Disease Management for Palm Trees

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Diseases

• Change in the form, functioning or physiology of the palm

• Diseases can have biological or non-living causes

• Biotic diseases are infectious and can spread, sometimes causing epidemics

Washingtonia filifera  ca 1920 in Ventura, California

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Diseases result in symptoms

• Symptoms sometimes define the disease:
  – Rots
  – Blights
  – Leaf spots
  – Wilts
  – Declines
Disease Management involves interrupting the disease tetrahedron.

- **HOST**: Susceptible
- **PATHOGEN**: Virulent
- **ENVIRONMENT**: Predisposing
- **TIME**

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Pink Rot
caused by
*Nalanthamala vermoeseni*

- Ascomycotina
  - The anamorphic state of *Rubrinectria*
- We have not seen evidence of the perfect state.

*Synnemata of N. vermoeseni*
Conidia and conidiophores of *N. vermoeseni*.

Infection court is through wounds

• Old pruning wounds or tears where leaves have been prematurely removed from the stem predispose palms to infection from pink rot. This is why spike wounds can dangerous on some palms.

Nalanthamala on Archontophoenix causing a trunk rot
Pink Rot
*Nalanthamala vermoeseni*

- On green tissue this organism will cause a canker. On gray or old trunk tissue the organism causes a slow rot without discoloration.
- Rots are often accompanied with dark discolored tissue.
- Cool weather disease. *N. vermoeseni* does not grow in temps above 30C.
Root Rots

• Palms can survive with very few roots so root rot symptoms often don’t show until cankers form above the ground on the main stem.

• Note spores of pink rot on the dead tissue

*Phytophthora palmivora* on Kentia
Pink Bud Rot

- *Nalanthamala* often infects congested foliage in the bud of palms. It is also systemically associated with palms that have wilt disease.
Pink Bud Rot

*N. Vermoeseni* on *Trachycarpus fortunei*

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Pink Rot is a disease of poor cultural conditions or abuses

- Sucepts
  - Transplants
  - Palms exposed to freezing temperatures
  - *W. filifera* when not in the desert
  - When infected with other pathogens
  - Excessive moisture
  - Lack of moisture
  - Over pruned
  - Spiked

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In-vitro control of \textit{N. vermoeseni}
Decline

- Poor adaptation
- Pink Rot present
- Cool temperatures (along coast of Ventura)
- Age
- Other factors: Turfgrass uses water etc.
- Diamond Scale increases susceptibility

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Pink Rot?

Photos courtesy of Frank Wong
Queen Palm Rot
Palm Tree Anatomy and Physiology: Trunk Cross Section

Internal Vascular Bundles

Starch Filled Parenchyma
Trunk Rot on Queen Palm
*Syagrus rommanzoffiana*

*Sistotrema* spp.
Fusarium Wilt

- *Fusarium oxysporum* f.sp. *canariensis*
- *Fusarium oxysporum* f.sp. *palmarum*

HOSTS:

*Phoenix, Washingtonia, Syagrus* (Florida)
Fusarium oxysporum

- Soil-borne fungus
- Long lived
  - Up to 25 years in soil without a host
- Survives in soil as long-lived chlamydospores
- Survives in warm and cool climates (Desert to Sea)
- Not easily controlled with fungicides, Some work in Florida shows efficacy of Phosphorus acids as protectants

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Host Range

• A *Fusarium oxysporum* has been isolated in Southern California in Queen palm but did not hybridize with the Fl isolate that is killing queens.
Fusarium Wilt

*Phoenix*, One sided frond death
Vascular discoloration
Death guaranteed
Fusarium Wilt

Can also cause discoloration of the vascular tissues in the palm rachis.
Symptoms in Stems

The variable response of Canary Island Date Palm to infection by *Fusarium oxysporum* f.sp. *canariensis* and *Nalanthamnala vermoeseni*.
Spread of Disease

- Sawdust is inoculum
- Trimming the pineapple on a 30 foot specimen can result in dust fall 100 feet from the tree being trimmed.
Diagnosis of *Fusarium oxysporum* f. sp. *canariensis*

- *Fusarium* is often found as a saprophyte on plants and in soil
- Only *Fusarium oxysporum* f. sp. *canariensis* causes wilt of Canary Palm
- Confirm the presence of the right *Fusarium* spp.
  - Symptoms
  - Lab isolation
  - PCR testing
Control Fusarium Wilt

- Make sure you are getting clean palms
- Do not plant *Phoenix* spp. into areas where palms were previously killed by *Fusarium*
- Do not use chainsaws to trim multiple *Phoenix* trees
- Disinfest saws (*in bleach for 5 minutes between trees*)
- Minimize movement of soil or water over soil so as not to spread the disease
- Fungicidal treatments are non-effective
- Research continues on Aliette/Phosphorus acids
Disease and pruning?


• Therefore we need to find a way to quickly and easily sanitize saws.
Sterilizing tools

• Bleach 1:4 or 1:9
• Alcohol (EtOH)
• Lysol
• Or Flaming??
Fungi isolated from a flamed saw

<table>
<thead>
<tr>
<th>Flame time</th>
<th>Total CFU</th>
<th>Total Pathogens</th>
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<tbody>
<tr>
<td>0 (no flame)</td>
<td>42a</td>
<td>17a</td>
</tr>
<tr>
<td>10s</td>
<td>2b</td>
<td>1b</td>
</tr>
<tr>
<td>20s</td>
<td>0.4b</td>
<td>0.1b</td>
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<tr>
<td>40s</td>
<td>0.3b</td>
<td>0b</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
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</table>

Effect of flaming on pathogens recovered from saw blades

Susceptibility of Landscape Palms to *Fusarium Oxysporum* f.Sp. *canariensis* Under Nitrate and Ammoniaical Fertilization

A. James Downer Donald Hodel Deborah Matthews and Dennis Pittenger
University of California ANR
Work at South Coast Research and Extension center showed fertilizer effects in the expression of Fusarium in Hebe

- Keim and Humphrey (1984) found that Calcium nitrate fertilized plants developed less disease than Ammonium sulfate fertilized plants.

Some History

• Foxy only found in *Phoenix canariensis*, (Feather 1979).
• Later, *Phoenix dactylifera* was shown to be susceptible (Ohr and others 1980)


Treatments

two factor factorial experiment in random blocks

Species
- Phoenix roebelini
- Phoenix reclinata
- Phoenix canariensis
- Washingtonia filifera
- Phoenix dactylifera

Fertilizer
- Calcium Nitrate
- Ammonium Sulfate
- CAN 27 (Calcium ammonium sulfate)
- Apex Palm Plus
- Untreated
Palm Growth as affected by fertilizer sources

![Bar chart showing palm growth affected by fertilizer sources.](chart.png)
Percent palms surviving

![Bar chart showing percent palms surviving for different species.]

- roebelini: 100 survivors
- reclinata: 60 survivors
- canariensis: 20 survivors
- filifera: 40 survivors
- dactylfera: 80 survivors
Survival percentages by species and fertilizer (Aug 2011)
Survival percentages by species and fertilizer (Aug 2012)
Fusarium Recovery

- *Fusarium oxysporum* was recovered from *Phoenix canariensis*, *P. reclinata* and *Washintonia filifera*

- Foxy was not recovered from *P. dactylifera* or *P. Robelini*. 
PCR and sequencing

- Confirm a match to the 567 base pair primers of Plyler et al.
Things to note

• F.oxy can not isolated from dacs or roebelini but from all others
• Nitrate treatment no P. canariensis surviors argues against finding of Keim.
• CAN 27 seemed to push the most growth
Dothiorella

- Symptoms are easily confused with Fusarium wilt.
- Disease is not systemic
- Disease thrives on drought stressed tissues/trees.
Vascular browning is quite distinct in the *Dothiorella* disease
*Dothiorella* will fruit in the dead tissues on the petiole
Rhachis Blight

- *Washingtonia* and *Phoenix*
- Many new fungi
- Disease of older leaves much as is Diamond Scale
- These diseases are often affiliated with palms in decline or affected by other diseases or landscape practices.

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New Palm Diseases
A new *Serenomyces* causing petiole blight on Phoenix

*Images from Soil and Plant Lab Inc.*
Rachis Blight
Phoenix canariensis
Cocoicola spp.

Images from Soil and Plant Lab Inc.
Petiole Blight
Washingtonia filifera
Cocoicola californica

Images from Soil and Plant Lab Inc.
**Cocoicola spp.**

- Pathogen reproduction and fruiting bodies often form on very diseased or dead tissue.
- The perithecia form in elongated diamonds on the rhachis.
Diamond Scale

- *Phaeocoropsis neowashingtoneae*  
  – (*Sphaerodothis neowashingtoneae*)
- Worst on *W. filifera* along the coast
- Non existent in *W. filifera* in the desert
- Occurs on *W. robusta* and hybrids along coast and in Mexico
- We conclude that the fungus evolved on *W. robusta* in Mexico and has migrated north to coastal CA.
Diamond Scale

*Phaeocoropsis neowashingtoniae*
Diamond Scale
Leaf Removal Study for Diamond Scale Control

- Diamond Scale can infect all year in coastal California.
- The pathogen can cause disease and fruiting bodies in less than three months time.
- Leaf removal does not prevent re-infection.
- It is not known how long fungicides protect against the disease.
Queen Palms
Palm Fertility

- Palms Require Nitrogen, Potassium, and Magnesium in greater abundance than other mineral nutrients.
- Most deficiencies in California, are macronutrient deficiencies seen on older leaves.
- Queen palms and date palms are the most often deficient
Effect of Fertilizer (Apex Palm Plus) on Queen palm quality ratings

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<tr>
<th></th>
<th>old lvs</th>
<th>New lvs</th>
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<tr>
<td>untreated</td>
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<td>3.4</td>
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<tr>
<td>1#</td>
<td>3.6</td>
<td>3.8</td>
</tr>
<tr>
<td>2#</td>
<td>4.0</td>
<td>4.2</td>
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Single source of nutrients study

- Queen palms were allowed to establish and develop their characteristic chlorotic look.
- Sulfate salts containing: NH4, K, Mg, and Ca were applied in a replicated experiment.
- Color ratings, tissue analysis and SPAD chlorophyll ratings are being taken.
Results of applied sulfates

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<tbody>
<tr>
<td>NH4</td>
<td>5</td>
</tr>
<tr>
<td>Ca</td>
<td>4</td>
</tr>
<tr>
<td>Mg</td>
<td>3.5</td>
</tr>
<tr>
<td>K</td>
<td>3</td>
</tr>
<tr>
<td>untreated</td>
<td>2</td>
</tr>
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Tissue Nutrient Content (N)

<table>
<thead>
<tr>
<th>Salt</th>
<th>Untreated</th>
<th>K2SO4</th>
<th>MgSO4</th>
<th>CaSO4</th>
<th>(NH4)2SO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>% N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ammonium sulfate improved queen palm quality significantly (approx. 2#/tree)