

Fusarium Wilt of Queen Palm and Mexican Fan Palm¹

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Summary

- As the name implies, Fusarium wilt of queen palm and Mexican fan palm is primarily observed on *Syagrus romanzoffiana* (queen palm) and *Washingtonia robusta* (Mexican fan palm or Washington palm). When this disease first appeared, it was called "Fusarium decline." That disease name is no longer valid.
- The disease is caused by the fungus *Fusarium oxysporum* f. sp. *palmarum*.
- This disease is similar to Fusarium wilt of Canary Island date palm, but the pathogen subspecies and host range are different.
- The leaf symptoms include a one-sided chlorosis (yellowing) or necrosis (brown due to death) of the leaf blades, with a distinct reddish brown or dark brown stripe on the petiole and rachis. The internal petiole and rachis tissue is discolored. 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. Palms often die two to three months after initial symptoms are observed. Due to the quick decline, the necrotic leaves do not droop or break and bend down around the trunk, but remain relatively rigid (as if freeze-dried).
- The only other disease that the leaf symptoms could be confused with is petiole (rachis) blight.
- It is not known exactly how the fungus spreads so widely in the landscape, but wind-blown spores are strongly suspected as a primary method. Local transmission of the fungus from palm to palm is possibly caused by contaminated pruning tools.
- There currently is no cure for this lethal disease.
- Laboratory confirmation of this Fusarium wilt pathogen requires molecular techniques.

Introduction

Fusarium wilt is very host specific, with the primary hosts being *Syagrus romanzoffiana* (queen palm) and *Washingtonia robusta* (Mexican fan palm or Washington palm). It is caused by *Fusarium oxysporum* f. sp. *palmarum*. When this disease was first observed, it was referred to as "Fusarium decline." However, now that the exact pathogen is known, the more correct disease name is "Fusarium wilt." The full name of "Fusarium wilt of queen palm

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and Mexican fan palm" was given to this disease to distinguish it from three other *Fusarium* wilt diseases that occur on palms, which are also very host specific.

Fusarium wilt of Canary Island date palm primarily occurs on *Phoenix canariensis*. It is caused by *F. oxysporum* f. sp. *canariensis* (note the different subspecies name). This disease is well established throughout Florida. *Fusarium* wilt of date palm, also called Bayoud disease, only occurs on *Phoenix dactylifera*, primarily in the North African countries of Morocco and Algeria. It is caused by *F. oxysporum* f. sp. *albedinis*. *Fusarium* wilt of oil palm only occurs on *Elaeis guineensis* and thus far is restricted to Central Africa and very localized areas of South America. It is caused by *F. oxysporum* f. sp. *elaeidis*.

Pathogen and Hosts

Fusarium wilt of queen palm and Mexican fan palm is caused by the fungus *F. oxysporum* f. sp. *palmarum*. The fungus causes a vascular wilt of the palm. Specifically, it obstructs the xylem (water-conducting) tissue, which results in the symptoms of leaf desiccation and death described below.

The fungus produces short-lived spores (macroconidia and microconidia). It also produces spores called chlamydospores that live in the soil and plant tissue for long time periods (usually years).

The primary hosts of the pathogen are *Syagrus romanzoffiana* (queen palm) and *Washingtonia robusta* (Mexican fan palm or Washington palm). Experimental and observational evidence suggests that the so-called "mule" palm, a cross between *Syagrus romanzoffiana* and *Butia capitata*, is also susceptible to this disease.

Thus far, the disease has only been documented in Florida, and it is widespread throughout most of the state. Affected palm trees have been observed mostly in mature landscapes. However, the disease has been observed on juvenile palms (palms without trunks) in a few nurseries. Because the diseased palms decline so quickly, the diseased nursery palms are often not marketable.

Symptoms

As with most diseases, *Fusarium* wilt symptoms are progressive. For queen palms, there will be at least one leaf with some or all leaflets discolored on only one side of the rachis. The leaflets will be either chlorotic (shades of yellow) or, more often, a shade of brown due to desiccation or death. The leaflets on the opposite side of the rachis will be a healthy green color (Figures 1 and 2). This very distinctive symptom is often referred to as "one-sided wilt" or "one-sided death." A reddish brown or dark brown stripe will be visible on the petiole and rachis of the affected frond, on the same side where the first dead leaflets appear. This streak may run the full length of the petiole and rachis, or just a portion of it. Internal discoloration will be observed in cross sections of the discolored petiole and rachis (Figure 3). Eventually, the leaflets on the other side of the rachis will turn brown and the entire leaf will die.



Figure 1. Beginning leaf symptoms of *Fusarium* wilt: The lowest leaflets on the left side of this queen palm leaf are beginning to die, and there is a reddish brown stripe moving from the petiole into the rachis.



Figure 2. Over half of the leaflets on this queen palm leaf have died or are dying, and there is a reddish brown stripe along the entire left side.



Figure 3. This cross section of an affected leaf petiole/rachis illustrates internal discoloration due to fungal infection.

For Mexican fan palms, there will be at least one older leaf with a mixture of healthy, chlorotic, and necrotic leaflet segments in the leaf blade. As with the queen palm, there will be a reddish brown or dark brown stripe on the petiole, with a corresponding internal discoloration in the cross section (Figure 4).

For both hosts, the disease symptoms normally begin on the lowest (oldest) leaves and move up the canopy, progressively killing younger and younger leaves. The spear leaf is the last leaf to die. Death



Figure 4. This Mexican fan palm leaf blade has half green and half dead or dying leaf segments. Note the reddish brown stripe on the petiole; it is on the same side as the dying leaf segments in the blade.

from Fusarium wilt occurs very quickly, with palms often dying within two to three months after initial symptom development. Due to the quick decline, a very characteristic symptom of this disease is the overall canopy appearance. The necrotic leaves do not droop or break and bend down around the trunk, but remain relatively rigid (Figures 5, 6, and 7).



Figure 5. Queen palm exhibiting typical late-stage symptoms of Fusarium wilt. The entire canopy is necrotic, but leaves are not drooping or hanging down around the trunk. (Reproduced by permission of Brooke Burn, UF/IFAS Extension)



Figure 6. Queen palm exhibiting typical late-stage symptoms of Fusarium wilt. The entire canopy is necrotic, but only a few leaves are hanging down around the trunk.



Figure 7. Mexican fan palm exhibiting typical symptoms of Fusarium wilt. Over half of the leaves have died, all in the lowest part of the canopy. The dying leaves have reddish brown stripes on the petiole.

Diagnosis

Field diagnosis can often be made based on the symptoms described above, especially if the symptoms are typical. No other fungal disease kills the entire palm canopy so quickly. The only other disease Fusarium wilt might be confused with, especially in Mexican fan palms, is petiole (rachis) blight (<http://edis.ifas.ufl.edu/pp145>). The latter is not a true vascular wilt, but the resulting leaf

symptoms of petiole (rachis) blight can be very similar to the initial symptoms of Fusarium wilt on Mexican fan palms. However, palms seldom die from petiole (rachis) blight.

Another disease that can kill queen palms is Texas Phoenix palm decline (<http://edis.ifas.ufl.edu/pp163>). However, the spear leaf (the youngest leaf that has not expanded) dies very early in the disease process if Texas Phoenix palm decline is the problem, whereas the spear leaf is the last leaf to die if Fusarium wilt is the problem.

Ganoderma butt rot (<http://edis.ifas.ufl.edu/pp100>) will cause palm canopies to die from the bottom to the top, but this is usually a slower process than what is observed in Fusarium wilt, and the canopy will not include leaves with the one-sided death typical of Fusarium wilt.

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. There are numerous *F. oxysporum* isolates that do not cause disease, but that are still associated with palm material. Unfortunately, it is not possible to separate pathogenic isolates from nonpathogenic 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 can confirm if the fungus is *F. oxysporum* f. sp. *palmarum*.

Contact a local county Extension office (<http://solutionsforyourlife.ufl.edu/map/index.html>) or the Florida Extension Plant Disease Clinic (<http://plantpath.ifas.ufl.edu/pdc/default.htm>) for complete details on correct sample submission procedures and cost of a laboratory diagnosis. The best leaf to sample is one where half the leaf is still green and the distinctive reddish brown or dark brown stripe is present on the petiole/rachis (see Figures 1, 2, and 4), and where there is internal discoloration of the petiole/rachis (see Figure 3). Do *not* place the leaf in plastic. Place the sample in a paper bag for hand delivery or a cardboard box for shipping.

Disease Management

Once the palm is affected by this disease, there is no cure. Currently, there is no method for preventing this disease, either. Based on observations in Florida, the pathogen appears to be spread primarily by airborne spores (conidia) moved by wind, and possibly birds or insects.

Once the disease is established in a landscape or nursery, it is thought that the disease may be transmitted from palm to palm via leaf-pruning equipment. The fungal pathogen is located in the vascular tissue of the leaf. Equipment used to remove leaves from an infected queen palm or Mexican fan palm (chain saw, lopper, pruning shear, hand saw, etc.) will have fungus-infested leaf material (wood dust, plant sap) remaining on the blades. If equipment is not cleaned and disinfected, the next queen palm or Mexican fan palm pruned by this equipment will be exposed to fungus-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.

Pruning should be restricted to removal of dead or dying leaves *only*. Severe pruning weakens palms and may increase 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 palm.

Table 1 provides a list of suggested 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 using 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 10 trees or every 2 hours. Rinse tools with clean water before pruning.

Again, this is a disease without a cure. In a nursery situation, diagnosis of this disease effectively destroys the crop, as the plants are not marketable and must be destroyed. In a landscape situation, the palm will eventually die and have to be removed. In

both situations, the diseased palm(s) should be removed and destroyed immediately.

As long as the disease is restricted to the canopy and has not moved into the trunk, only the diseased canopy should be incinerated, placed in a landfill or composted properly. If this is not possible (as is the case in many Florida counties), then be sure the palm canopy is not chipped for mulch in the landscape. Chain saws and other tools used for removal must be brushed free of plant material and disinfected as described previously. If the trunk is clean (no signs of discoloration), it could be chipped and recycled as mulch. Stumps should be ground or removed to prevent colonization by the fungus that causes Ganoderma butt rot (<http://edis.ifas.ufl.edu/pp100>).

Based on other Fusarium wilt diseases of palms, it is recommended that a queen palm or Mexican fan palm not be planted back into a site where one of these species has died from Fusarium wilt.

Selected References

- Elliott, M. L., E. A. Des Jardin, K. O'Donnell, D. M. Geiser, N. A. Harrison, and T. K. Broschat. 2010. *Fusarium oxysporum* f. sp. *palmarum*, a novel forma specialis causing a lethal disease of *Syagrus romanzoffiana* and *Washingtonia robusta* in Florida. *Plant Disease* 94:31-38.
- Simone, G. W. 1998. *Prevention and management of palm diseases in Florida's landscapes*. Plant Pathology Mimeo 98-4. Gainesville: University of Florida Institute of Food and Agricultural Sciences.
- Smith, D. I., I. W. Smith, and P. Clements. 2003. *Fusarium wilt of Canary Island date palm*. Forests Fact Sheet. Victoria, Australia: Department of Sustainability and Environment.

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

Material	Percent solution	Soaking time
Household bleach (e.g., Chlorox [®])	25% (1 part bleach + 3 parts water)	5–10 minutes
Pine oil cleaner (e.g., Pine Sol [®])	25% (1 part cleaner + 3 parts water)	5–10 minutes
Rubbing alcohol (70% isopropyl)	50% (1 part alcohol + 1 part water)	5–10 minutes
Denatured ethanol (95%)	50% (1 part alcohol + 1 part water)	5–10 minutes

Note: The above materials were shown to be effective in eliminating *F. oxysporum* from the wood dust or palm sap trapped on pruning tools (Simone 1998). It is suggested that the solution be replaced after 10 trees or every 2 hours. Rinse the tool with fresh water after disinfecting. Other potential disinfectants are trisodium phosphate or quaternary ammonium salts. The latter is recommended at a 5% solution, soaking for 5 minutes (Smith, Smith, and Clements 2003).