Figure 1. Bark cracking can occur with or without ooze.

Emerging trunk disorders

By Evan Johnson and Megan Dewdney

The last two years have seen increasing grower questions and reports of citrus trunk disorders in Florida. Sometimes these reports are associated with sudden tree collapse. In many cases, phytophthora foot rot is initially suspected. Typically, the symptoms don't quite match those of foot rot, and phytophthora cannot be isolated from the lesion. If *Phytophthora spp.* are present in the soil, they are well below damaging levels when sampled.

This leads to multiple questions. Are all these trunk disorders similar? Why are they suddenly emerging now? What are the causes and how do we manage them? These questions are under active investigation.

So far, three main types of trunk disorders have cropped up with distinct symptoms.

BARK CRACKING

The first disorder was observed after a grower call in 2018. There was bark cracking and partial healing on the trunk near the soil line. The first few trees were right next to the pumphouse and showed some possible gumming or ooze, but further scouting through the grove showed this to be the exception (Figure 1).

Oddly, the cracking was mostly isolated to the rootstock and rarely spread above the graft union. It generally occurs on the side of the trunk opposite the microjet, but in other instances it was more uniform around the trunk. This bark cracking tends to appear three to four years after planting but has been observed on older trees in some groves. Its occurrence does not match known rootstock susceptibility to pathological problems.

Researchers are currently trying to determine if these symptoms are caused by an unknown pathological agent, are early symptoms of the fungal disease discussed later in this article or are growth cracks from the intensive horticultural management used to mitigate HLB. If it turns out to be growth cracks, this is still a concern because cracks may leave the tree open to infection by phytophthora or opportunistic pathogens.

ADVENTITIOUS ROOTS AND BARK NECROSIS

A second recent trunk disorder symptom involves adventitious root formation followed by bark dieback (Figure 2, page 12). Once the bark dieback occurs, the adventitious roots lowest on the remaining live bark rapidly grow. This has only been observed on young trees less than two years after planting, but it has been observed on up to 30 percent of some plantings.

White fungal mycelium on the dead bark and purple staining of the wood have been observed, but this is likely secondary as it is not a consistent fungus and is only present after bark necrosis (death).

The cause of the bark necrosis is unclear. The two most probable causes are phytotoxicity from improper use

Figure 2. Bark necrosis and adventitious roots have been found on young trees less than two years after planting.

of pesticides, in particular herbicides, on new plantings or improper trunk wrap installation. If a wrap tightens around the trunk when the caliper increases and it is even slightly buried into the soil, it can suffocate the young bark and lead to necrosis. This worsens when the inside of the plastic wrap is smooth, because it forms a better seal and restricts air flow.

Neither possibility has been conclusively linked, but if either is the cause, a few simple actions can be taken to reduce risk. Always read pesticide labels carefully, especially when treating young trees because there are often special notes. For tree wraps, make sure they remain loose on the trunk to allow for air movement. If the tree wrap has a grooved and a smooth side, ensure the grooved side is inward to allow air movement even if the trunk expands. Be sure to loosen or remove the trunk wraps before the trunk grows into them.

KRETZSCHMARIA DUESTA

The third trunk disorder has been observed at multiple sites since last December and can be directly linked to a fungal pathogen. In most cases, the grower notices the problem when a tree that looked healthy a week before suddenly collapses, dropping all its leaves and leaving behind bright orange fruit if it is of bearing age.

The symptoms can be reminiscent of tristeza quick decline, except that a fungal stroma, or visible fungal mass, forms a collar around the trunk at the soil line (Figure 3, page 13). The fungal stroma is often visible prior to tree collapse, but it is uncertain if it always develops before collapse.

The wood of the structural roots immediately below the trunk will be soft and spongy and is easily cut with a shovel. This disease is caused by the fungus *Kretzschmaria duesta* that feeds on the lignin and cellulose in the wood. When cutting through the trunk, thin black lines are likely to be seen in the wood (Figure 3, page 13).

The canopy will continue to look healthy until the damage is enough to prevent water transport and the tree collapses. This is considered an uncommon disease in citrus called ustulina root rot, named after a previous name of the fungus. The pathogen can infect many different tree species from cold temperate to tropical climates and is usually considered an urban tree disease because it tends to attack weak and stressed trees. In the past, it was associated with citrus planted on land previously occupied by or near infected oak trees.

There are instances when the fungus is recorded to be transmitted by root grafting. The spores can also move through the air, but very little is known about its epidemiology.

The recent emergence of this disease in multiple groves and in one case at high incidence (visible on approximately 20 percent of the trees) raises questions as to what has changed to make it more common. It is possible that an environmental event a few years ago increased tree susceptibility, and the disease will fade into rarity again.

The stress HLB causes to the tree might make the tree more susceptible to initial infection. It is also possible that the intensive horticultural management, especially of young trees, is pushing the trees to grow so fast that it weakens their physical barriers to infection (e.g., possible growth cracks).

K. duesta survives in old root material after tree removal, so it is advised to remove as much of an infected tree's root system as possible to reduce inoculum for neighboring trees and replants. Care should be taken not to move soil from the location to prevent spread to other trees in the grove.

If a case is seen, it would be worth scouting for more fungal stromas on the trunks of other trees in the grove to determine the extent of the problem. At this time, it is uncertain if a preventive treatment could be done. Once infection is observed on a tree, the tree is likely too damaged for chemical treatment to be useful, even if an effective treatment was known. The affected trees should be removed quickly as it is suspected they are inoculum sources for nearby trees.

One factor to consider when replanting is rootstock. Historical reports indicate sour orange and Swingle are highly susceptible and should be avoided when replanting an infected tree site. Susceptibility of other rootstocks is not known at this time.

As growers continue to adapt to citrus production with HLB and alter horticultural practices to mitigate HLB damage, they need to be aware that new problems may appear that are favored by these new conditions. The sooner a problem can be identified, the faster its cause can be understood, and management strategies developed. Observant eyes and open communication are key to identifying and developing management tools for these emerging problems.

It should be noted that phytophthora foot rot is still an important problem in Florida groves. Because it is known and manageable, it should be ruled out as a problem before considering these other trunk disorders. If you are concerned you may have one of these disorders, contact your local Extension agent or specialist.

Evan Johnson is a research assistant scientist and Megan Dewdney is an associate professor, both at the University of Florida Institute of Food and Agricultural Sciences Citrus Research and Education Center in Lake Alfred.

Figure 3. *Kretzschmaria duesta* causes tree collapse, visible fungal stroma and black lines in the wood.