

# A BRIEF INTRODUCTION TO PLANT PATHOLOGY

Pat Nolan

Dept. of Agriculture, Weights &  
Measures (Retired)

County of San Diego

Blue mold of citrus caused by *Penicillium* sp. (C)



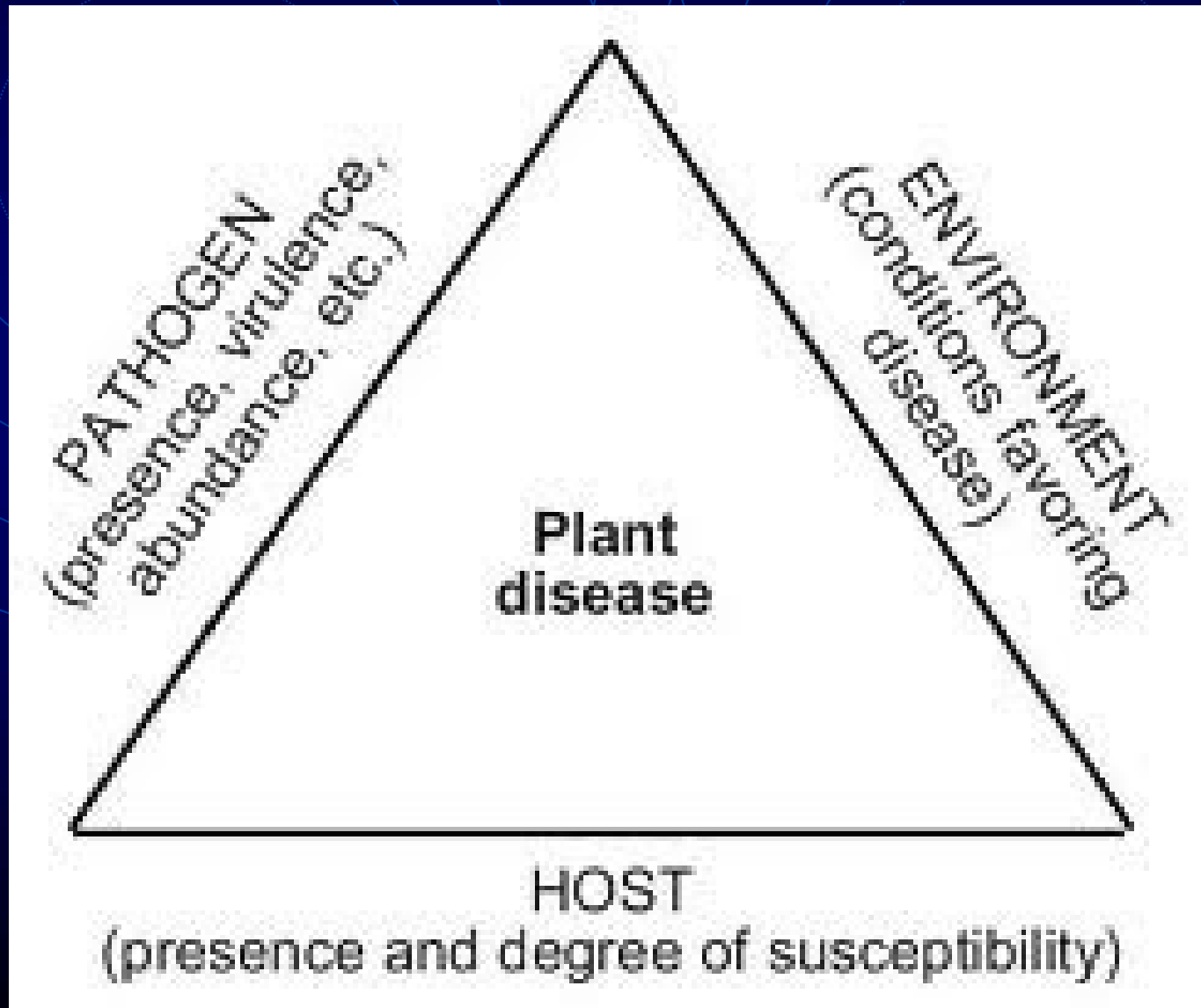
# What is a disease?

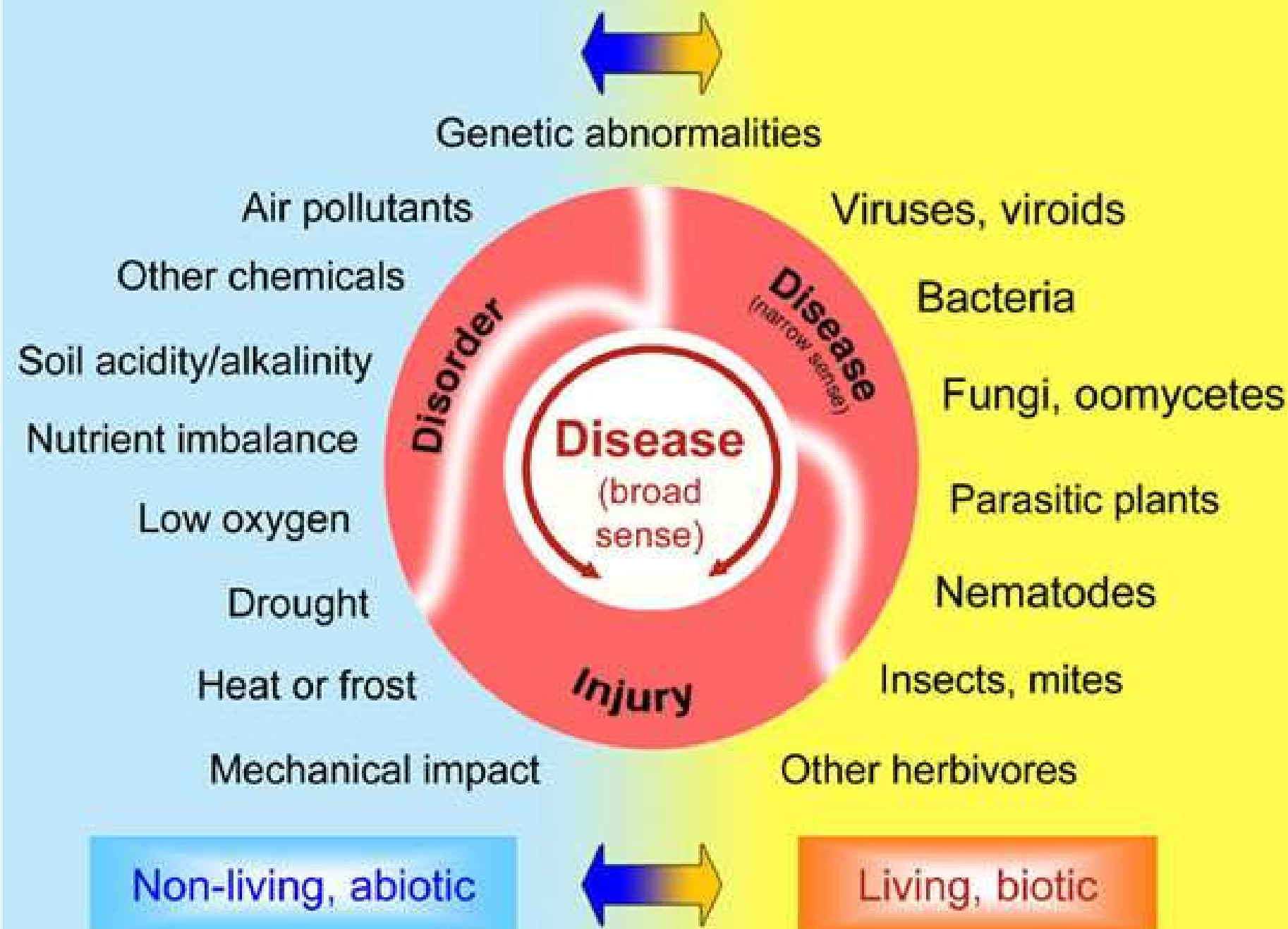
- Harmful alteration of normal development. It is a complex interaction that occurs over time.



Apple scab caused by *Venturia inaequalis* (C)

# What factors interact to get a disease?







# Terms Used To Describe Diseases

- Chlorosis: Yellowing of normally green tissue (adj. chlorotic)
- Necrosis: Death of cells (adj. necrotic)
- Sign: The pathogen or its parts seen on the plant
- Symptom: Visible alterations as a result of disease



Impatiens Necrotic Spot Virus on Lettuce (C)

Photo by Trical Diagnostics

# Steps In Diagnosis

- What is the plant?
- How has it been cared for, soil type, chemical applications, etc?
- What symptoms and signs can you see?
- Microscopic exam
- Other tests-serology, DNA, etc.

Wilt of *Phoenix canariensis* caused by  
*Fusarium oxysporum* f. sp. *canariensis* (A)



Heather Scheck



# Causes of Disorders

- Abiotic Factors-noninfectious, such as environmental stress, nutrient deficiencies, mechanical damage, air pollution, etc.



Oedema on geranium leaf



Zinc deficiency on citrus







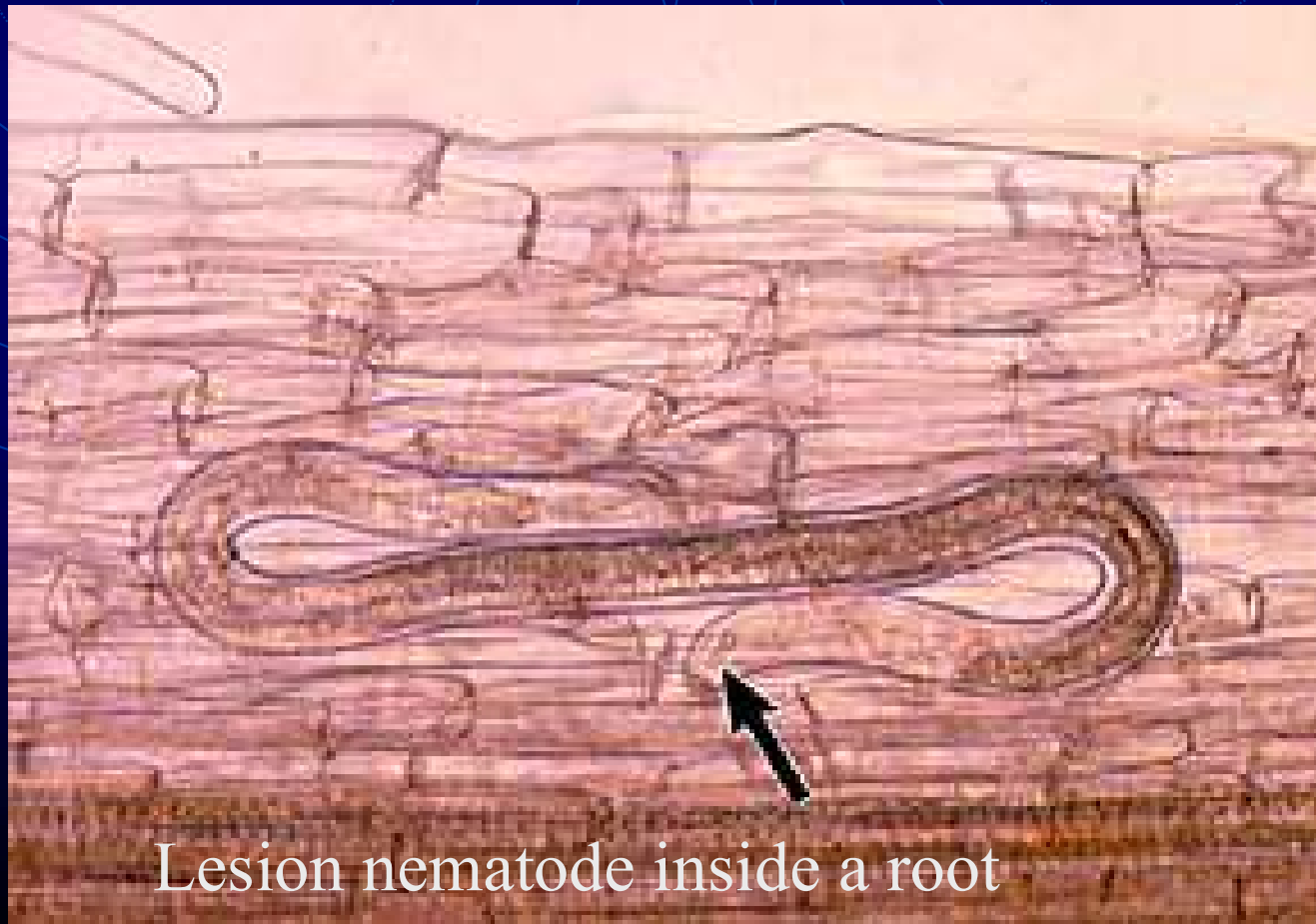






# Causes of Disease-Biotic Agents

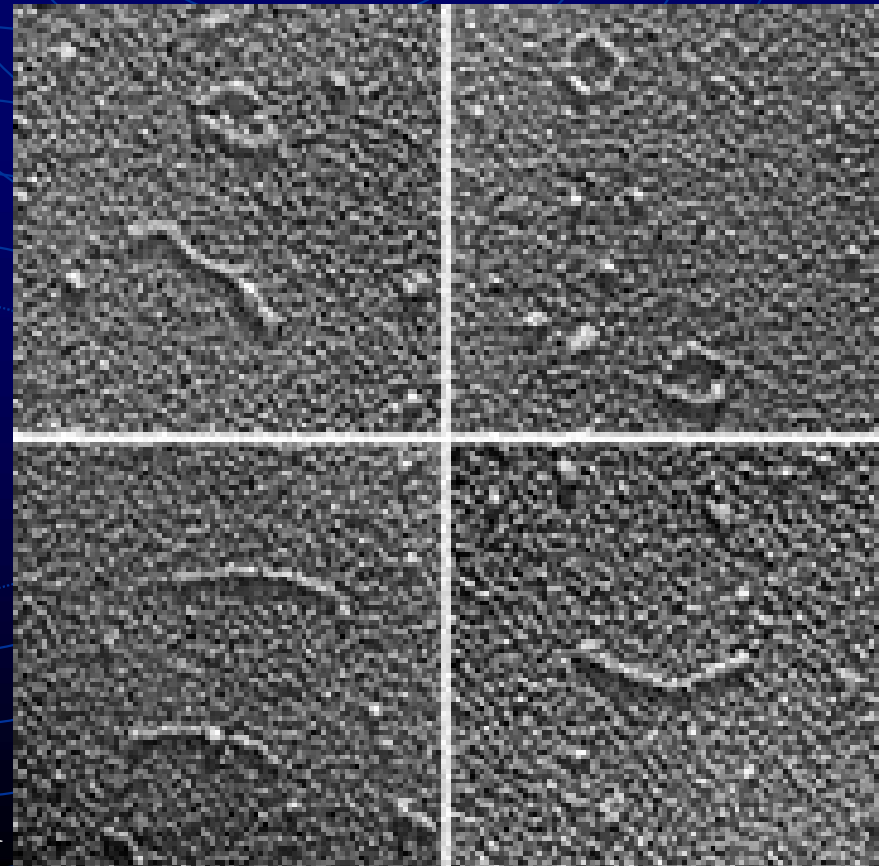
- Living organisms that can multiply and spread, such as viroids, viruses, bacteria, fungi, nematodes



Lesion nematode inside a root

# Characteristics of Submicroscopic Pathogens

- Very Small-Can see only with electron microscope
- Vectors Needed
- Parasites
- Limited Control Options



Viroids: Naked RNA

# Viroid Diseases



Avocado Sunblotch (C)

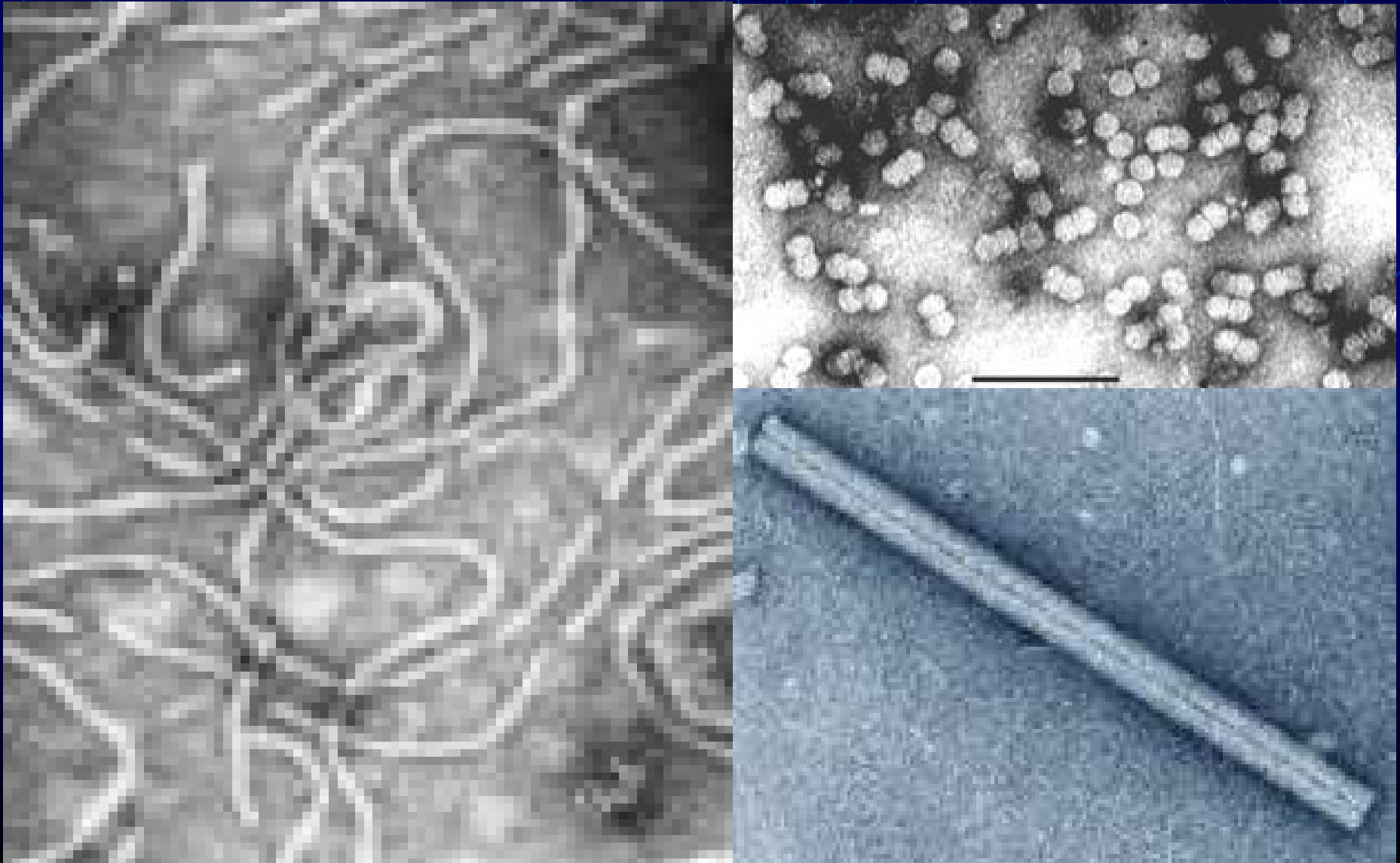


# Hop Stunt Latent Viroid



Photos from Greenhouse Grower

# Diseases Caused by Viruses



# Common Virus Families

- Bunyaviruses-Impatiens Necrotic Spot virus, Tomato Spotted Wilt Virus
- Closteroviruses-Citrus Tristeza Virus
- Cucumoviruses-Cucumber Mosaic Virus
- Geminiviruses-Abutilon Mosaic Virus
- Potyviruses-Potato Virus Y
- Tobamoviruses-Tobacco Mosaic Virus

# Modes of Viral Transmission

- Seed
- Pollen
- Insect
- Mite
- Nematode
- Fungi
- Mechanical





# Symptoms of Viral Infection

- None/Symptomless
- Mosaic or Mottle
- Leaf Spots
- Stunting/Yield Loss
- Deformations
- Death



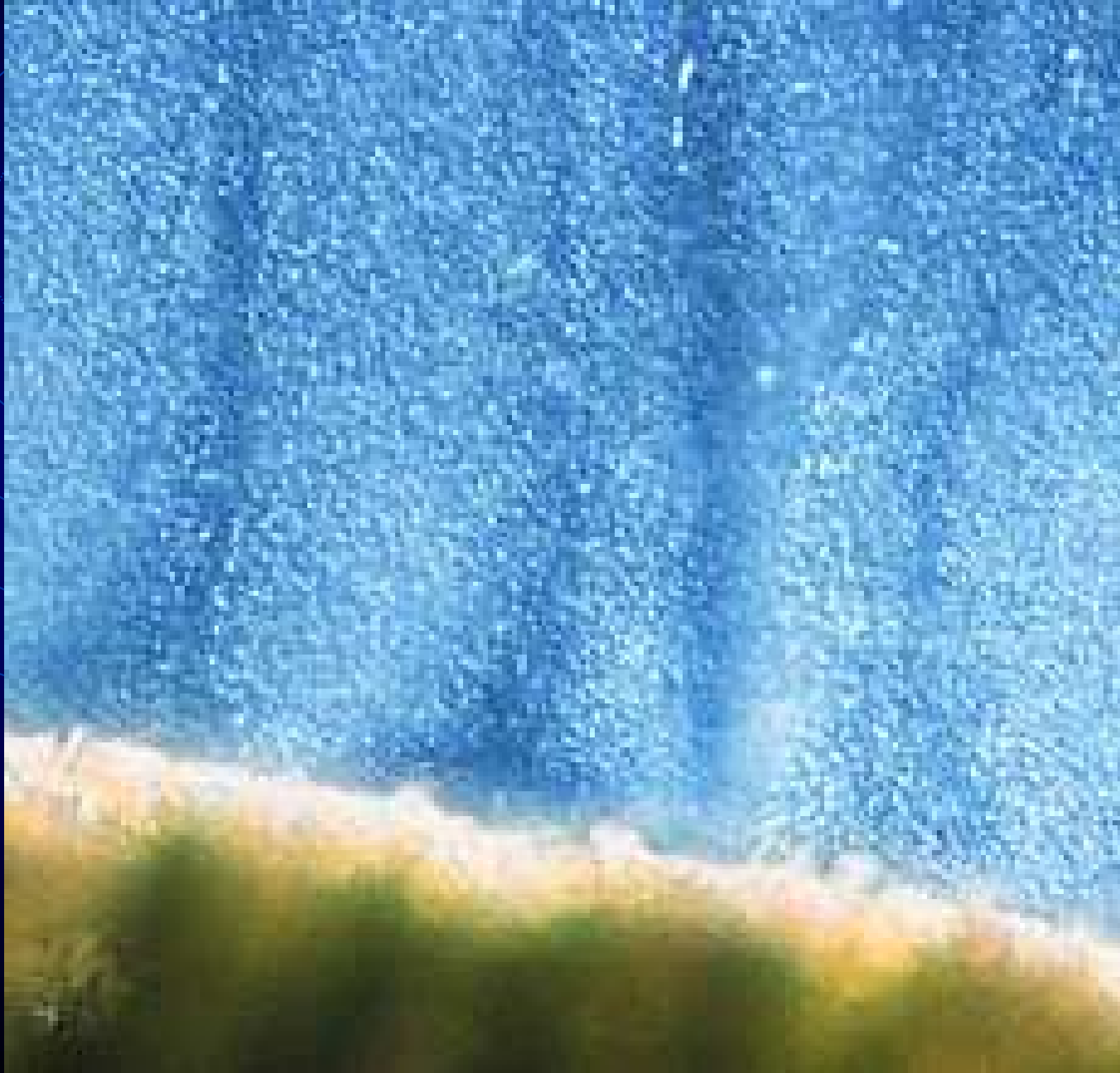
# Impatiens Necrotic Spot on Stephanotis and Hosta Virus X on Hosta



# Tomato Yellow Leaf Curl Geminivirus (B)



# Diseases Caused By Bacteria



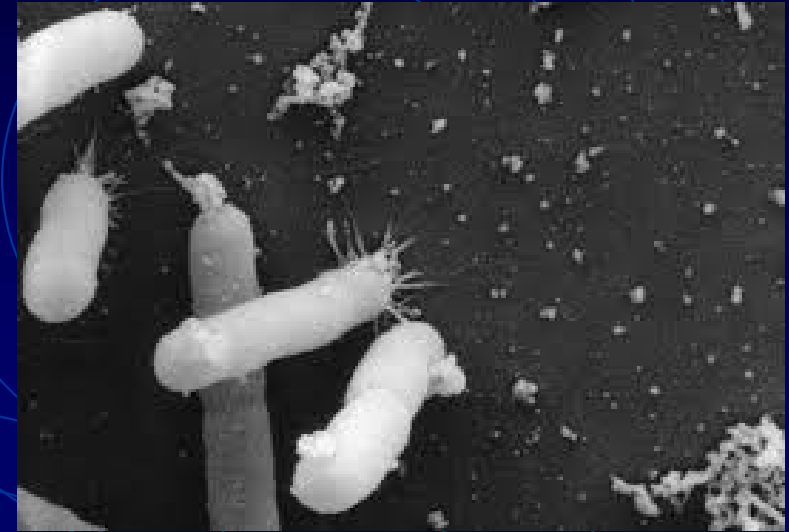


# Fire Blight of Flowering Pear Caused by *Erwinia amylovora* (C)

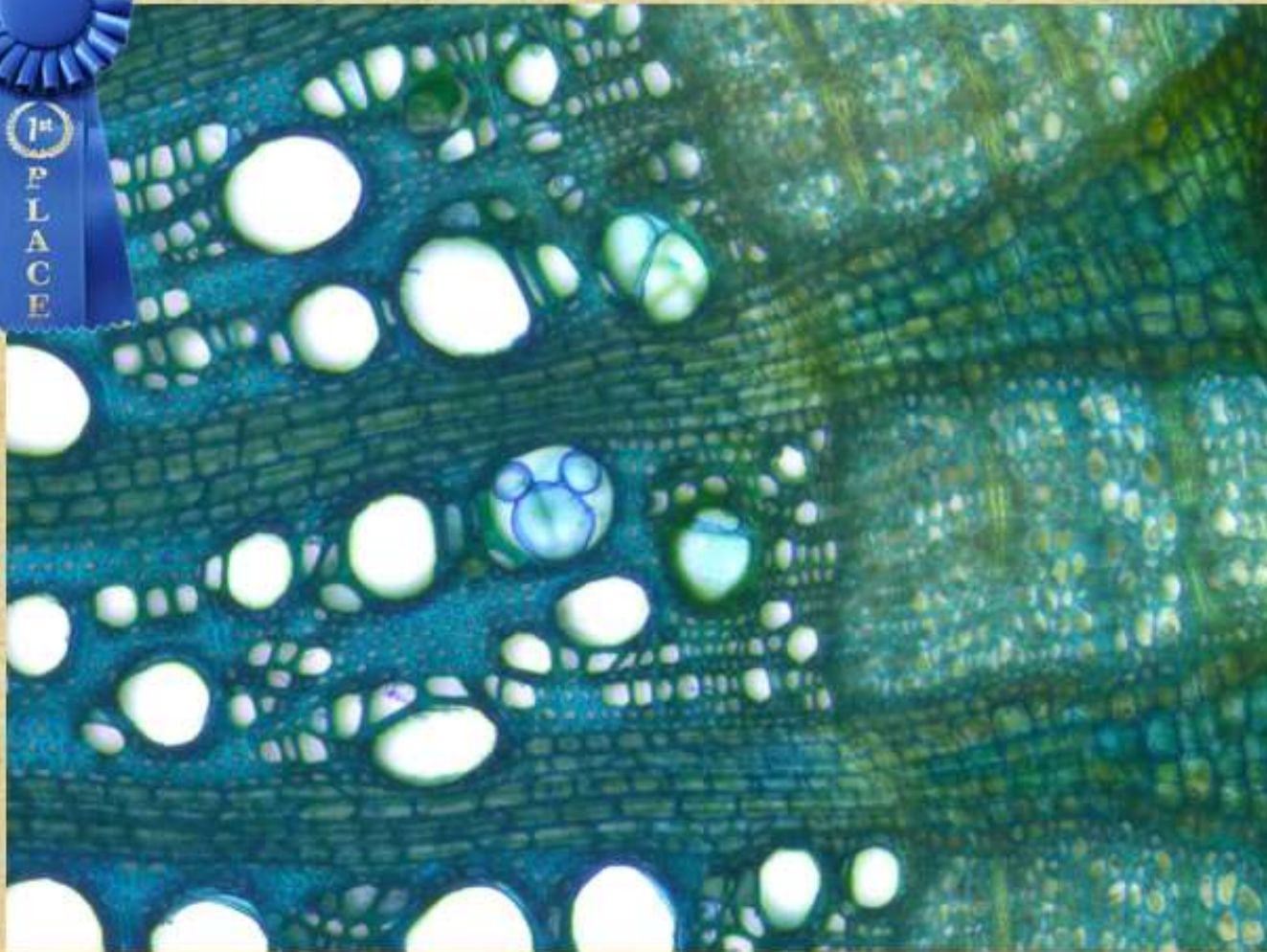




# Pierce's Disease Caused by *Xylella fastidiosa* (C)







### ***"Hidden Mickey"***

**By Jeannette Rapicavoli**

Brightfield microscopy;  
1776 × 1322; Cross section of  
a grapevine stem infected  
with *Xylella fastidiosa*. Tissue  
was stained with toluidine  
blue O to visualize tylose  
production in the xylem  
vessels. To my delight, this  
section contained a tylose  
that perfectly resembled  
Mickey Mouse.





Photo by Pat Nolan





Photo by Pat Nolan



Scorch disease



Oleander Leaf Scorch



Scorch disease on olive



Citrus Variegated Chlorosis

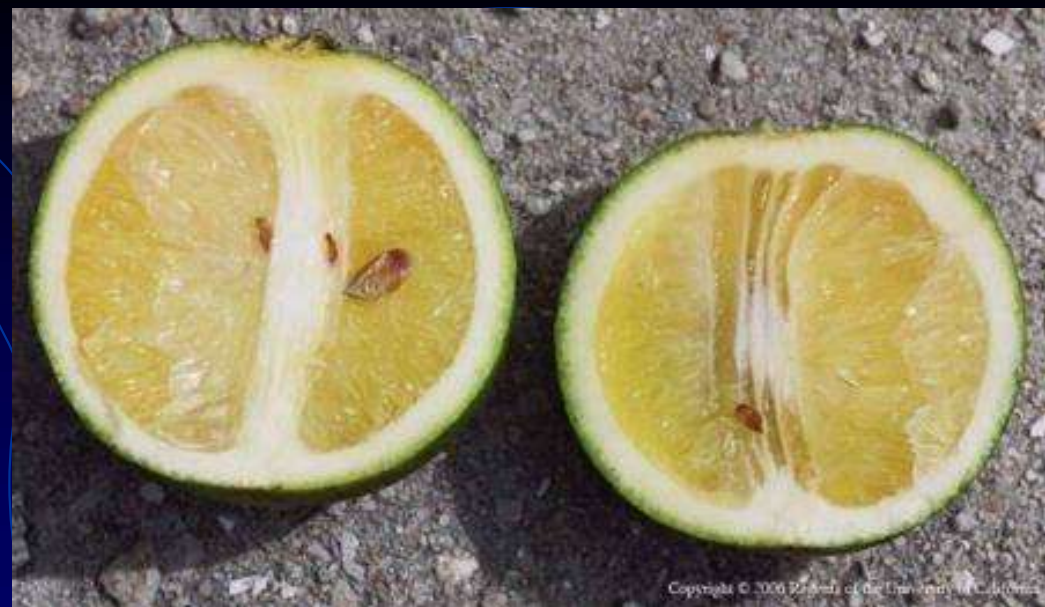


Huanglongbing (HLB) caused by *Candidatus* *Liberibacter asiaticus* (A). First found in CA in 2012.







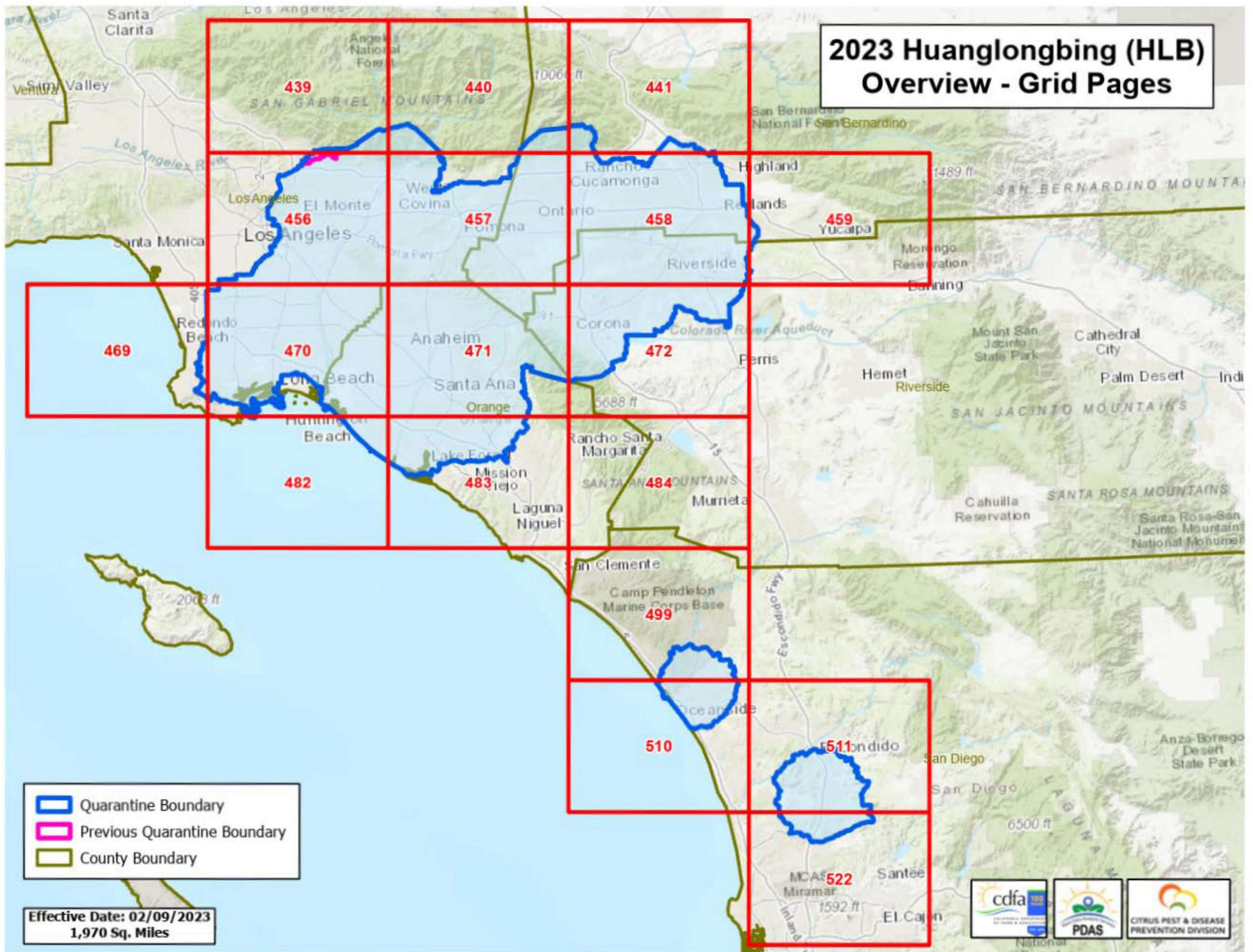








# 2023 Huanglongbing (HLB) Overview - Grid Pages





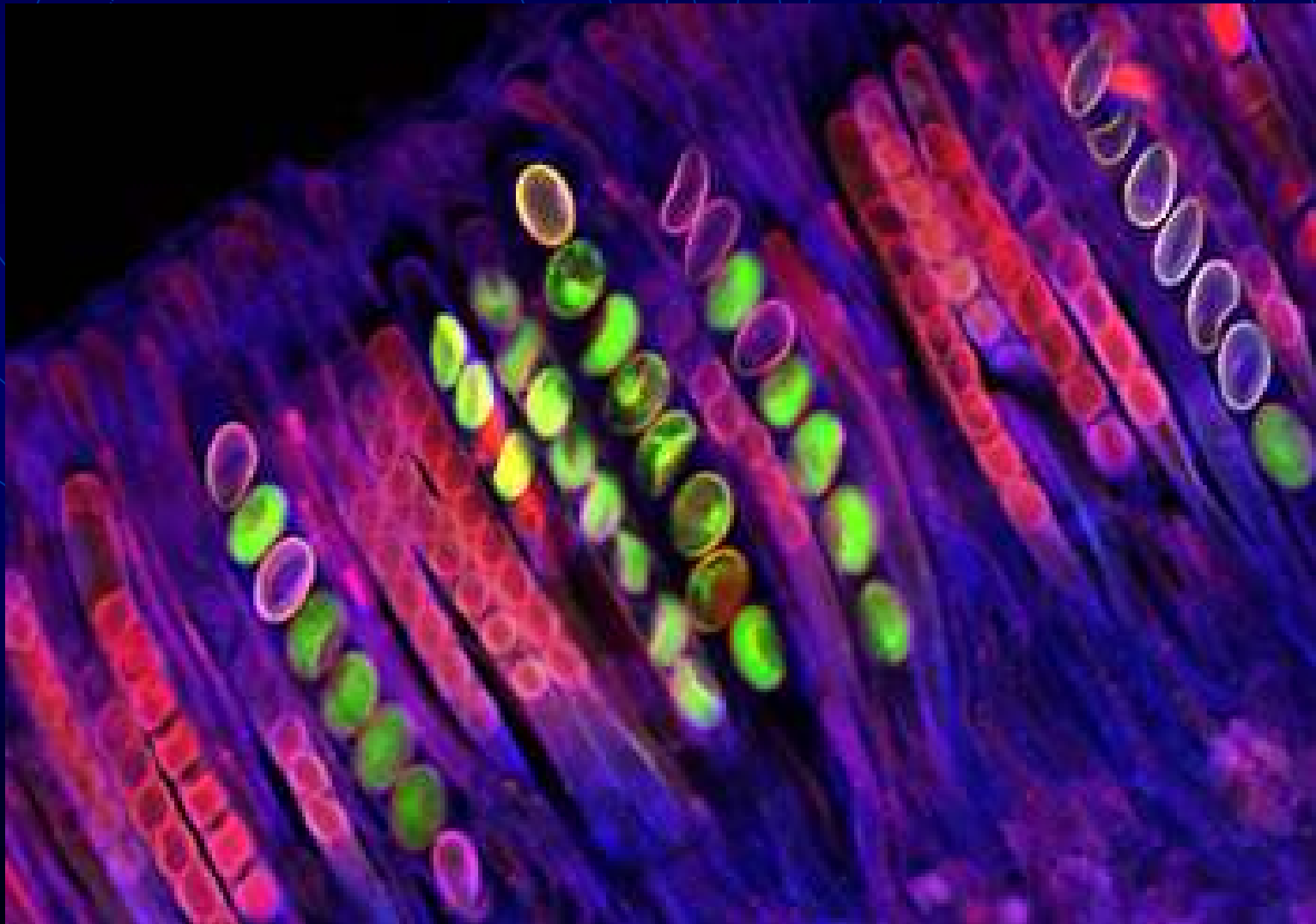
# Diseases Caused By Nematodes



Juvenile root knot nematode, *Meloidogyne* sp.



# Diseases Caused By Fungi and Fungus-like Organisms





# Downy, the red-nosed



sporangiospore

## *"Downy, the Red-Nosed Sporangiospore"*

**By Andrew L. Loyd**

Everyone's favorite holiday character, Downy the Red-nosed Sporangiospore. The sporangiophores and sporangiospores of *Peronospora geranii* were sporulating on the underside of *Geranium carolinianum* in Charlotte, NC (1117 x 1106 digital photomicrograph).



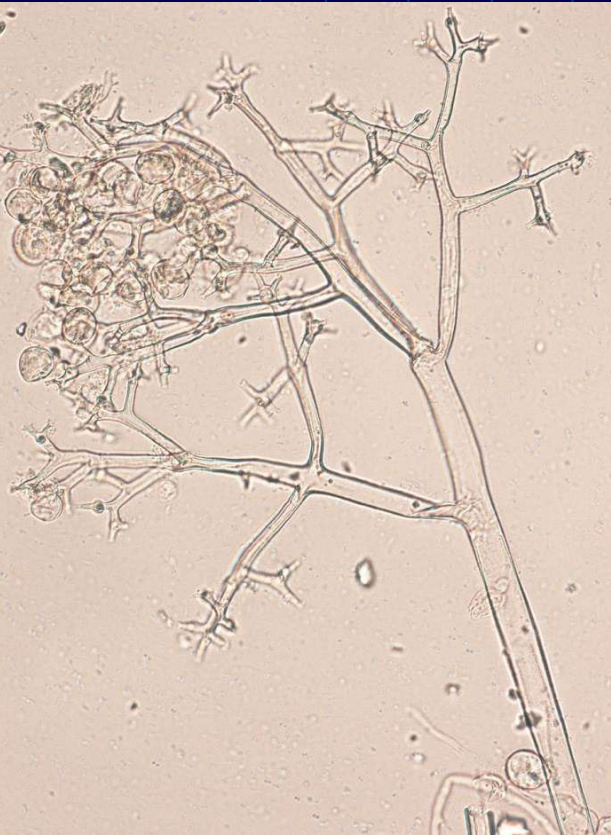
# Downy Mildews, mostly *Peronospora* spp. (not true fungi)



*P. belbarhii* on basil



*P. mesembryanthemi* (C)  
on iceplant



*P. obducens*  
on Impatiens



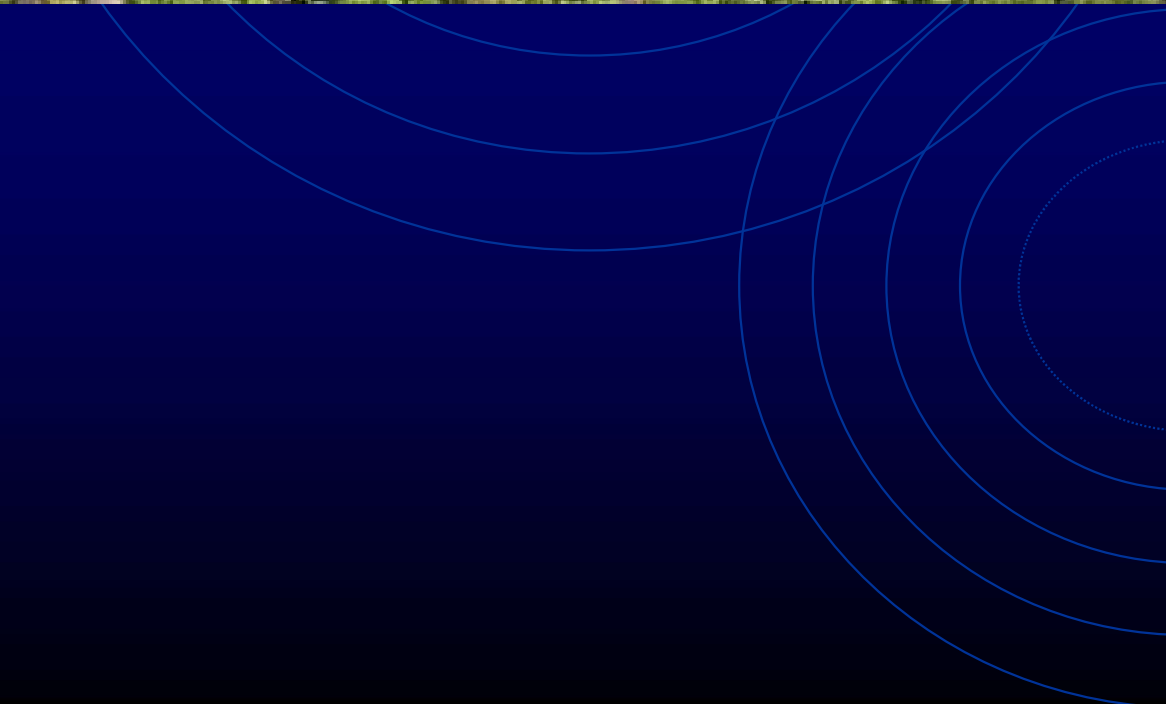
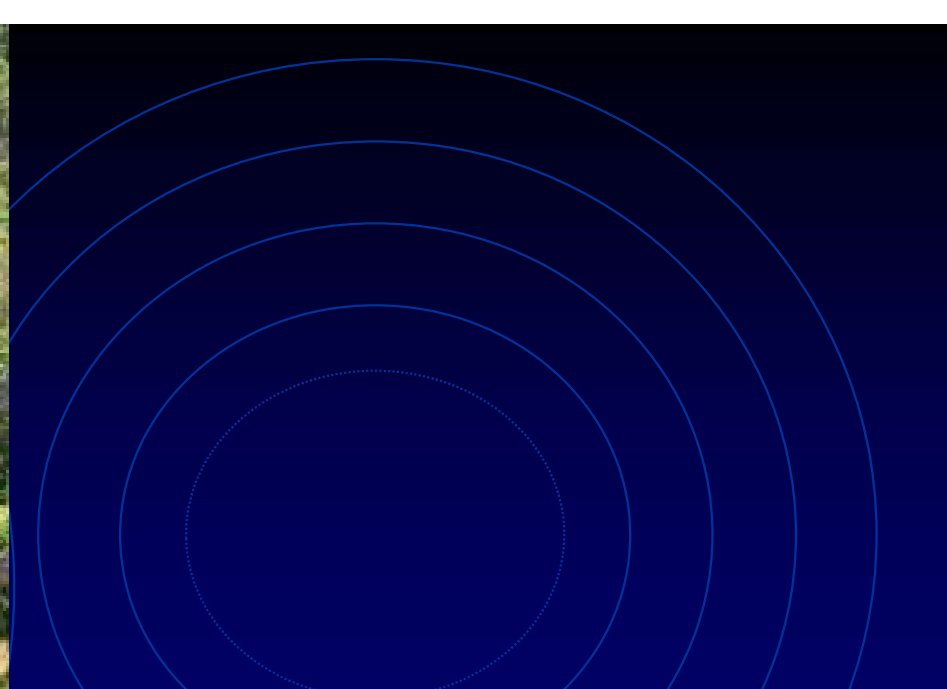
# Leaf Spots/Blights/Tree Killers

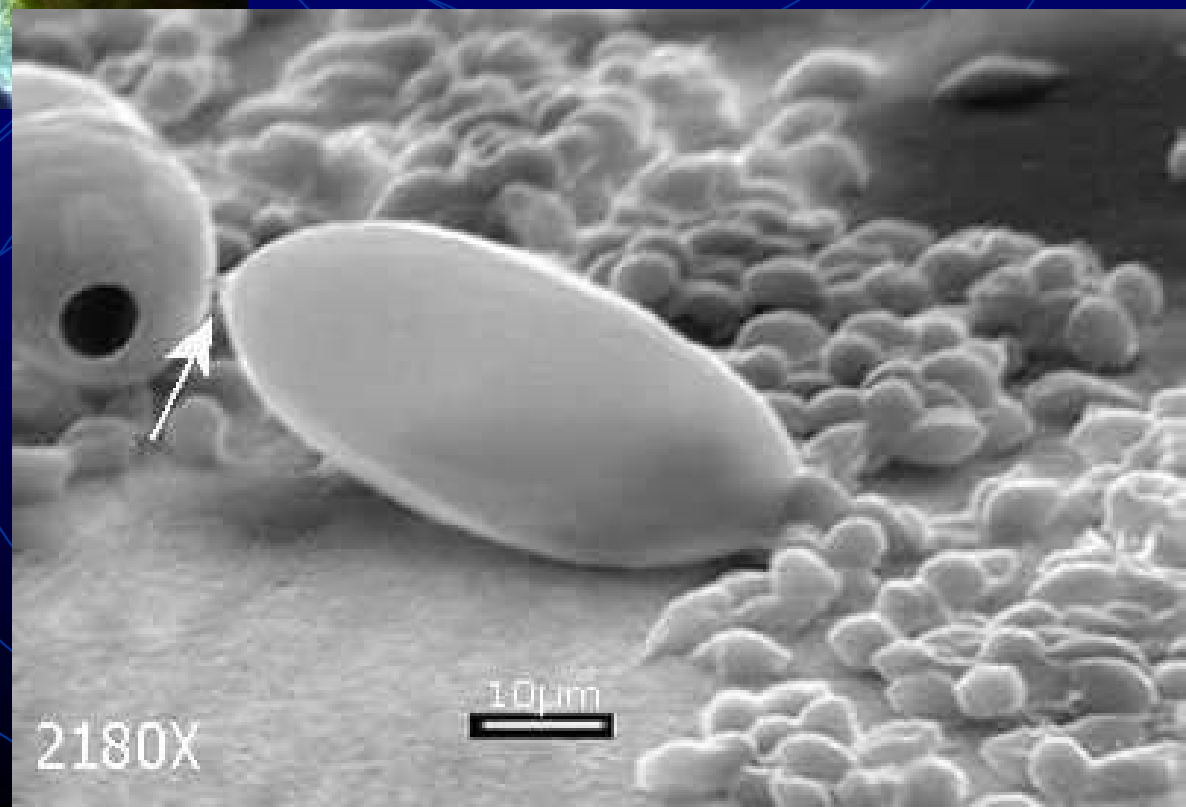
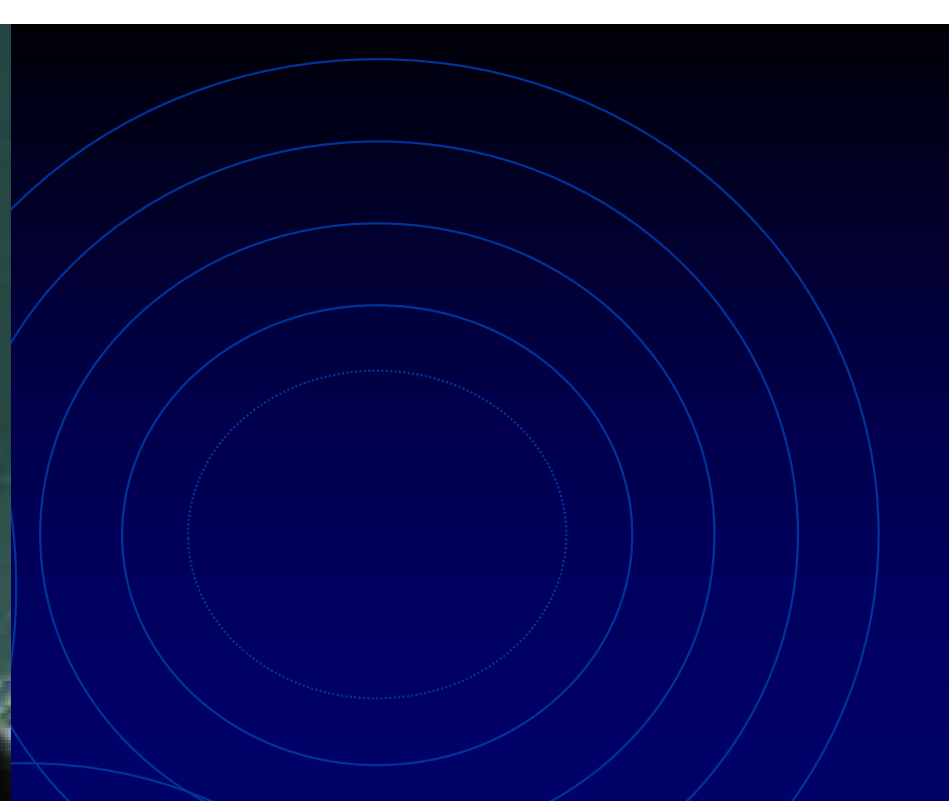
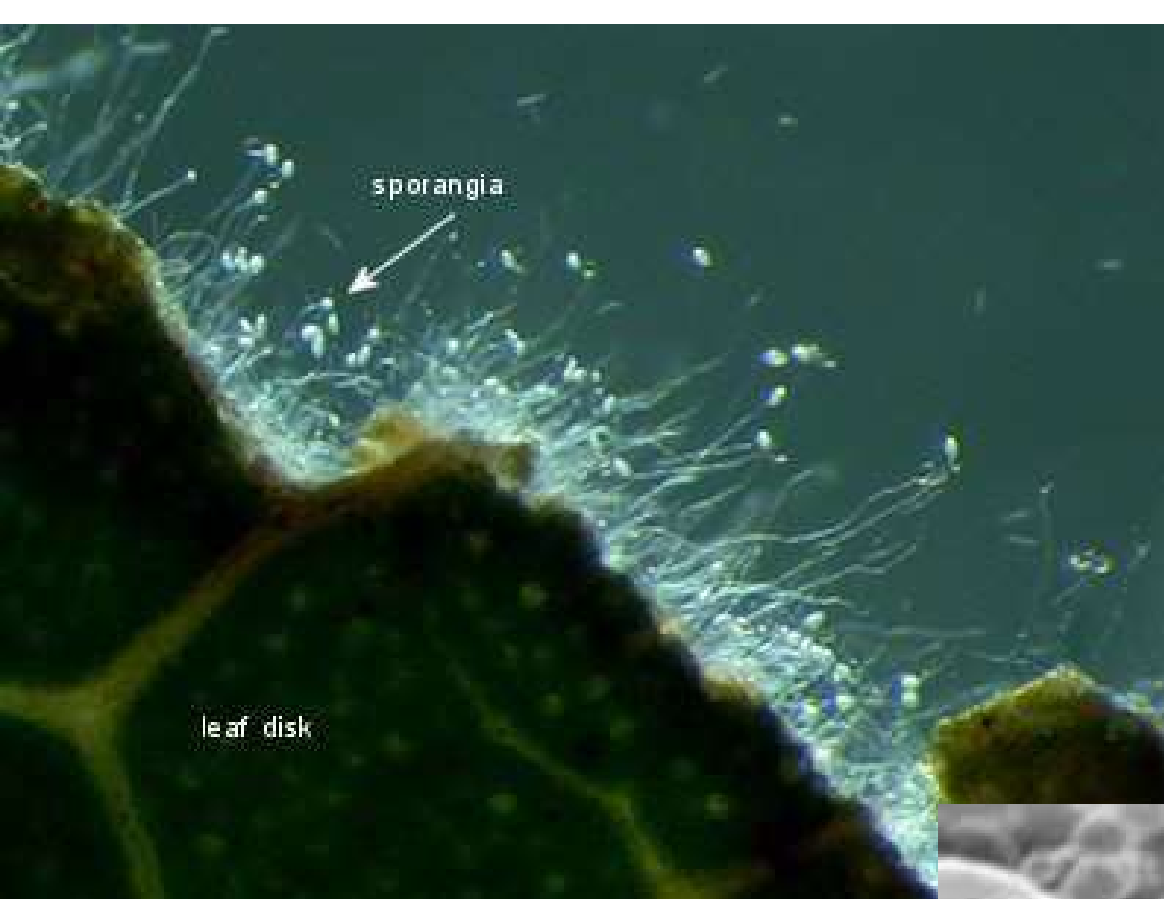
(*Phytophthora* spp. are not true fungi either)



*Phytophthora* spp. are not true fungi either



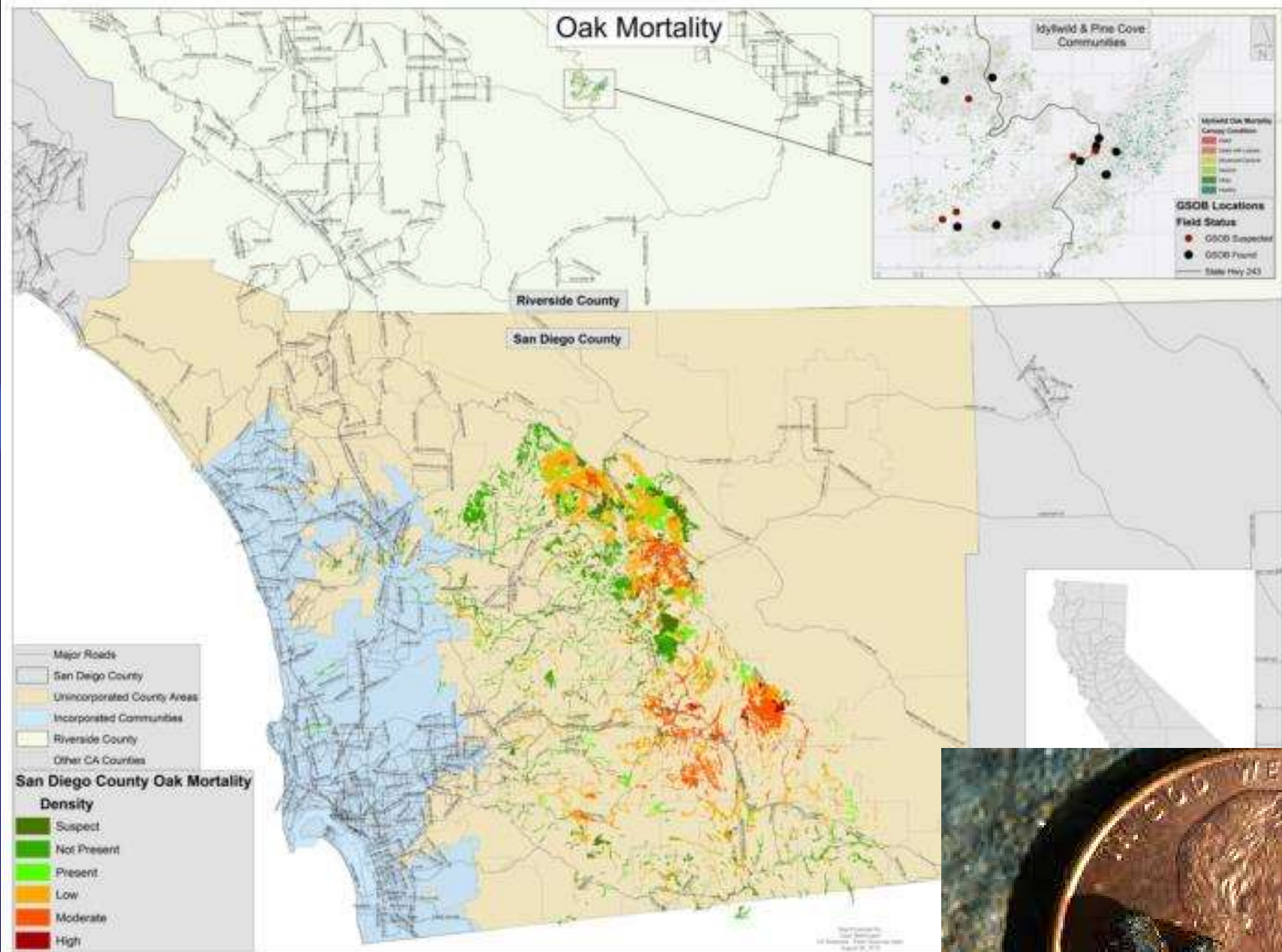




# *P. ramorum* Federal Quarantine Status









# Root Rots





# Trunk Rots

A close-up photograph of a tree trunk showing signs of decay. A large, white, irregularly shaped mass of fungus is growing on the bark. The fungus has a soft, cottony texture. Below it, a smaller, more structured white mass is visible, possibly a fruiting body. The surrounding bark is brown and textured, with some green moss or lichen visible on the left side.

*Ganoderma* sp. (C)



# Foliar Diseases

- Leaf Spots and Blights
- Powdery Mildews
- Rusts



Gladiolus rust caused by *Uromyces transversalis* (C)



# Leaf Spots



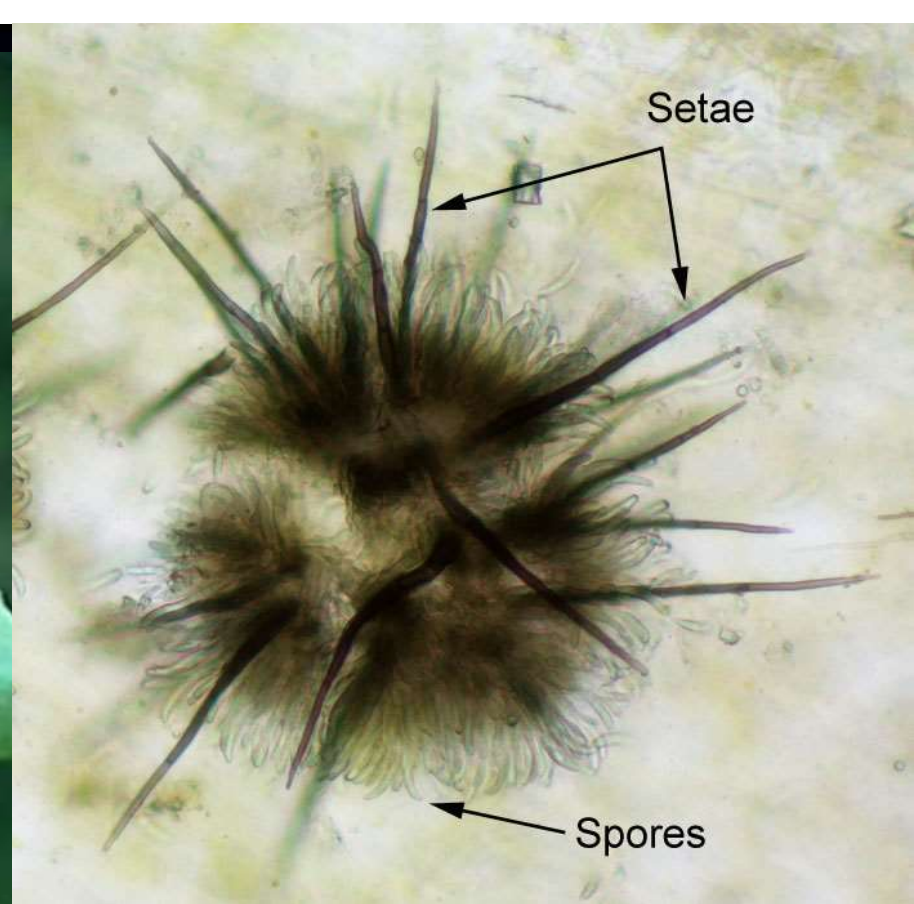
Entomosporium leaf spot on flowering pear and Rhamphiolepis





*Entomosporium* sp. (C)





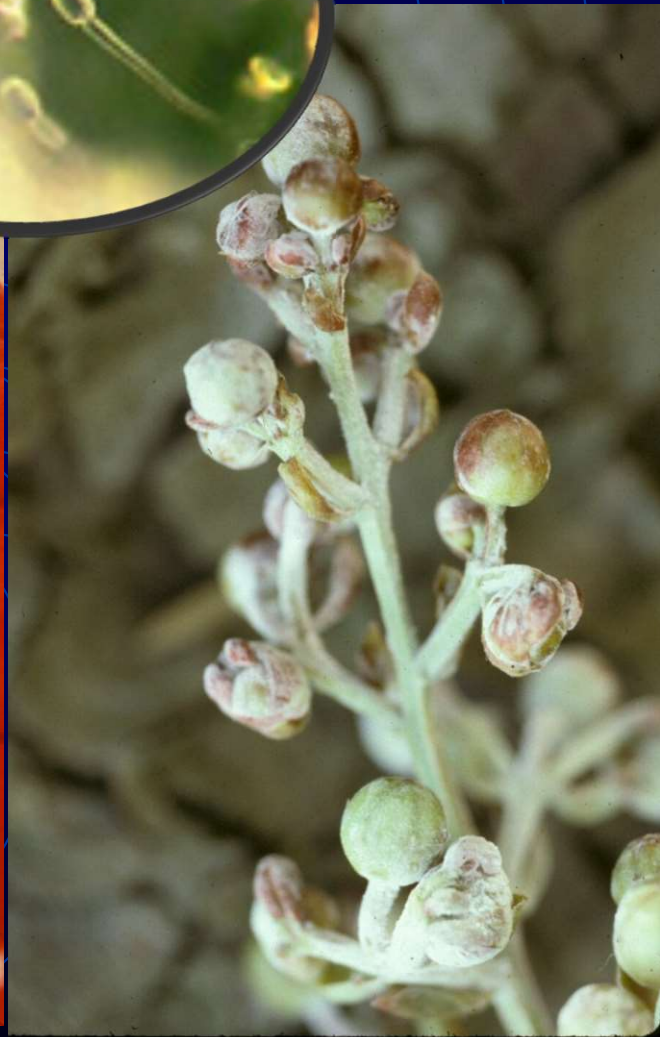
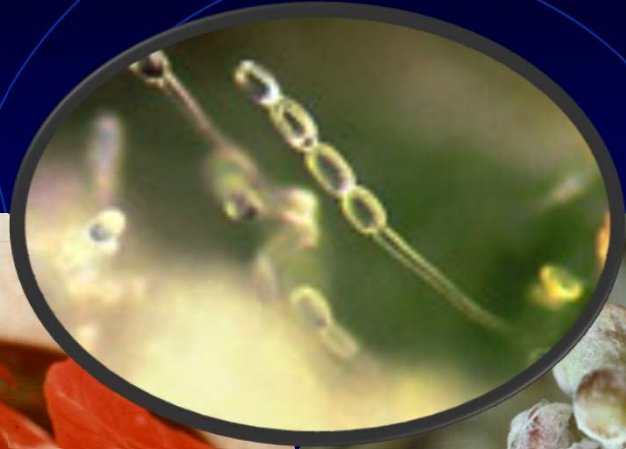
Anthracnose of Sycamore Caused By  
*Apiognomonia veneta* (C)

Anthracnose of *Cymbidium* Caused  
by *Colletotrichum cymbidiicola* (Q)  
found in San Diego County in 2014





# Powdery Mildews



*Oidium* sp. (C) on poinsettia and crape myrtle



*Erysiphe diffusa* on California peppertree  
Discovered in San Diego in 2019



Powdery Mildew on Sycamore







Powdery mildew on *Quercus agrifolia* caused by *Sphaerotheca lanestris*



# Rusts



Geranium Rust Caused By *Puccinia pelargonii-zonalis* (C)





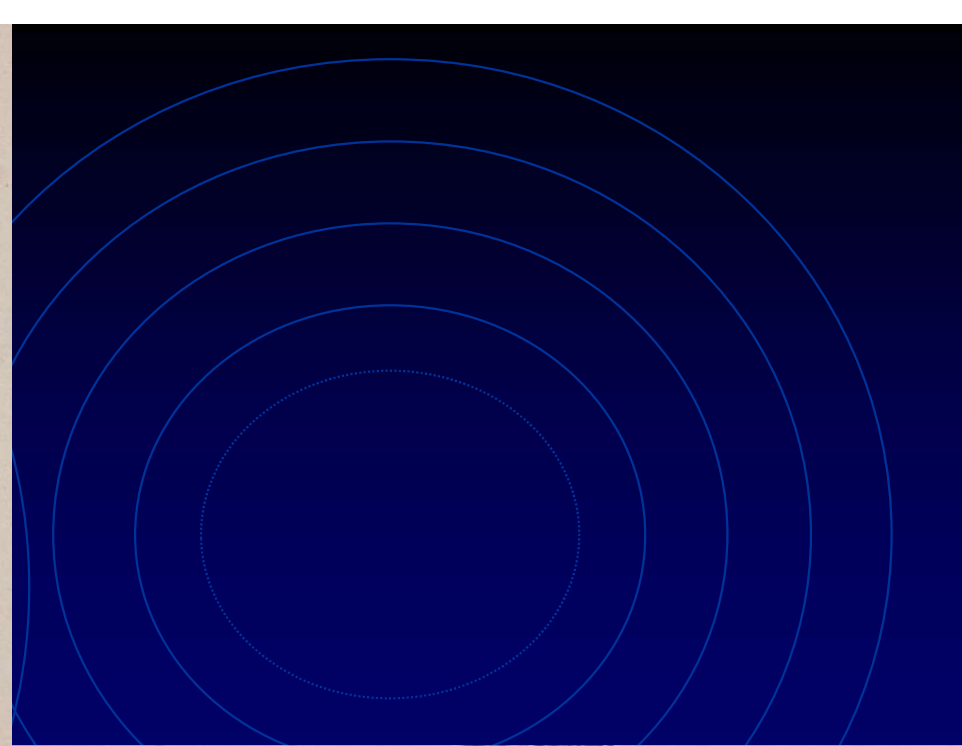
Rusts on daylily, sunflower, mint and eugenia





Chrysanthemum White Rust Caused by *Puccinia horiana* (Q)

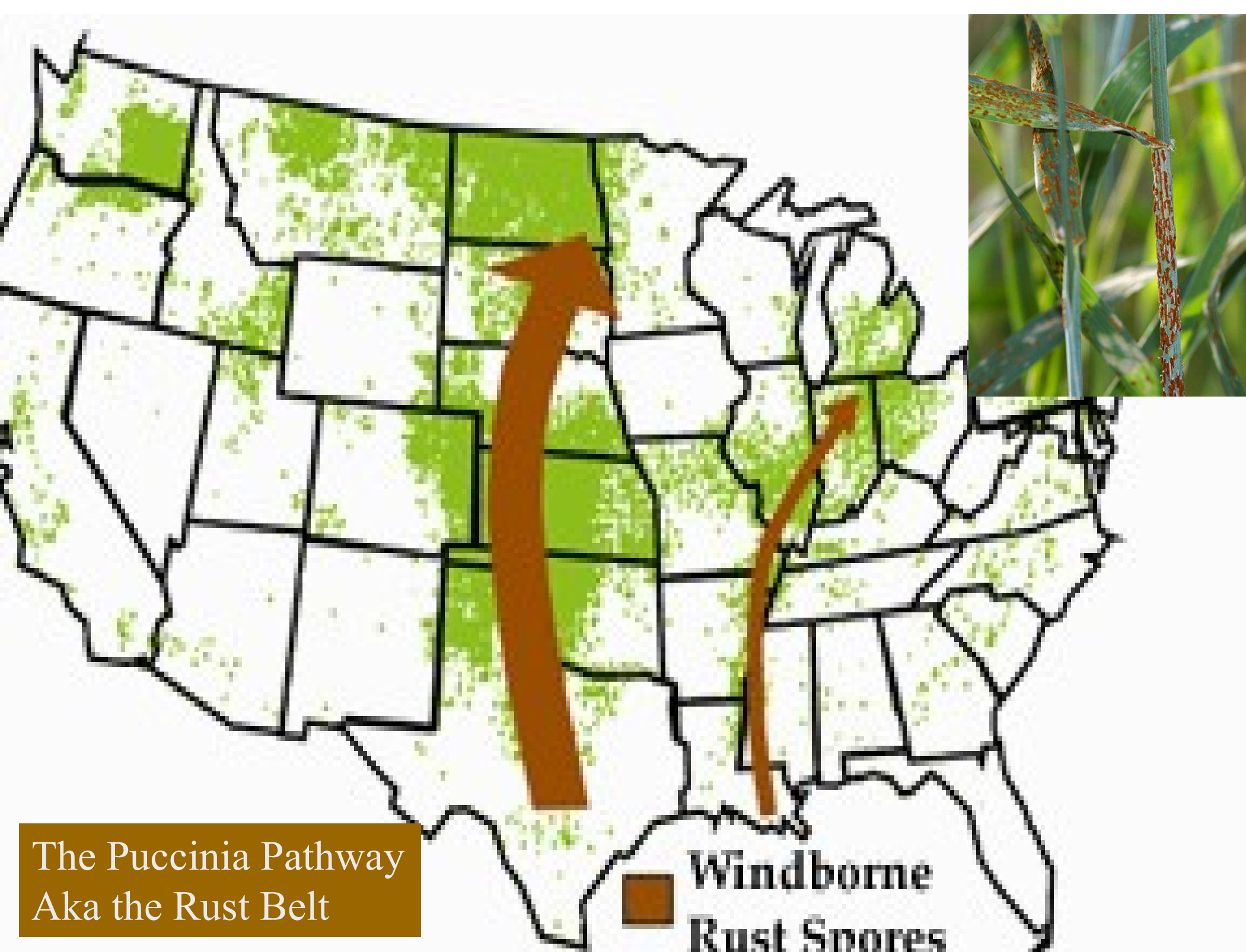




Uredospores and teliospores of  
*Phragmidium mucronatum* (C) (rose rust)  
and *Puccinia hemerocallidis* (C  
(daylily rust)







# Control

- Right plant in the right place
- Cultural methods-don't overwater, overfertilize, proper pruning, rotation, pest exclusion, etc.
- Sanitation, sanitation, sanitation
- Resistant varieties
- Pesticides- fungicides, insecticides













