour orange rootstock. Field evaluation of alternate rootstocks will enable a smoother transition away from sour orange.

Florida will experience some loss of dooryard citrus trees on sour orange rootstock due to the action of BrCAand CTV. Homeowners with citrus on sour orange rootstock can plan ahead by planting their favorite citrus varieties on CTV-tolerant rootstocks. By doing so, they may have fruit bearing trees by the time quick decline may affect their current fruit-bearing trees.

Citrus is propagated vegetatively, which greatly increases the possibility for spreading disease because CTV is graft transmissible. Man can quickly spread CTV faster and further than any aphid. One pickup truck of infested nursery stock can spread the virus several hundred miles in a few hours from nursery sites to grove plantings.

The first step in any integrated management program should be to ensure that budwood and nursery stock are free of disease (with the possible exception of mild strains of CTV used for cross protection). Mandatory budwood certification will require source trees to have annual tests for CTV, where sources testing positive for severe strains of CTV will no longer be permitted to be used for propagation.

DO NOT BRING CITRUS TREES INTO FLORIDA. The establishment of BrCA in Florida makes it even more important than ever to keep foreign citrus plants out of Florida. Many locations overseas have very severe strains of CTV that will spread rapidly in the presence of BrCA. Once severe

strains of CTV begin to spread, they are difficult, if not impossible to eradicate. Citrus trees smuggled from other parts of the world could eventually put much of Florida's citrus industry at risk.