PP-215

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Fusarium Wilt of Canary Island Date Palm[1]

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Summary

- As the name implies, Fusarium wilt of Canary Island date palm is primarily observed on *Phoenix canariensis* (Canary Island date palm).
- The disease is caused by the fungus *Fusarium oxysporum* f. sp. *canariensis*.
- The leaf symptoms include a one-sided death, wherein the leaflets on only one side of the rachis are desiccated or dead. This is often accompanied by a reddish-brown or dark-brown streak on the petiole and rachis on the same side as the desiccated or dead leaflets. Eventually, the entire leaf dies.
- The disease symptoms normally appear first on the oldest (lowest) living leaves, and then progressively move upward in the canopy until the palm is killed.
- The only other disease that these symptoms could be confused with is petiole/rachis blight.
- Transmission of the fungus from palm to palm is primarily by contaminated pruning tools.
- There is no cure for this lethal disease. Fungicides have not been effective against Fusarium wilt.
- Since there is no cure, disease management is aimed at disease prevention. A new hand saw or a disinfected pruning tool should be used for pruning leaves from each individual Canary Island date palm.
- A laboratory confirmation of Fusarium wilt, using molecular techniques, is strongly recommended for nursery situations.

Introduction

Unlike most fungal diseases of palms, this disease is very host specific, with the primary host being *Phoenix canariensis* (Canary Island date palm). It is caused by *Fusarium oxysporum* f. sp. *canariensis*. The name "Fusarium wilt of Canary Island date palm" was given to this disease to distinguish it from two other Fusarium wilt diseases that occur on palms, which are also very host specific. In Florida (and the U.S.), the name is often shortened to simply "Fusarium wilt."

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"Fusarium wilt of date palm" (also called Bayoud disease) only occurs on *Phoenix dactylifera*, and thus far is restricted to Morocco and Algeria. It is caused by *Fusarium oxysporum* f. sp. *albedinis*. "Fusarium wilt of oil palm" only occurs on *Elaeis guineenis* and *Elaeis oleifera*, and thus far is restricted to countries in Central Africa and South America. It is caused by *Fusarium oxysporum* f. sp. *elaeidis*.

Pathogen and Hosts

Fusarium wilt of Canary Island date palm is caused by the fungus *Fusarium oxysporum* f. sp. *canariensis*. It was first documented in the U.S. in the 1970s in California, but was not documented in Florida until 1994. The disease has been observed in Australia, France, Greece, Italy and Japan.

This fungus causes a vascular wilt of the palm. Specifically, it obstructs the xylem (water-conducting) tissue, which results in the symptoms of desiccation and death described below.

The fungus produces short-lived spores (macroconidia and microconidia). It also produces chlamydospores, spores that will live in the soil and plant tissue for long time periods (usually years). Because most of the root system is left behind after a palm dies from this disease, this mass of roots may act as a reservoir for the fungus for long time periods.

Experimental and observational evidence suggests that other *Phoenix* species may be susceptible to this fungus, including *Phoenix dactylifera* (date palm), *Phoenix reclinata* (Senegal date palm), and *Phoenix sylvestris* (wild date palm), but not *Phoenix roebelenii* (pygmy date palm).

The disease has also been noted on *Washingtonia filifera* (California fan palm) in one location each in California and Australia. Both these sites had previously contained diseased Canary Island date palms that died from Fusarium wilt. However, the field diagnosis of Fusarium wilt-like symptoms on *Washingtonia robusta* (Mexican fan palm), a palm commonly grown throughout Florida, can probably be attributed to petiole/rachis blight. See the fact sheet on this disease at http://edis.ifas.ufl.edu/pp145.

From 1999 through 2004, the Florida Extension Plant Disease Clinic reported 71 palm samples positive for *Fusarium oxysporum* f. sp. *canariensis*. Of these, 56 were *Phoenix canariensis*, 4 were *Phoenix dactylifera*, 1 was a *Phoenix sylvestris*, 5 were unidentified *Phoenix* spp., 4 were palms of unknown genera (information not provided when sample submitted), and 1 was a *Washingtonia robusta*. Thus, in Florida, as for most of the world, the vast majority of palms diagnosed with Fusarium wilt have been *Phoenix canariensis*.

Palm Anatomy

To understand the symptoms described below, the terminology regarding palm anatomy must be defined. *Phoenix* species are an example of a pinnate or feather-leaf palm. The entire leaf is often called a frond. The leaf consists of a blade, a petiole and a leaf base. The leaf base is the broad section that attaches to the trunk. The petiole is the “stem” of the leaf from the leaf base to the point where leaflets begin to attach to it. On a feather-leaf palm, the extension of the petiole into the leaf blade where all the leaflets attach is called the rachis. The leaflets are often referred to as pinnae.

Symptoms

Although the name “Fusarium wilt” implies that the primary symptom will be a wilt, vascular wilts in palms do not cause wilt symptoms. Instead, they cause leaf desiccation and leaf death symptoms. As with any disease, a progression of symptoms is observed with Fusarium wilt. Initial symptoms normally occur on the lowest (oldest) living leaves. Leaflets, either all of them or only a portion, on only one side of the rachis will be discolored, usually a shade of brown due to desiccation or death. The leaflets on the opposite side of the rachis will be healthy. This very distinctive symptom is often referred to as a “one-sided wilt” or “one-sided death” (Figure 1). Eventually, the leaflets on the other side of the rachis will turn brown also, and the entire leaf dies.

A reddish-brown or dark-brown streak or stripe will be observed on the petiole and rachis of the affected frond, initially on the same side where the first dead leaflets appeared, and usually beginning at

Figure 1. One-sided death of leaflets is typical of Fusarium wilt. Credits: T.K. Broschat

Figure 2. Reddish-brown stripe on leaf petiole is on same side that exhibited one-sided death of leaflets due to Fusarium wilt. Credits: N.A. Harrison

Figure 3. Longitudinal section of petiole illustrates the vascular discoloration due to infestation of xylem tissue by *Fusarium oxysporum* f. sp. *canariensis*. Credits: G.W. Simone

or near the leaf base (Figure 2). This streak may run the full length of the petiole and rachis, or just a portion of it. Internal discoloration will be observed in both cross-sections and longitudinal sections of the discolored petiole and rachis (Figure 3). This internal discoloration is due to the fungus infesting the xylem tissue.

The disease symptoms normally begin on the lowest (oldest) leaves and then move up the canopy, progressively killing younger and younger leaves (Figure 4). The palm may die relatively quickly (within months) or linger for a couple of years. The reasons for this disparity is not known.

Possible variations in symptoms include the disease initially starting mid-canopy rather than at the bottom of the canopy. For some leaves, the leaflets may begin turning brown at the leaf tip and on both sides at once, rather than just on one side. It has also been noted that the presence of palm weevils in the bud of Fusarium wilt-stressed palms hasten the decline of the palm, and may complicate determining the cause of the palm's decline.

Diagnosis

Field diagnosis can often be made based on the symptoms described above, especially if the symptoms are typical ones. The only other disease Fusarium wilt of Canary Island date palm might be confused with is petiole/rachis blight. The latter is not a true vascular wilt and usually does not kill the palm, but the resulting individual leaf symptoms can be very similar on a *Phoenix* species. See the fact sheet on this disease at http://edis.ifas.ufl.edu/pp145.

While a molecular laboratory diagnosis to confirm the field diagnosis may not be a necessary

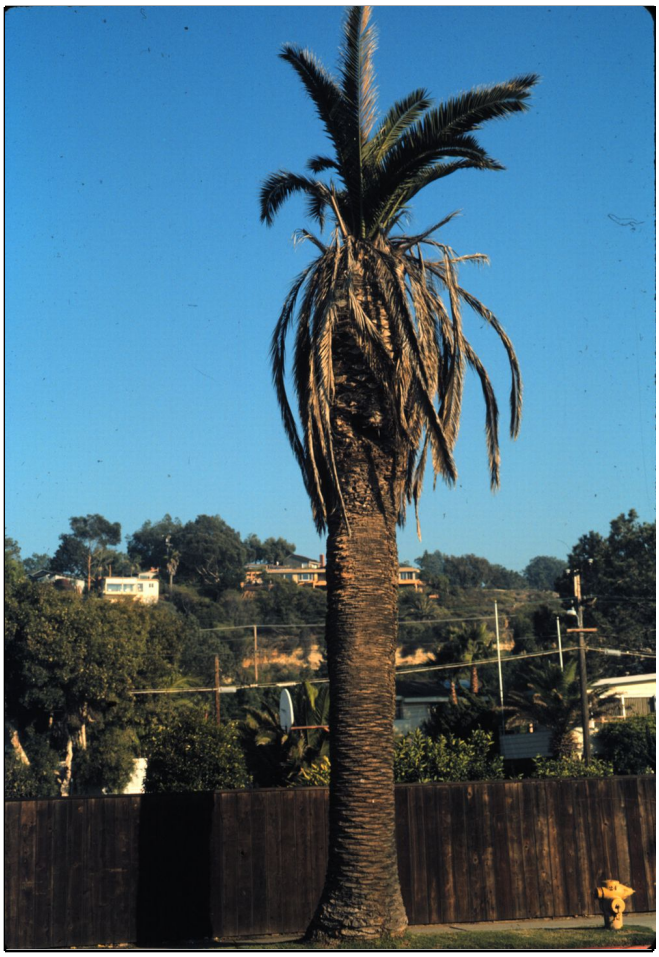

Figure 4. Progressive death of leaves up through the canopy due to Fusarium wilt. Note that the right side of the upright leaf at top of canopy is exhibiting the one-sided death of leaflets typical of Fusarium wilt. Credits: T.K. Broschat

expense for a landscape situation, it is critical if the disease symptoms are occurring in a palm nursery. To confirm the field diagnosis, a laboratory must isolate the pathogen from the affected leaf tissue and then conduct a molecular test on the isolated culture. Currently, only the Florida Extension Plant Disease Clinic in Gainesville conducts this molecular test. Contact your local county Extension office or the Clinic for complete details on correct sample submission procedures and cost of a laboratory diagnosis.

Molecular confirmation of the isolated fungus is critical. There are numerous *Fusarium oxysporum* isolates that do not cause disease, but may be associated with palm material. Unfortunately, it is not possible to separate pathogenic isolates from non-pathogenic isolates based on their appearance in culture. Thus, isolation of a fungus that looks like *F. oxysporum* does not confirm the field diagnosis. The fungus growing on the culture plate is then subjected to a molecular test that is specific for *F. oxysporum* f. sp. *canariensis*.

If the field symptoms appear typical for Fusarium wilt, but the molecular test results are negative, then there are two things to consider. First, the symptoms may not be an expression of Fusarium wilt, but may be an expression of petiole/rachis blight. Many of the petiole/rachis blight pathogens are not culturable from plant tissue. Second, the symptoms may be an expression of Fusarium wilt, but a false negative was obtained from the molecular test. No diagnostic test is perfect every time.

The next step would be to obtain new samples from the diseased palm or similarly diseased palm and resubmit to the Clinic for the molecular test for *F. oxysporum* f. sp. *canariensis* and to confirm presence or absence of petiole/rachis blight pathogens. Be sure to discuss the problem with the clinic staff before resubmitting samples. If no symptomatic leaves are available, wait until new symptoms develop before resubmitting.

Disease Management

There are no cures for this disease. Fungicides have been evaluated, but none have been effective. Disease management is based solely on disease prevention.

The fungus is moved between distant locations by plant material, both live plants and probably seed. This is probably how the disease was first introduced (and re-introduced) into Florida. Unpublished research from both Florida and Australia have demonstrated the fungus can colonize palm seeds. This makes it critical for palm nurseries to know that their seed source and stock plants are coming from a disease-free source. Likewise, nursery growers, landscape architects and installation companies should examine and select Canary Island date palms while they are still in the field or on site at a container nursery *and* make this inspection *prior* to any trimming of older leaves so the plants can be inspected for symptoms. Then, either monitor the trimming of these palms to ensure they are trimmed

correctly, or trim them at the installation site using the correct procedure discussed below.

Once the disease is established in a landscape or nursery, the disease appears to primarily be transmitted from palm to palm via leaf pruning equipment (Figure 5). The fungal pathogen is in the vascular tissue of the leaf. Equipment used to remove leaves from an infected Canary Island date palm (chain saw, lopper, pruning shear, hand saw, etc.) will have fungal-infested leaf material (wood dust, plant sap) on the blades. If that equipment is not cleaned and disinfected, the next Canary Island date palm (and perhaps other *Phoenix* species) pruned by this equipment will be exposed to this fungal-infested leaf material.

It is important to note that a palm could be infected but appear healthy (symptomless) because the disease has not developed to the point that leaf symptoms are being expressed. Unfortuantely, we do not know how long this infected but symptomless stage of the disease lasts. It could be 6 to 18 months. Thus, the fungus could *still* be moved from palm to palm by pruning infected but symptomless leaves!

This means Canary Island date palms should be pruned with either new handsaws or clean, disinfected tools – both in the landscape and nursery. This applies to *all* Canary Island date palms, diseased and healthy. **Either a new handsaw or a clean, disinfected pruning tool should be used for each individual palm.** Pruning should be limited to once each year. Furthermore, pruning should be restricted to removal of *only* dead or dying leaves. Severe pruning, such as “hurricane cuts” or “pineapple cuts,” weakens trees and increases the risk of pathogen transmission. Pruning should be viewed as a risk factor for Fusarium wilt disease transmission, and not as a benefit to the Canary Island date palm.

Table 1 is a list of materials that can be used as disinfecting agents. Brush the tool blades clean of debris before placing in the disinfectant solution. For chain saws, it is recommended that they be taken apart and both the chain and bar soaked. By having multiple pruning tools, one tool can be soaking in the disinfectant solution while the other tool is used for pruning. The disinfectant solution should be replaced at least every ten trees or every two hours. Rinse tools with clean water before pruning.

The following is a management suggestion. For the initial installation of a Canary Island date palm, it is normal to remove a large number of fronds. Using a handsaw would be time consuming. So, either use a new chainsaw or disinfect the chainsaw between each palm. Thereafter, the number of leaves pruned should be limited as only dead leaves should be removed. This can be accomplished with a new handsaw for each palm.

While this is an extraordinary measure, it is inexpensive disease prevention management for extremely valuable palms. A mature Canary Island date palm that has died from Fusarium wilt is expensive to remove and expensive to replace. It is certainly more economical to prevent the disease than deal with the deadly consequences, especially if there are multiple Canary Island date palms in the landscape (Figure 5). Using a new handsaw or disinfecting the pruning tool is inexpensive in comparison to a devastated landscape.

Figure 5. Multiple *Phoenix canariensis* dying from Fusarium wilt. The disease is moved from palm to palm by infested pruning tools. Credits: H.M. Donselman

Again, this is a disease without a cure. In a nursery situation, diagnosis of this disease effectively destroys the crop as the plants are unsaleable and must be destroyed. In the landscape situation, the palm will eventually die and have to be removed. In both situations, but especially the nursery situation, the diseased palm(s) should be removed and destroyed immediately. Be very careful not to distribute potentially fungal-infested soil or potting

mix in the nursery. Surrounding Canary Island date palms should be monitored closely, as it is quite likely the entire crop could be infected.

The diseased palm should be incinerated or placed in a landfill. If this is not possible (as is the case in many Florida counties), then be sure the palm is not chipped and recycled for mulch in the landscape. Instead, chipped material should be placed in a compost pile. Chain saws and other tools used for removal must be brushed free of plant material and disinfected as described previously.

Chlamydospores of *Fusarium oxysporum* f. sp. *canariensis* can survive for long periods in the soil, and certainly will survive in any infected root mass left behind when a diseased palm is removed. Experimental and observational evidence has shown the potential for infecting palms, especially seedling palms, with this fungus via the root system. Therefore, it would not be prudent to plant a Canary Island date palm back into a site where Fusarium wilt had killed the previous palm(s). It is not known how far away from the potentially fungal-infested site one must move before it is safe to plant a Canary Island date palm, or other potentially susceptible *Phoenix* species.

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Table 1. Suggested materials and soaking times for disinfecting pruning tools.

Material[z]	% Solution	Soaking time
Household bleach (ex: Chlorox)	25% (1 part bleach + 3 parts water)	5 minutes minimum
Pine oil cleaner (ex: Pine Sol)	25% (1 part cleaner + 3 parts water)	5 minutes minimum
Rubbing alcohol (70% isopropyl)	50% (1 part alcohol + 1 part water)	5 minutes minimum
Denatured ethanol (95%)	50% (1 part alcohol + 1 part water)	5 minutes minimum

[z]The above materials were shown to be effective in eliminating the fungus from the wood dust or palm sap trapped on pruning tools (Simone, 1998). It is suggested that the solution be replaced after ten trees or every two hours. Rinse the tool with fresh water after soaking. Other potential disinfectants would be trisodium phosphate or quaternary ammonium salts. The latter is recommended at a 5% solution, soaking for 5 minutes (Smith et al., 2003).