Palm Diseases and Disorders: Visual and Laboratory Diagnosis

This Lucid key is based solely on visual symptoms for two primary reasons. First, visual symptoms are sufficient to diagnose many palm problems, especially physiological disorders such as nutrient deficiencies. Second, visual symptoms are the first step in determining which diagnostic lab to use for further analysis and which tissue should be sampled for analysis. Many times, diagnosis of a palm problem is a multi-step procedure whereby *possible* causes of the problem are ruled out, one at a time. Never rely on a laboratory diagnosis without also making a good faith attempt at the visual diagnosis. The two diagnoses should agree.

Just because a laboratory report suggests deficiencies of one or more nutrient elements or the presence of one or more potential pathogens does not mean that those deficiencies or pathogens are the actual cause of the particular problem. "False positives" are common, and often misleading. This is one weakness of laboratory diagnostics when used as the sole method of diagnosis. In the case of palm diseases, "false negatives" are also a common problem, especially when the wrong tissue is sampled or a sample of poor quality is submitted to the laboratory. If the two diagnoses (visual and lab) do not agree, then re-examine the problem to determine which diagnosis is more likely to explain the symptoms being observed (compare to descriptions and photos in the fact sheets), and if you sampled the correct material for the laboratory diagnosis. Alternatively, you may need to start at the beginning as neither diagnosis may be correct.

Laboratory Disease Diagnosis

A laboratory disease diagnosis may be required to confirm the visual diagnosis, as it may not be readily apparent which pathogen is causing the symptoms observed. Sometimes a laboratory diagnosis is necessary because two diseases have identical symptoms. For example, Fusarium wilt and petiole (rachis) blight of *Phoenix canariensis* have similar symptoms but one is lethal (Fusarium wilt) and one is not. Only a laboratory diagnosis will determine which pathogen is present.

Sampling the correct tissue is critical for an accurate laboratory diagnosis. For example, lethal yellowing is confirmed from internal trunk corings, while petiole (rachis) blight pathogens only infect the palm petiole or rachis. In both cases, sampling leaflet tissue of a palm affected by either of these diseases would have yielded a false negative. Thus, it is imperative to make the visual diagnosis as accurate as possible in order to determine which tissue to sample. Many "potential" plant pathogens are naturally part of the palm environment, so it is easy to isolate these "potential" pathogens rather than the actual pathogen causing the symptoms observed. The laboratory is analyzing the tissue that ***you*** provide. Sampling the proper tissue and providing adequate background information on the problem increases the likelihood of obtaining an accurate diagnosis. A good series of photographs illustrating the problem is always helpful.

One common error in diagnosing palm problems is to sample roots. In the landscape and field nursery, root rots of palms are uncommon, and are usually the secondary result of a palm being planted incorrectly or in the wrong environment. Examples include planting *Phoenix dactylifera* in soils that are routinely water-logged or planting any palm too deeply. A diagnostic laboratory will usually be able to isolate *potentially* pathogenic fungi from roots, but these fungi are seldom

the *primary* cause of the problem observed. This is an important distinction for management purposes, as one needs to first correct the primary cause, if possible. Likewise, soil sampling for potential pathogens is not recommended because there are always "potential" pathogens in the soil. Root rots of palms growing in containers are more likely to occur because of the confined root system, often growing in a degraded, poorly-drained growing medium.

Sometimes it is not possible to make a confirmation of a visual diagnosis until a dead or dying palm is cut down. For example, palms affected by Ganoderma butt rot may die without producing conks (basidiocarps) from the lower trunk area. However, when the palm is cut down and multiple cross-sections are made of the trunk, the disease will be easily confirmed based on the pattern of rot within the trunk, and without the necessity of a laboratory diagnosis. Another example concerns damage to the apical meristem (bud or heart). Many abiotic and biotic problems may kill the bud, but you may not be able to determine or confirm the cause until longitudinal sections are made through the bud.

Leaf Nutrient Analysis

Most nutrient deficiency problems can be readily diagnosed by visual symptoms alone. For most palm species, diagnosis should rely on visual symptoms rather than a leaf nutrient analysis. Base line data for nutrient sufficiency has been developed for only a few palm species. Therefore, without a comparison to a known nutrient sufficient palm of the same species, a leaf nutrient analysis can be misleading.

There are situations where multiple deficiencies may be present on a single palm. Symptoms of these deficiencies may be present on different parts of the palm (e.g., old vs. new leaves), but may occasionally be superimposed on the same tissue. A common example of the latter is potassium and magnesium deficiency symptoms, both being present to some degree on the older leaves of a palm. For these situations, leaf nutrient analysis can be useful for distinguishing multiple deficiencies where the symptoms of one deficiency may mask those of another.

Leaf analysis can also be used to confirm or clarify a diagnosis based on visual symptoms. However, there are exceptions. For example, leaf analysis is not particularly useful for diagnosing iron deficiency in any plant, and leaf analysis may not accurately assess the boron sufficiency status of a palm at any given time, due to the often transient nature of boron deficiency.

In order to obtain useful results from a leaf analysis, the proper leaves must be sampled. Leaf nutrient analyses are based on samples of several leaflets (pinnate-leaf palms) or leaf segments (fan leaf palms) taken from the center of the youngest, fully expanded leaf. Depending on the nutrient deficiency, this may or may not be the leaf exhibiting symptoms. In pinnate-leaf palms, this youngest, fully-expanded leaf should have all of its basal leaflets (or spines in some species) expanded out and perpendicular to the petiole axis, as in older leaves.

Leaf Disease vs. Nutrient Deficiency

Too complicate matters even further, it is possible to have both a nutrient deficiency and a leaf spot or leaf blight disease. Furthermore, some nutrient deficiencies look like a leaf spot disease. If you cannot decide which problem you are observing, then collecting samples for *both*

a disease diagnosis and leaf nutrient analysis may be necessary. However, this will require duplicate samples and may require sampling different tissue on the same plant. As explained above, leaf nutrient analysis is based on leaflets from the youngest fully expanded leaf. Leaf disease samples should be the leaves exhibiting the leaf spot or leaf blight symptoms.

Tissue to sample for laboratory diagnosis, after a preliminary visual diagnosis has been made.

Visual Diagnosis	**Palm Tissue to Sample for Laboratory Diagnosis[1]**
Bud Rot	Spear leaf or next youngest leaf exhibiting typical disease symptoms. If bud is already rotted, it is often not useful to sample the tissue as secondary microorganisms hinder isolation of the primary pathogen.
Damping-off	Entire plant. Shake-off excess soil or potting mix. Place ONLY the root system in a plastic bag. Do not place entire palm seedling in plastic bag.
Diamond Scale	Leaf exhibiting typical symptoms or signs of disease: entire leaf or, at a minimum, 5 to 8 leaflets or leaf segments with symptoms or signs.
Fusarium Wilt	Leaf exhibiting typical one-sided symptoms of the disease: entire leaf or, at a minimum, leaf petiole or rachis.
Ganoderma Butt Rot	Visual diagnosis is based on presence of conk or on multiple cross-sections through lower 3-4 feet of trunk. Select a cross-section of the trunk that has both diseased and healthy trunk tissue. The interface between diseased and healthy tissue is the ideal sample.
Gliocladium Blight	Tissue with pink spore mass present.
Gliocladium Trunk Rot	Water-soaked green trunk tissue, or trunk tissue with pink spore mass present.
Graphiola Leaf Spot	Laboratory diagnosis is not necessary as fungal structures can be easily observed with hand magnifying glass.
Hartrot and Marchitez Sorpresiva	Oldest or next younger unopened inflorescence for detection of protozoan.
Leaf Spots and Leaf Blights	Leaf exhibiting typical symptoms of disease: entire leaf or, at a minimum, 5 to 8 leaflets or leaf segments with symptoms.
Lethal Yellowing	Internal trunk tissue for detection of phytoplasma.
Nutrient Deficiency	Select the youngest, fully-expanded leaf. Remove 4 to 6 leaflets on both sides of rachis of a feather-leaf palm. Remove 4 to 6 central leaf segments from blade of fan-leaf palm.
Petiole (Rachis) Blight	Leaf exhibiting typical symptoms of disease: entire leaf or, at a minimum, leaf petiole or rachis exhibiting symptoms
Red Ring	Nematodes can be obtained from the discolored ring of trunk tissue, leaf petioles or roots.
Tar Spot	Leaf exhibiting typical symptoms of disease: entire leaf or,

	at a minimum, 5 to 8 leaflets or leaf segments with symptoms.
Texas Phoenix Palm Decline	Internal trunk tissue for detection of phytoplasma.
Thielaviopsis Trunk Rot	Select a cross-section of the trunk that has both diseased and healthy trunk tissue. The interface between diseased and healthy tissue is the ideal sample.

[1]Unless otherwise instructed, plant tissue samples for disease diagnosis should NOT be placed in a plastic bag. Instead, place tissue in a plain paper bag or in a box and pack with newspapers. If sending entire leaves or portions of the petiole, it is acceptable to cut the leaf or petiole into smaller sections and bundle together with tape or string.