UF UNIVERSITY of FLORIDA
IFAS Extension

PP-214

Field Identification of Citrus Canker Symptoms and Decontamination Procedures [1]

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Identifying Citrus Canker

Citrus canker, caused by the bacterial pathogen *Xanthomonas citri* subsp. *citri*, is a serious disease of citrus. Most citrus cultivars are susceptible; grapefruit, Mexican lime, and some early oranges are the most susceptible. 'Navel', 'Pineapple', and 'Hamlin' oranges are moderately susceptible. Mid-season oranges, 'Valencia' oranges, tangors, tangelos, and other tangerine hybrids are less susceptible, and tangerines are tolerant. The disease causes necrotic dieback, general tree decline, premature fruit drop, and fruit blemishes. Severely infected trees become weak, unproductive, and unprofitable.

The citrus leafminer (*Phyllocnistis citrella*) has increased the vulnerability and susceptibility of citrus trees to canker. Leaves and stems damaged by the citrus leafminer are more likely to be infected because the wounds allow the bacterium to easily penetrate the tissue (Fig. 2). When leafminer feeding galleries become contaminated with the bacterium, the number of lesions and the area infected greatly expand and result in enormous inoculum production. The leaf

Figure 1. Necrotic canker lesions on grapefruit stems, leaves, and fruit

Figure 2. Canker lesions in leafminer galleries on upper side of leaf

1. This document is PP-214, one of a series of the Plant Pathology, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date August 2005. Revised July 2011. Visit the EDIS website at http://edis.ifas.ufl.edu.

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lesions sometimes fall out, leaving holes. This is known as the "shot hole effect" and is most common with old grapefruit lesions.

Leaf Symptoms. Lesions appear within five to seven days under warm, moist conditions between 82°F and 86°F. The early leaf symptoms appear as slightly raised, tiny, blister-like lesions (Fig. 3). When leaf lesions are young, the yellow halo is most prominent (Fig. 4). As the lesions age, they turn tan to brown, and a water-soaked margin appears surrounded by a yellow ring or halo. The center of the lesion becomes raised and corky. The lesions are usually visible on both sides of the leaf (Fig. 5).

Figure 3. Young, blister-like lesions of citrus canker

Figure 4. Young lesions of citrus canker with yellow halo

Figure 5. Old lesions of citrus canker displaying the "shot hole effect"

Stem and Twig Lesions. Stem lesions often indicate infection has been present for at least a year. They serve as a reservoir for persistent inoculum and are able to produce inoculum for up to four years. When they occur on woody tissue, they are the same color as the branch but have a raised, wart-like surface (Fig. 6a). Symptoms on twigs and fruit are similar and consist of dark brown or black raised corky lesions surrounded by oily or water-soaked margins (Fig. 6b). As the lesions mature, they appear scabby or corky.

Figure 6a. Young lesions of citrus canker on young twigs

Figure 6b. Young lesions of citrus canker on young twigs

Fruit Lesions. Young lesions are raised, blister-like, tan, and can be surrounded by yellow halos, depending on fruit maturity (Fig. 7). As lesions age, they become dark brown to black with brown to black sunken, corky centers, and they may have yellow halos (Fig. 8). Old lesions often have a gray appearance. Generally, the lesions are circular and vary in size. Lesions cause blemishes and early fruit drop, thereby reducing fruit yield (Fig. 9). The internal quality of the fruit is not affected.

Figure 7. Young, blister-like canker lesions on fruit

Figure 8. Old lesions of citrus canker on grapefruit

Figure 9. Fruit drop caused by a severe canker outbreak

Decontamination Procedures

Citrus canker is highly contagious and can be spread rapidly by wind-driven rain, storm events such as tornadoes and tropical storms, equipment, and human movement within groves (Fig. 10). Movement of infected or exposed trees, seedlings, and propagative material is the primary means of spreading the canker pathogen over long distances. Contaminated clothing, tools, lawnmowers, and other landscaping equipment, as well as ladders, containers, and other items associated with harvesting are also potential sources for transmission to susceptible tissue.

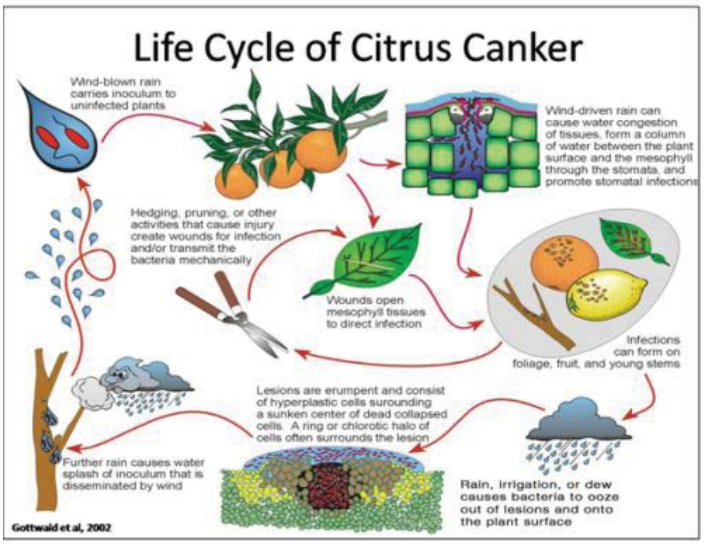

Figure 10. Citrus canker life cycle

Decontamination is a key practice to prevent the spread of citrus canker. Before decontaminating, remove any limbs, fruit, soil, or leaves from yourself, vehicles, and all equipment. This includes small personal items such as hats, jackets, and picking sacks. Leave any debris on the property to prevent further spread. If the grove location has an automatic decontamination spray system in place, confirm it is working properly before proceeding through it (Figs. 11a, 11b, and 11c). Due to mechanical issues or lack of solution, it may not be fully operational. Since all citrus groves do not have automatic decontamination stations or the system may not be functioning properly, it is best for grove workers and managers to be equipped with spray bottles of personal and equipment decontamination solution (Fig. 12a). If an automatic system is not available, a hand spray bottle for personal decontamination is sufficient. The decontamination solution is like a mild soap. Using the spray bottle, apply a light mist to your arms, hands, and the bottoms of shoes. A rule of thumb is if it came in contact with a citrus tree, then apply the decontamination solution; therefore, it may also be necessary to apply it to your chest and legs.

To decontaminate vehicles and equipment, a one-gallon garden sprayer is simple and lightweight for storage and transport. When applying, begin spraying at the top of the vehicle and/or equipment and move downward until the spray material is running off. Other areas to spray include, but are not limited to, the tops of tool boxes, tires, and wheel wells. Unless it is designated as a two-in-one solution, the decontamination solutions are intended for either personnel or equipment. Do not use the solution designated for equipment on your skin as it is harsher than the personal solution. Equipment decontamination solutions should be checked monthly for quaternary ammonium chloride (QAC) concentration to ensure effectiveness.

Figure 11a. Automatic personnel decontamination station

Figure 11b. Automatic vehicle and equipment decontamination station

Figure 11c. Large tank used for storage of decontaminant for automatic systems

Figure 12a. Types of spray bottles

Decontamination training is required annually for grove workers and harvesters. Trainings can be scheduled through local University of Florida Extension offices. Personnel are required to decontaminate upon exiting a grove. The exception to this rule applies to harvesters. Harvesters are required to decontaminate upon entering and exiting a grove regardless of whether an infection is known to exist. State regulations require all vehicles and equipment exiting citrus groves to be decontaminated. A grove owner/caretaker may also require decontamination upon entering groves. If you suspect citrus canker, provide a digital photo to your local county Extension office for assistance with identification and management options.

Additional Information

For more information about citrus canker, visit these websites:

USDA Animal and Plant Health Inspection Service
http://www.aphis.usda.gov/plant_health/plant_pest_info/citruscanker/index.shtml

Approved Decontamination Products and Methods
http://www.freshfromflorida.com/pi/chrp/schedules/decontamination.pdf

Citrus Canker Extension Program
http://canker.ifas.ufl.edu

Citrus Health Response Program
http://www.doacs.state.fl.us/pi/canker/

Citrus Leafminer, *Phyllocnistis citrella* Stainton (Insecta: Lepidoptera: Phyllocnistinae)
http://edis.ifas.ufl.edu/in165

Florida Citrus Pest Management Guide: Citrus Canker
http://edis.ifas.ufl.edu/cg040

University of Florida Local Extension Offices
http://solutionsforyourlife.ufl.edu/map/index.html