Broken Branches
Brown heartwood rot of citrus

At first it just looks like a dead branch. But what’s that brown streak running down the center of the wood inside? It’s a fungus, Coniophora eremophila, and it’s slowly killing your citrus tree.

Brown heartwood rot of citrus is native to Arizona; it has been identified on the dead wood of many common Sonoran Desert plants, including ironwood, desert-willow, saguaro cacti, Arizona black walnut, jumping cholla, velvet mesquite, point-leaf manzanita, and others. The fungus sporulates on the fallen dead wood of some of these plants, and is carried into citrus orchards by wind, where the spores enter the wounds in cracked or broken limbs.

“At first, one branch will appear to be affected,” says Michael Matheron, a plant pathologist at the Yuma Agricultural Center, Mesa Station. “It falls off, followed by another, and another, until the tree becomes a stump.” The rot is a serious problem for many citrus growers in Yuma. The disease has also been detected in Phoenix, Lake Havasu City, and the Coachella Valley in California.

“Lemon trees are showing the most serious effects,” Matheron says. “The disease is most evident in Yuma County where a 1992 survey of orchards revealed that 30% of lemon trees 27 to 30 years old were infected.” The fungus attacks mature trees reaching the end of their useful life, which in Yuma happens to be 30 to 35 years. The disease reduces yields as the branches fall off.

Matheron has been working with Donna Bigelow and R.L. Gilbertson, UA plant pathologists, to find out how the fungus grows and spreads and to develop guidelines growers can follow to manage the disease in their orchards.

“The tree shows no signs of the fungus to the naked eye,” Matheron warns. “It just looks like brown tissue. But if you culture it out, it will grow on an agar plate.” UA laboratory studies showed that the fungus favors temperatures of the low desert. It’s most active at 86 to 104 degrees Fahrenheit, (30 to 40 degrees Celsius).

The fungus does not sporulate on the dead heartwood, even though it’s spreading inside the tree. To infect another tree, spores must come from the outside. Because infected trees in an orchard cannot spread the disease, taking them out won’t help, unless a grower wants to plant something else in place of the declining tree.

In 1992 and 1993, Matheron inoculated selected old Lisbon lemon, Marsh grapefruit, Valencia orange and Orlando tangelo trees with the fungus by drilling a hole in a branch, inserting a wooden plug colonized with the fungus, and covering it with paraffin. After six to nine months, the branch was cut off and split open to reveal if the branch was infected. Twenty-five trees per orchard were inoculated, and they all developed the characteristic brown streaking of Coniophora eremophila.

“Of all the citrus tested, the fungus seemed to like the lemon best,” Matheron says. He found that the fungus grew rapidly — up to one foot during an eight month incubation.

The next question was, does the fungus develop equally in lemon branches of different ages? Although the scientists had already documented that the wounds from broken branches seemed to be more susceptible to the fungus, they also discovered that branch diameter made a difference. Younger branches with smaller diameters did not become as severely infected. In fact, pruning younger trees, a common orchard practice, appeared not to make the tree more susceptible.

“Our results should encourage the growers that their practice of pruning young trees doesn’t open the tree to infection,” Matheron says. “It doesn’t mean younger trees are immune; we have found it in isolated cases on younger trees. Even in older trees, the fungus seems to gain access to the tree through a stress fracture, possibly due to high winds during thunderstorms, or heavy fruit loads, not where a tree branch is actually cut off.”

What about controls for the fungus? The researchers recently tested four fungicides on fungus cultures in a laboratory. Later they again inoculated trees with the fungus-infected plugs, treated the trees with different fungicides, then harvested the branches to find out whether or not the disease had spread. Research on different lemon rootstocks showed no real difference in susceptibility to the fungus.

“Finding trees to inoculate became a problem, because once you inoculate these trees, they’re gone,” Matheron admits. “We ended up using the trees that were more derelict — one step behind the bulldozer.” Of everything they tried, Matheron says only one product worked — Nectec paste — and it’s not registered for food crops in the U.S. The paste is a combination of imazalil and propiconazole and some inert ingredients.

“The Nectec paste seemed to stop it dead in its tracks,” Matheron says. “All of the treatments with it reduced the growth of the inoculant, but it’s not likely that Nectec will be registered for tree fruits.” In addition to the Nectec paste and the fungicides, he also tried white tree paint, which wasn’t helpful.

Controlling the disease becomes more complex when multiple pathogens are involved. For example, nematodes and another fungus disease, phytophthora, might make a tree more susceptible to heartwood rot.

So what’s a grower to do? The scientists say 1) minimize limb breakage due to equipment, wind and fruit load, and 2) remove decayed branches immediately. Lemon branches break more than grapefruit and orange branches, Matheron notes. It might be better to grow a shorter lemon tree to reduce breakage.

“If you see the brown rot infection, cut the branch off. If the limb breaks at the main scaffold, it’s gone too far. A broken branch is the kind of environment that’s conducive to the introduction of spores,” he says. Growers should remove orchards at about 30 years if severely infected, but the time to pull the trees really depends on each grower.

“The bottom line is that as long as they can make more money from a tree than it takes to grow that tree for a year, they’ll keep it in,” Matheron says. “On the other hand, they might want to take declining trees out and replace them with young vigorous trees that could bear more fruit in a few years.”

— Susan McGinley