

## Ganoderma Butt Rot of Palms<sup>1</sup>

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### Summary

- Ganoderma butt rot is caused by the fungus *Ganoderma zonatum*. This fungus degrades or rots the lower 4-5 feet of the trunk.
- All palms are considered hosts of this fungus. This fungus is not a primary pathogen of any other plant species.
- Symptoms may include wilting (mild to severe) or a general decline. The disease is confirmed by observing the basidiocarp (conk) on the trunk. This is a hard, shelf-like structure that will be attached to the lower 4-5 feet of the palm trunk. However, not all diseased palms produce conks prior to death.
- A palm cannot be diagnosed with Ganoderma butt rot until the basidiocarp (conk) forms on the trunk, or the internal rotting of the trunk is observed after the palm is cut down.
- The fungus is spread by spores, which are produced and released from the basidiocarp (conk).
- Conditions that are conducive for disease development are unknown.
- There are currently no cultural or chemical controls for preventing the disease or for curing the disease once the palm is infected.
- A palm should be removed as soon as possible after the conks appear on the trunk. Remove as much of the stump and root system as possible when the palm is removed.
- Because the fungus survives in the soil, planting another palm back in that same location is not recommended.

### Introduction

Ganoderma butt rot is a lethal disease of palms, both in the landscape and natural settings. While the disease is more prevalent in the southern half of the state, where palms are in greatest abundance, it is certainly not restricted to that area. The fungus that causes the disease is distributed throughout Florida, from Key West to Jacksonville to Pensacola. It is also known to occur in Georgia and South Carolina.

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## Pathogen and Hosts

The fungal genus *Ganoderma* is a group of wood-decaying fungi that are found throughout the world on all types of wood — gymnosperms, woody dicots, and palms. There are many different species of this fungus in Florida, but only one is a pathogen of palms. That fungus is *Ganoderma zonatum*. Another fungal name that was associated with this disease in the first half of the 20th century was *Ganoderma sulcatum*. Recently, these two species have been grouped together as one, *G. zonatum*.

While there are a few reports of *G. zonatum* on non-palm hosts, these reports are very limited. Therefore, palms are considered the primary hosts of this fungus. In general, if you observe a basidiocarp (conk) on a palm trunk, especially if it is still living, it is probably safe to assume it is *G. zonatum* and not some other *Ganoderma* species. Likewise, the *Ganoderma* species often observed on hard-wood trees, such as oak, are rarely observed on living palms. These other *Ganoderma* species may occur on dead palm trunks and stumps, but they are present simply as saprobes (fungi that live off dead plant material).

All palms are assumed to be susceptible to this disease. While not all palms growing in Florida have been documented with *Ganoderma* butt rot, at least 65 species of palms have. Those not documented with this disease are not commonly grown and have thus far escaped. The only possible exceptions would be palm species that do not form woody trunks — e.g., *Sabal minor* and some *Chamaedorea* spp. Since *G. zonatum* kills by degrading wood, these palm species may not have any suitable tissue to serve as a substrate for the fungus.

## Symptoms, Signs and Diagnosis

*Ganoderma zonatum* is a white rot fungus that produces numerous enzymes that allow it to degrade (rot) woody tissue, primarily lignin and cellulose. As the fungus destroys the palm wood internally, the xylem (water-conducting tissue) will eventually be affected. Therefore, the primary symptom that may be observed is a wilting, mild to severe, of all leaves but the spear leaf (Figures 1 and 2). Other symptoms can best be described as a general decline – slower

growth and off-color foliage. However, these symptoms alone should not be used for diagnosis of *Ganoderma* butt rot, since other disorders or diseases may also cause these symptoms.



**Figure 1.** *Sabal palmetto* (sabal palm) with wilted and desiccated leaves due to *Ganoderma zonatum* infection. Credits: M. L. Elliott

The basidiocarp or conk is the most easily identifiable structure associated with the fungus. The conk originates from fungal growth *inside* the palm trunk. Figure 3 illustrates different stages in the development of the conk. When the conk first starts to form on the side of a palm trunk or palm stump, it is a solid white mass that is relatively soft when touched. It will have an irregular to circular shape and is relatively flat on the trunk or stump.

As the conk matures, a small shelf or bracket will start to form as the basidiocarp begins to extend or protrude from the trunk. It will still be white, both on the top and bottom surfaces. Eventually, it will form a very distinct shelf-like structure that is quite hard with a glazed reddish-brown top surface and a white undersurface (Figure 4). A mature conk will have distinct zones, hence the name *G. zonatum*. The conk will have a half-moon shape with the relatively “straight” side directly attached to the trunk.





**Figure 2.** *Syagrus romanzoffiana* (queen palm) dying from *Ganoderma zonatum*. Only the spear and one other leaf remain green. Credits: M. L. Elliott



**Figure 3.** Three phases of basidiocarp (conk) development of *Ganoderma zonatum*. The white "button" near the top of the picture is the beginning stage of the conk. The lower-right structure is a mature conk. The lower-left structure is also a mature conk, but it is an old one; the underside of this conk is no longer white. Credits: M. L. Elliott

If a conk is present on the trunk at the same time the wilt or decline symptoms appear, then it is safe to diagnose *Ganoderma* butt rot. However, it is not uncommon for conks not to appear prior to severe decline and death of a palm. In that situation, the only way to determine if *Ganoderma* butt rot is the cause is to cut cross-sections through the lower 4 feet of the trunk after the palm is cut down (Figures 5 and 6). Conks may form on the palm stump after the diseased palm is removed.



**Figure 4.** Basidiocarp (conk) of *Ganoderma zonatum*. Note glazed reddish-brown top surface and white undersurface. The "straight" side of the conk is directly attached to the trunk. There is no "stem" or "stalk" that attaches the conk to the trunk. Credits: M. L. Elliott



**Figure 5.** Cross-sections of lower trunk of *Syagrus romanzoffiana* infested with *Ganoderma zonatum*. Top-left section is bottom section (section 1) and remaining sections progress up the trunk. Note darkening of wood due to fungal degradation (rot). Credits: M.L. Elliott



**Figure 6.** Comparison of pygmy date palm sections that are either healthy (right) or diseased (left) with *Ganoderma zonatum*. Credits: M.L. Elliott

Conks of *G. zonatum* can be up to 8 inches at their widest point and 2 inches thick. However, conks will take on the shape and size of the area in which they are growing (Figure 7). Microscopic



basidiospores are produced in the “pores” present on the underside of the conk. When basidiospores are dropped en masse on a white surface, they will appear brownish-red in color (Figure 8). Objects immediately around a conk that has dropped its spores may appear to be covered with a rusty colored dust. One conk can produce 3 cups of spores.



**Figure 7.** Cut palm stump with numerous basidiocarps (conks) of *Ganoderma zonatum* forming on it. The conks in the palm stump's center are crowding each other and thus are forming into shapes different from those on the outer edges of the stump. Credits: M. L. Elliott



**Figure 8.** Spore release from mature conks (same stump as Figure 7) has resulted in reddish-brown appearance of conks and surrounding area. Credits: M. L. Elliott

## Disease and Fungus Life Cycle

The fungus is spread primarily by the spores produced in the basidiocarp (conk). The spores become incorporated into the soil, germinate and the hyphae (fungal threads) then grow over the palm roots. The fungus does not rot the palm roots, it

simply uses the roots as a means of moving to the woody trunk tissue (Figure 9). Once a palm is infected with *G. zonatum*, the fungus will move with that palm to the location in which it is transplanted. It is also possible that soil associated with transplanted palms is infested with the fungus.



**Figure 9.** Longitudinal section through *Phoenix roebelenii* trunk and root system. The trunk is darkened due to infection with *Ganoderma zonatum*. The fungus is not rotting the roots but was isolated from the roots. Credits: M. L. Elliott

We do not know exactly how many months or years pass between initial infection of a palm and development of the conk. There is *no* method that can determine if a palm is infected with *G. zonatum*. Until the conk forms, there can be no confirmation of this disease. Therefore, it is not possible to guarantee that a palm is free of *Ganoderma* when first planted in the landscape.

Figures 5 and 10 are examples of the wood rotting and disease progression pattern observed. The fungus colonizes and degrades the palm trunk tissue closest to the soil line first, expands in diameter at the base and moves up the center or near-center of the trunk. Therefore, the disease progression pattern within the trunk is best described as cone-shaped, widest at the soil line and narrowing to a pinpoint.

The location of the conk is where the fungus is *emerging* from the trunk. This means the degradation is occurring internally as the fungus moves from the lower center of the palm to the outside. Therefore, wounds are *not* a likely factor in disease initiation. Other external environmental factors associated with the trunk are probably not associated with disease development either, such as too much mulch around



**Figure 10.** Sections 5 and 6 of Figure 5 (bottom row, middle sections) after incubation in a moist chamber for 4 days. White growth is hyphae of *Ganoderma zonatum* and corresponded with the discolored area of the cross-sections. Credits: M. L. Elliott

the trunk, irrigation heads striking the trunk, flowers or shrubs too close to the trunk, or painting the trunk.

## Disease Management

No environmental conditions or landscape management practices have been observed that favor the development of *Ganoderma* butt rot. The disease occurs in natural settings (palms never transplanted) and in highly-maintained, transplanted landscapes. It occurs on palms that have been maintained very well nutritionally (no nutrient deficiencies) and on palms that were severely stressed by deficiencies. The disease occurs in well-drained settings and in swamps. The fungus has killed trees that had no apparent mechanical injuries and those that had been severely damaged by, for example, weed trimmers. Soil type appears to have no relationship with disease either, as diseased palms have been observed on deep sands (both silica and calcareous), muck (peat), and limestone rock. There has been no discernible pattern to provide clues as to why some palms become infected and die from *G. zonatum*, and others do not.

In general, the fungus will be located in the lower 4-5 feet of trunk. This has three implications. First, this means the fungus is not spread with pruning tools since the fungus is not associated with leaves. Second, this means that only the lower trunk portion should *not* be chipped and used for mulch. If possible, the diseased section should be placed in a landfill or incinerated. The remaining, fungus-free portion of the palm trunk could be chipped and used for mulch in the landscape.

Third, only the lower 4-5 feet of trunk will need to be protected from the fungus. However, typical xylem-limited, systemic fungicides will not be effective unless they are capable of spreading beyond the vascular tissue and protecting *all* the wood in the lower portion of the trunk. We know of no fungicide with these capabilities. Also, no fungicide will be effective once the conks have formed, since a large percentage of the trunk cross-sectional area has already been destroyed. Since we have no means of predicting or determining which palms are infected with *G. zonatum*, this effectively eliminates the use of fungicides as a control method, either preventively or curatively, for the present time. Therefore, there are no fungicide recommendations for this disease.

Since basidiospores from the basidiocarps (conks) are probably the primary method of spreading the fungus, palms should be monitored closely, especially after a palm has died or been removed *for any reason*. The fungus will readily colonize and degrade palm stumps (See Figures 7 and 8). Once the fungus becomes established in this dead wood, it will normally produce conks with millions of basidiospores that are easily moved by wind and water.

Therefore, monitor palms and palm stumps for the conks. Remove the conk and place in a trash receptacle that will be incinerated or delivered to a landfill. Do not place in trash that will be recycled in the landscape. The earlier the conk is removed (i.e., before it becomes a distinct shelf-like structure), the less likely that spores will be released into the environment. If you have never observed *Ganoderma* butt rot on the property, monitoring the palms once every six months will be adequate. Once you have observed the conks on palms or have a palm cut or fall down for any reason, monitor your palms at least once a month. Also, monitor the entire neighborhood, not just your yard. These spores blow with the wind, so it should be a community effort to reduce the spread of the spores of this lethal fungus.

Once a conk is observed on a palm, the palm should be removed – primarily for safety reasons. This is especially important during the hurricane season. As indicated before, if conks are being produced on a live palm, it means that a significant

portion of the trunk is already rotted. These palms are likely to be the first blown down in heavy winds. As much as you may want to keep the palm, it is probably best not to do so. When you remove the palm, remove as much of the stump and root system as possible. Any palm material left behind will be a host for the fungus.

The fungus survives in the soil. It has been observed that replacement palms planted into the same site where a palm died from *Ganoderma* butt rot also became diseased and died. Therefore, replanting with another palm is risky. No other plant species (pines, oaks, woody shrubs, etc.) are affected by *G. zonatum* – only palms. In other words, replacing the *Ganoderma*-diseased palm with any other plant except a palm would be a wise choice.

We do not know how long you should wait before it is safe to plant another palm in a *Ganoderma*-infested site. We can say that the time is measured in multiple years, not months, since the fungus is probably capable of living in the soil almost indefinitely.

If you insist on replanting with a palm, follow these guidelines. Remove the stump and all roots from the site. Then, fumigate the soil. You can have this done by a licensed professional using a legally registered fumigant for the landscape. An example would be the product dazomet (trade name = Basamid). If the palm was located in a site surrounded by concrete (ex: a street median), also remove all of the old soil. Bring in new soil and then fumigate. However, this does not guarantee the new palms will remain free of *Ganoderma zonatum*, as the fungus may already be associated with the new palm and fungal spores can be easily blown into the newly fumigated site.

### Selected References

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