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Dooryard Citrus Production: Citrus Diseases Exotic to Florida[1]

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Florida is world famous for its citrus production, and many homeowners in Florida enjoy growing citrus in their yards. Unfortunately, citrus is susceptible to a large number of diseases caused by plant pathogens, and losses due to plant diseases can be severe. Major citrus diseases that are present in Florida include citrus tristeza virus (CTV), blight, greasy spot, *Alternaria* brown spot, *Phytophthora*-induced diseases, melanose, scab, postbloom fruit drop (PFD), citrus canker, and citrus greening. Fortunately, many other pathogens that can attack citrus have not been reported in Florida. Any exotic pathogen, if introduced, has the potential to significantly reduce the ability of homeowners to successfully grow citrus, as well as increase the cost of commercially grown citrus.

One example of the impact of exotic pathogens is citrus greening disease (see IFAS publication "Dooryard Citrus Production: Citrus Greening Disease"). Citrus greening is a devastating disease of citrus that has reduced or eliminated citrus production wherever it has spread. In 1998, the Asian citrus psyllid, the insect pest that transmits greening, was discovered in Florida. In 2005, citrus greening was discovered. This pest and disease were accidentally introduced to Florida through the movement of infected plant material. Within two years of the discovery of greening disease in Florida, hundreds of acres of infected trees had to be removed, many more acres went into decline, and production costs have more than doubled. This series of events has affected prices of both fresh fruit and juice products, directly impacting the consumer.

This paper will focus on five citrus diseases exotic to Florida: black spot, citrus leprosis, citrus tristeza virus-stem pitting (CTV-SP), citrus variegated chlorosis (CVC), and sweet orange scab. The purpose is to: 1) raise homeowner and hobby citrus grower awareness of diseases that may pose potential risks to Florida, and 2) provide basic identification information so that these diseases can be detected early and eradicated quickly and properly to minimize overall impact should they be introduced to Florida.

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Black Spot

Citrus black spot is a fungal disease of citrus caused by the pathogen *Guignardia citricarpa*. Black spot causes necrotic lesions on fruit making them unacceptable for sale as fresh fruit. Severe cases of black spot cause premature fruit drop, thus causing significant yield losses. Citrus black spot has not yet been detected in Florida, but climatic conditions in Florida are favorable for it. Citrus black spot could be introduced to Florida from a number of areas, including Southeast Asia, Africa, Australia, and South America, through the movement of infected fruit or the illegal importation of plant material.

All varieties of citrus are susceptible to varying degrees. Grapefruit and Valencia oranges are highly susceptible, and are major components of the Florida citrus industry.

The most conspicuous symptoms of black spot are varying forms of fruit lesions. Lesions begin as small orange or red spots with black edges that enlarge over time. The various forms of lesions are: hard spot lesions (Fig. 1), virulent spot lesions (Fig. 2), and speckled blotch or false melanose spots (Fig. 3). Black spot may also cause leaf spots, but these are not as conspicuous as the fruit lesions (Fig. 4).



Figure 1. Hard spot lesions caused by citrus black spot disease (*Guignardia citricarpa*). Credits: Photo from L.W. Timmer and N. Peres, University of Florida.

Citrus Leprosis

Citrus leprosis is a viral disease that causes chlorotic (yellow) lesions on citrus leaves, fruit and stems. Leprosis is currently a major disease of citrus in Brazil and other South American countries. Leprosis was present in Florida prior to 1925, but is no longer present. Leprosis is transmitted by several species of mites belonging to the genus Brevipalpus.



Figure 2. Virulent spot lesions caused by citrus black spot disease (*Guignardia citricarpa*). Credits: Photo from L.W. Timmer and N. Peres, University of Florida.



Figure 3. Speckled blotch or false melanose spots caused by citrus black spot disease (*Guignardia citricarpa*). Credits: Photo from L.W. Timmer and N. Peres, University of Florida.



Figure 4. Leaf spots caused by citrus black spot disease (*Guignardia citricarpa*). Credits: Photo from L.W. Timmer and N. Peres, University of Florida.

For additional information on Brevipalpus mites see IFAS publications EENY-384 and EENY-381, available online at: http://edis.ifas.ufl.edu/IN690 and http://edis.ifas.ufl.edu/IN685, respectively.

Leprosis primarily affects oranges, but can also affect tangerines/mandarins. Symptoms appear on leaves, fruit and stems (Figs. 5-7), appearing first as chlorotic spots and then becoming necrotic lesions. Large lesions may result in fruit drop, leaf drop and stem dieback

Given that leprosis has been present in Florida in the past, the climatic conditions for its re-establishment and spread exist. It is important that



Figure 5. Chlorotic (yellow) leaf spots caused by citrus leprosis on sweet orange. Credits: Photo from R.H. Brlansky, University of Florida.



Figure 6. Symptoms of citrus leprosis on green fruit. Chlorotic (yellow) lesions are early symptoms (A); as lesions age the centers may become necrotic (B) Credits: R.H. Brlansky (A) and J.D. Yates (B) University of Florida.



Figure 7. Necrotic lesions on citrus stems caused by citrus leprosis Credits: Photo from J.D. Yates, University of Florida.

leprosis-infected material be kept out of Florida to avoid re-introducing this potentially damaging disease.

Citrus Tristeza Virus-Stem Pitting (CTV-SP)

CTV-SP is a viral disease caused by specific strains of citrus tristeza virus (CTV). CTV is present in Florida; however, the specific strains that cause CTV-SP are not. CTV causes general tree decline of trees grafted on sour orange and bitter sweet rootstocks.

Trees infected with CTV can be replaced by trees grafted on non-susceptible rootstocks. Unlike CTV decline, CTV-SP can affect trees regardless of the rootstocks they are grown on. Currently there are no CTV-SP-resistant cultivars of sweet orange or grapefruit. CTV-SP is widespread in Asia, Australia, South Africa, Brazil, Columbia, and many other citrus-growing areas.

The presence of non-stem pitting strains of CTV in Florida indicates that conditions are favorable for CTV-SP to spread should it be introduced. Also, the brown citrus aphid (*Toxoptera citricida* (Kirkaldy), Fig. 8), which is the most efficient insect at transmitting CTV-SP, is already well established in Florida, indicating that the disease could spread very quickly if introduced. More information about the brown citrus aphid can be found in IFAS publication EENY-007, available online at: http://edis.ifas.ufl.edu/IN133



Figure 8. Brown citrus aphid infestation on young citrus shoot Credits: Photo from R.H. Brlansky, University of Florida.

There is some variability in the susceptibility of citrus varieties to CTV-SP. Limes, grapefruit and

sweet oranges are all highly susceptible. Tangerines (mandarins) are tolerant, but may show symptoms under some conditions.

The severity of symptoms of CTV-SP can vary depending on the specific strain of the virus that is infecting a tree. The disease gets its name from the stem pitting it causes throughout stems above the bud union, which can be seen when the bark is peeled away (Fig. 9). Severe stem pitting may give stems a rope-like appearance. Trees may continue to grow vigorously with this symptom, but fruit size can be reduced (Fig. 10). The most severe form of the disease can cause brittle stems, abnormally thick bark, and small misshapen fruit. Leaves may be chlorotic (Fig. 11).



Figure 9. Stem pitting of grapefruit stem caused by citrus tristeza virus-stem pitting (CTV-SP). Credits: Photo from R.H. Brlansky, University of Florida.



Figure 10. Reduced fruit size caused by citrus tristeza virus-stem pitting (CTV-SP, right) compared with normal sized healthy fruit (left). Credits: Photo from R.H. Brlansky, University of Florida.

Citrus Variegated Chlorosis (CVC)

CVC is a bacterial disease caused by the pathogen *Xylella fastidiosa*. Other strains of *X. fastidiosa* cause diseases of grape, peach, almond, plum, oak and sycamore and are present in parts of the U.S. The bacterium is spread by small insects known as sharpshooter leafhoppers (Fig. 12). There are at least four genera of sharpshooters in Florida that may be capable of transmitting the disease if it is introduced (see IFAS publication EENY-334,



Figure 11. Leaf chlorosis (yellowing) caused by severe infection of Citrus tristeza virus-stem pitting (CTV-SP) in a young tree. Credits: Photo from R.H. Brlansky, University of Florida.

available online at: http://edis.ifas.ufl.edu/IN611). Currently, CVC is prevalent in Brazil, Argentina and Paraguay, and has recently spread beyond South America to Costa Rica (Aguilar et al., 2005).



Figure 12. A sharpshooter leafhopper that transmits citrus variegated chlorosis (CVC).

Trees infected with CVC develop chlorotic (yellow) spots on the upper surfaces of the leaves (Fig. 13). On the lower surface of the leaf, brown gummy lesions develop corresponding to the chlorotic spots on the upper surface. Trees infected with CVC have reduced vigor and growth, and may flower and fruit abnormally. Fruit infected with CVC are small and hard, and are very high in acid, rendering them unsuitable for eating or juicing.

CVC is most serious on sweet orange cultivars, but there is some variation in its severity depending on the cultivar. Lemons, limes, tangerines/mandarins, kumquats, and grapefruit are somewhat less susceptible. Rangpur lime, citron and pummelo are considered resistant to CVC.



Figure 13. Chlorotic (yellow) spots on upper leaf surface caused by citrus variegated chlorosis (CVC). Credits: Photo from R.H. Brlansky, University of Florida.

Sweet Orange Scab (SOS)

SOS is a fungal disease caused by the fungus *Elsinoe australis*. A very closely related fungus, *Elsinoe fawcetti*, already exists in Florida and causes the disease known as citrus scab. Citrus scab is a serious disease on tangerines, tangerine hybrids (e.g. temple), grapefruit, and lemons, but it rarely infects sweet orange. SOS, on the other hand, causes severe damage to sweet oranges, tangerines, and tangerine hybrids. Presently, SOS occurs in the humid, citrus-producing areas of South America, in countries such as Argentina, Brazil, and Ecuador, but to date it has not been detected outside South America.

Unlike citrus scab, SOS does not develop on leaves or stems. SOS causes corky, wart-like lesions on fruit that are tan to grey colored (Figs. 14-15). The SOS fungus only attacks young fruit, which are susceptible only for 6-8 weeks after bloom. The fungus requires moisture to spread, and so will be most severe if rain or high humidity exists during and shortly after bloom.

What Can Homeowners Do?

All of the diseases discussed in this paper have one thing in common: their introduction to Florida will require human involvement. None of the natural means of spread for these diseases is capable of moving them from their current locations to Florida. Preventing them from entering Florida is far easier and less expensive than trying to control or eradicate them once they are here. To this end, it is critical that citrus fruit and plant material not be brought into Florida illegally.

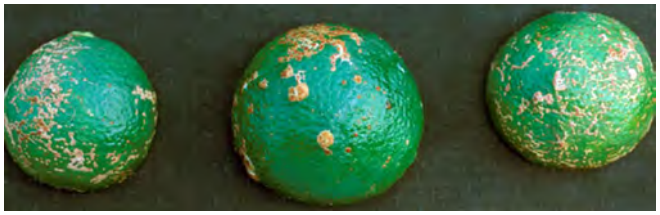


Figure 14. Sweet orange scab lesions on young fruit. Credits: Photo from L.W. Timmer, University of Florida.



Figure 15. Sweet orange scab lesions on mature (ripe) fruit. Credits: Photo from L.W. Timmer, University of Florida.

If one of these diseases should make its way to Florida, early detection of it will be very important to prevent it from spreading. Homeowners can assist in early detection by being aware of the diseases and their symptoms, and carefully observing anything unusual on their dooryard trees, and requesting the assistance of an Extension Agent as needed.

Citrus is a vital part of Florida's economy and is a major component of the landscape. Protecting this resource should be a goal of all of Florida's citizens.

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