

Bud Rots of Palm¹

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Summary

- There are many pathogens that can cause bud rots of palm in Florida. The most common one is *Phytophthora palmivora*, followed by *Thielaviopsis paradoxa* and bacteria.
- Symptoms of bud rot are similar no matter which pathogen causes the disease.
- The first symptom is discoloration of the spear leaf and wilting/discoloration of the next youngest leaf. If severe, the spear leaf will easily pull from the bud.
- In palms with a canopy above eye level, this first symptom is often missed. Instead, what is observed is a lack of new leaves being produced, and an open-topped crown. Because the bud is dead, no new leaves emerge. Older leaves remain healthy for months after the bud dies.
- Laboratory diagnosis is necessary to determine the pathogen responsible for symptoms.
- In a nursery, water management and sanitation are critical for *Phytophthora* bud rot and *Thielaviopsis* bud rot management.
- Preventive applications of fungicides are useful in a nursery situation for *Phytophthora* bud rot and *Thielaviopsis* bud rot, less so in a landscape with mature palms (palms with trunks).
- Bacterial bud rot is most often associated with cold damage. While unproven, bud drenches with copper-based pesticides are commonly used in an attempt to protect palm buds. The product must be applied at the time of the cold damage and not when symptoms are observed.

Introduction

To understand bud rots, we begin with an explanation of palm anatomy. The apical meristem is the growing point of the palm, and is often called the bud or heart. All leaves originate from the apical meristem. The youngest, unopened leaf (spear leaf) and the recently expanded leaves are coming from and attached to the bud. All forthcoming new leaves are being formed in the bud as the palm grows. Unlike broadleaf trees (e.g., oak, citrus) that have multiple apical meristems, each palm stem has only one apical meristem. Thus, when the bud (apical meristem) is damaged or diseased, the palm usually dies because growth ceases in the bud.

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The location of the bud, relative to the soil line, depends on the size of the palm. If the palm is still a juvenile, then the bud is at or near ground level, since a juvenile palm has no stem (trunk). A palm stem increases in diameter at ground level *before* elongating. Initially, the stem consists of little more than overlapping leaf bases protecting the apical meristem (bud). If the palm has a stem (trunk), then the bud will be above ground, protected by the oldest leaf bases.

Pathogens and Hosts

There are three pathogens that are the primary cause of palm bud rots in Florida – *Phytophthora palmivora*, *Thielaviopsis paradoxa*, and bacteria. The symptoms are similar no matter which pathogen causes the disease. Thus, a laboratory diagnosis is required to determine the exact cause of the symptoms observed.

Phytophthora

Phytophthora palmivora is the fungus most commonly associated with palm bud rots in Florida. This fungus is found worldwide in tropical, sub-tropical and warm temperate climates. It causes disease on numerous plants besides palms. Its host range within the palm family appears to be broad also. *Phytophthora* bud rot is observed in container nurseries, field nurseries and the landscape, in all stages of palm development.

The fungus produces three types of spores – sporangia that can be moved by wind or water, zoospores that are motile in water, and chlamydospores that are very long-lived in the soil. Free water is very important for the life cycle of this fungus, and a critical factor in disease development.

Thielaviopsis

Thielaviopsis paradoxa is a fungus that can also be found worldwide, and appears to have a broad host range within the palm family. Its “asexual” stage name has changed from *Thielaviopsis* to *Chalara* and, more recently, back to *Thielaviopsis*. It is this stage that is most often encountered. The fungus produces two different types of asexual spores, endoconidia and chlamydospores. The latter will survive for very long periods in the soil.

The fungus also has a “sexual” stage name of *Ceratocystis paradoxa*. This stage is rarely observed in natural settings. The fungus produces volatile substances, specifically ethyl acetate and ethyl alcohol, which often give the diseased tissue a fermented fruit odor. *Thielaviopsis* bud rot can occur in container nurseries, field nurseries and the landscape, in all stages of palm development. This fungus also causes a trunk rot of palms, but only on palms that have developed a significant trunk.

Bacteria

Various bacteria (probably *Erwinia* spp.) are associated with bud rots that occur when a palm is exposed to temperatures colder than which it is adapted. These bacteria are not primary pathogens. Rather, the disease results due to damage to the bud by the cold temperatures, followed by invasion of these bacteria.

Symptoms

Phytophthora and Thielaviopsis Bud Rots

The first symptom of a bud rot caused by these two fungal pathogens is the discoloration of the spear leaf (youngest, unopened leaf) and the wilting and discoloration of the next youngest leaves. The leaves will be a lighter green color than normal or chlorotic (yellow) (Figure 1). Eventually, these leaves become desiccated, turn brown and collapse. A close examination of the leaves, especially the spear leaf, often reveals blighted areas on the blade. The leaf base of these leaves often have distinct brown or necrotic (dead) areas. As the disease progresses, the spear leaf will be easily pulled from the bud, and the leaf base will be rotted and have a foul odor.

These symptoms occur because the pathogen has either infected the youngest leaves and then progressed down the leaves to the bud, or the pathogen has invaded the bud directly via a wound.

If the diseased palm is still in a container or small enough in the field or landscape that the top of the canopy is still at eye level or below, the wilting and discoloration of the youngest leaves will be the first symptoms observed. However, if the palm is so large that the canopy is above eye level, then the first



Figure 1. Spear leaf and next youngest leaf exhibiting typical symptoms of *Phytophthora* bud rot. Credits: T.K. Broschat

symptom observed is usually the lack of new leaves being produced, especially the spear leaf, and an open-topped crown (Figure 2). The diseased palm did go through the discoloration and wilting of the youngest leaves, but you may have missed seeing that symptom.

No new leaves emerge from the bud because the bud is already dead. However, the leaves that were already present prior to infection of the bud by the pathogen will remain green, appear healthy and remain attached to the trunk for many months. Eventually, the disease will encompass the entire canopy, and all the leaves will become various shades of green, yellow and brown as they collapse (Figure 3).



Figure 2. Bud rot of *Cocos nucifera*: no new leaves are emerging and crown is open-topped, while older leaves in canopy look healthy at this time. Credits: M.L. Elliott

Bud rot caused by *Phytophthora* will be more likely to occur during the rainy season, and appears to occur with greater frequency after a tropical storm or



Figure 3. This is the same palm as shown in Figure 2, but six months later. Still no new leaves being produced and older leaves are now declining. Credits: M.L. Elliott

hurricane (Figure 4). Bud rots caused by *Thielaviopsis* do not appear to occur that frequently, and while the disease may be related to occurrence of tropical storms, it has been observed year round. In container nurseries, however, bud rots caused by *Phytophthora* and *Thielaviopsis* can occur at any time.



Figure 4. Multiple *Washingtonia robusta* in this field nursery are being affected by *Phytophthora* bud rot. Those most affected were juvenile palms in a low-lying area. Credits: T.K. Broschat

Bacterial Bud Rot

In Florida, bacterial bud rot is the secondary result of cold damage. It may be months before the disease is evident. The symptoms are similar to those caused by the fungal pathogens described above. The main difference is that the bacteria are restricted to the bud area. Thus, blighted areas are usually not observed on the spear leaf blade.

Diagnosis

Since all three pathogens cause similar symptoms, a laboratory diagnosis is required to determine the cause of the symptoms observed. This is especially critical if fungicides are used as part of a management program, as each pathogen requires a different group of active ingredients. The Florida Extension Plant Disease Clinic (FEPDC) network can provide this service. Contact your local county Extension office or FEPDC for details on sample submission and cost of a laboratory diagnosis. In general, the best sample is one with both healthy and diseased tissue. A sample of a completely rotted bud will make the diagnosis more difficult as secondary organisms will likely be present.

For container-grown or small, field nursery palms, the spear leaf and bud are readily accessible. For mature, tall palms in the landscape, the palm will need to be removed (cut down) in order to sample the bud, or the canopy accessed via a ladder or bucket truck. Be sure to provide pertinent information regarding environmental conditions that occurred prior to symptom development.

Disease Management

Phytophthora or Thielaviopsis Bud Rot

Cultural Control

In container nurseries and for juvenile palms in a field nursery, sanitation and water management are critical for these two diseases. Water is required for spore germination and infection. Rain and irrigation can splash spores from one plant to another. A flooded field also allows spores to move. Increasing distance between plants, increasing air movement and irrigating in the early morning hours to reduce leaf wetness at night are critical water management components. When possible, overhead irrigation should be eliminated.

Spores can also be moved by insects, snails and rodents, with infested potting mix and soil, or possibly by pruning tools. Pruning tools should be disinfected and palms trimmed carefully so as not to damage the bud or young leaves.

In general, severely diseased plants should be removed and destroyed immediately to limit spread of the pathogens. Potting mix of diseased container palms should be removed from the nursery. For mature palms, the diseased palm should be removed, and the canopy (including the bud) region destroyed. The lower trunk should be pathogen-free, so it would be acceptable to chip it and recycle in the landscape.

While the cultural controls described above are applicable for bud rots caused by both fungal pathogens, a laboratory diagnosis is required before fungicides are applied. This is because the fungicides used for *Phytophthora* are not effective against *Thielaviopsis*, and vice versa.

Fungicides for Juvenile Palms

For juvenile palms, bud drenches are appropriate since the bud is readily accessible. For bud rot caused by *Phytophthora*, products containing the active ingredients fosetyl-Al, mfenoxam or propamocarb are recommended. Propamocarb is for use in container nurseries only. For bud rot caused by *Thielaviopsis*, products containing the active ingredient thiophanate-methyl is recommended. If it is not clear from the laboratory diagnosis which pathogen is causing the disease, then mixtures of these products that conform to the label could be used. A product that is already a mixture of fungicides effective against both pathogens, for use on nursery crops only, is Banrot[®] (active ingredients etridiazole and thiophanate-methyl). As with the other fungicides, it should be applied as a bud drench. Etridiazole is a contact fungicide, whereas all the other fungicides listed are systemic fungicides. All fungicides must be used according to the label.

Unless bud rot is caught very early in a juvenile palm, the palm usually dies. The primary reason for applying a fungicide in a nursery situation is to prevent disease development on remaining palms. Nursery stock should be monitored closely at all times for bud rots, but especially after a tropical storm or prolonged periods of rainy weather. Preventive fungicide applications may be warranted in these environmental situations.

Fungicides for Mature Palms

Disease management of mature palms is more difficult. This is especially true of palms in the landscape or field nursery when the palms have trunks that are too tall to allow for an easy view of the bud and emerging leaves. Again, unless the bud rot is caught very early, the palm usually dies. If the spear leaf is missing and no new leaves are emerging or you can pull the spear from the bud, the palm should be removed immediately. It is only acting as a source of fungal spores for infecting the surrounding palms. Since the bud is already dead on these palms, no fungicides would be recommended.

While no research has been conducted on mature palms, fungicides may be useful as a preventive measure on palms in close proximity to a palm that has died from bud rot. For *Phytophthora* bud rot, a soil or bud drench with products containing the active ingredient mefenoxam may be effective, as may a bud drench with the active ingredient fosetyl-Al. For *Thielaviopsis* bud rot, a soil or bud drench with thiophanate-methyl may be effective as a preventive measure.

Bacterial Bud Rot

Since this problem primarily seems to occur when cold weather has damaged the bud, and it is impossible to determine if the bud has been damaged by cold weather, there are few management techniques available. While unproven, bud drenches with copper-based pesticides are commonly used in an attempt to protect palm buds. If such a product is used, it must be applied at the time of the cold damage, and not after symptoms develop.

Note, the copper-based product must be a pesticide. Copper products used for nutrient purposes may be phytotoxic when used in the same manner as a pesticide. Also, copper-based bactericide/fungicides containing copper sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) are often phytotoxic to palms unless the copper sulfate pentahydrate has been neutralized with an alkaline component (e.g., calcium hydroxide). Safer copper-based pesticides for palms contain the active ingredients copper hydroxide, copper oxychloride, or basic copper sulfate [$\text{CuSO}_4 \cdot 3\text{Cu}(\text{OH})_2$]. These are often

referred to as "fixed coppers." All pesticides must be used according to the label.

It has been observed that palms with bacterial bud rots sometimes recover if the bud has not been severely damaged. In other words, the disease stops developing before the bud is destroyed. In these situations, recovery will first appear as abnormally short leaves. Each successive new leaf emerges longer than those before it, until a normal canopy is restored.

Since it is extremely difficult to determine if a palm has been killed by cold damage or a subsequent bacterial bud rot, these affected palms should be monitored closely for at least six months before deciding whether to remove them.

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