

## **Citrus Diseases Exotic to Florida: Black Spot<sup>1</sup>**

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Citrus is susceptible to a large number of diseases caused by plant pathogens. Economic losses due to plant diseases can be severe, but fortunately, not all pathogens attacking citrus are present in Florida. Major citrus diseases currently present in Florida include tristeza, blight, greasy spot, *Alternaria* brown spot, *Phytophthora*-induced diseases, melanose, scab, postbloom fruit drop (PFD), and citrus canker. Eradication of citrus canker is ongoing in Florida. There are several serious pathogens that have not been introduced into Florida. Any exotic pathogen, if introduced, has the potential to significantly increase production costs and decrease profitability for Florida growers. The background information for each exotic citrus disease will be presented in a series of fact sheets. Our intent is to: 1) provide a basis for evaluating exotic pathogens that may pose potential risks to Florida citrus; and 2) to create a decision-making framework to prevent their introduction and spread. This paper will discuss citrus black spot.

### **Why Are We Concerned About Citrus Black Spot?**

Citrus black spot is one of the most important fungal diseases of citrus worldwide. The symptoms are necrotic lesions on fruit that make them unacceptable for fresh market. When disease is severe, black spot may cause extensive premature fruit drop that reduces yields of fruit for processing. Thus, citrus black spot must be controlled to achieve profitable production. Citrus black spot has been a significant production problem in a number of countries in Southeast Asia, Africa, South America, and in Australia. Although citrus black spot has not been reported in the U. S., climatic conditions in Florida are likely favorable for the occurrence and establishment of black spot disease. Citrus cultivars grown in Florida are also vulnerable to damage by black spot. Citrus black spot could be introduced to the U. S. via movement of infected fruit or illegal introduction of vegetative plant materials.

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## The Causal Agent of Citrus Black Spot

Citrus black spot is caused by a fungus whose imperfect (asexual) stage is called *Phyllosticta citricarpa*, and whose perfect (sexual) stage is called *Guignardia citricarpa*. *G. citricarpa* is limited to citrus as far as is known. *G. mangiferae*, a related species, is a common saprophyte that has been isolated from numerous plants including almonds, avocados, guavas, mangoes, passionfruit, and a variety of ornamentals. *G. mangiferae* is widespread in Florida. Isolation of *G. mangiferae* from citrus fruit spots has periodically caused confusion when a diagnosis of citrus black spot was based on fungal morphology in culture without testing pathogenicity.

### Which Cultivars Are Affected?

Citrus black spot is common in subtropical regions with summer rains and has been found in numerous countries in South America, Asia, and Africa, and in Australia. All citrus cultivars are susceptible to at least some degree. Lemons, grapefruits, limes, and mandarins are especially susceptible and late maturing varieties, such as Valencias, can suffer severe yield losses due to premature fruit drop. Sour orange and Tahiti lime are not susceptible.

### What Are The Typical Symptoms Caused By Black Spot?

*G. citricarpa* causes cosmetic lesions on the rind of fruit that are the most conspicuous symptom of infection. Fruit symptoms can be quite variable. Black spot lesions begin as small orange or red spots with black margins and enlarge to become necrotic lesions. Green tissue may surround the black lesions. At least four types of lesions have been described. Hard spot lesions (Fig. 1) and virulent spot (Fig. 2) are the most conspicuous. Speckled blotch or false melanose spots (Fig. 3) appear on green fruit. Freckle spots become more pronounced late in the season or during storage. Black pycnidia, which are the asexual reproductive units of the fungus, may be present in all types but speckled blotch. *G. citricarpa* may also cause leaf spots, particularly on lemons, but these are usually not conspicuous (Fig. 4). High

temperature, high light intensity and stress all favor symptom expression.



**Figure 1.** Hard spots with black pycnidia caused by *Guignardia citricarpa*.



**Figure 2.** Virulent spots caused by *Guignardia citricarpa*.

### How Is Citrus Black Spot Transmitted?

Infection of citrus black spot is favored by warm wet conditions in the summer, presence of susceptible fruit, and presence of abundant inoculum. While conidia (asexual spores) may cause infection, the primary source of infection is ascospores (sexual spores) produced on dead leaves on the ground. Ascospores are forcibly ejected during rains or irrigation onto fruit and infection occurs mostly in



**Figure 3.** Speckled spots caused by *Guignardia citricarpa*.



**Figure 4.** Leaf spots caused by *Guignardia citricarpa*.

late spring and summer. Fruit are susceptible for 4-5 months after petal fall. Although infection occurs when fruit are young, the fungus undergoes a long period of latency and symptoms may not appear until the fruit become mature.

### How to Detect Black Spot in the Field?

Citrus black spot can be identified by fruit symptoms. For confirmation, the causal fungus must be cultured from infected tissues and identified as *Guignardia*. However, differentiation of isolates that cause citrus black spot from non-pathogenic isolates requires a pathogenicity test. The disease progresses slowly and it may take several months to produce black spot symptoms after inoculation. Effective molecular techniques are currently being evaluated and tested for identification using tissue samples directly.

### How to Control Black Spot?

Citrus black spot is an exotic disease to Florida. It is important to keep it out of the state, and if introduced, to quickly detect any infections before they become established. In countries where citrus black spot is endemic, fungicides are required to control the disease. Protective treatments using copper or strobilurin fungicides or mancozeb must be properly timed, and up to 5 sprays may be required during the period of susceptibility. Benomyl is also effective in controlling citrus black spot. This product is no longer available on the market, but other products from that group such as carbendazim or thiophanate methyl are also effective. Removal of dead leaves in groves reduces inoculum potential and is an effective practice. Long distance spread of citrus black spot occurs via infected nursery stock, and steps to avoid movement of infected trees help limit spread of the disease to new areas. Little effort has been made toward developing varieties with tolerance or resistance to citrus black spot. Cooperative interactions with scientists in countries where citrus black spot is a significant problem will greatly increase our understanding on the nature of the disease and its management.

### What Can Growers Do?

Black spot is a serious disease of citrus and affects all citrus cultivars important in Florida. Given that the climatic conditions are highly suited for establishment of the pathogen, black spot could have serious economic impact on citrus production if introduced into Florida. Preventing citrus black spot from entering Florida is much easier than trying to eradicate or control it. It is important to avoid bringing propagation materials from black spot-infected areas to Florida. Any citrus propagating materials must be introduced through the Florida Department of Agricultural and Consumer Services, Division of Plant Industry to ensure they are free of citrus black spot.

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