

# IPM for Trees

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# Oakworm (Oak moth)

- *Phryganidia californica*
- Outbreaks occur every 5-7 years after warm winters
  - Last big outbreak 2007
- Localized defoliation of oaks
  - Especially in early fall (end of 3<sup>rd</sup> gen.)











# Oak moth

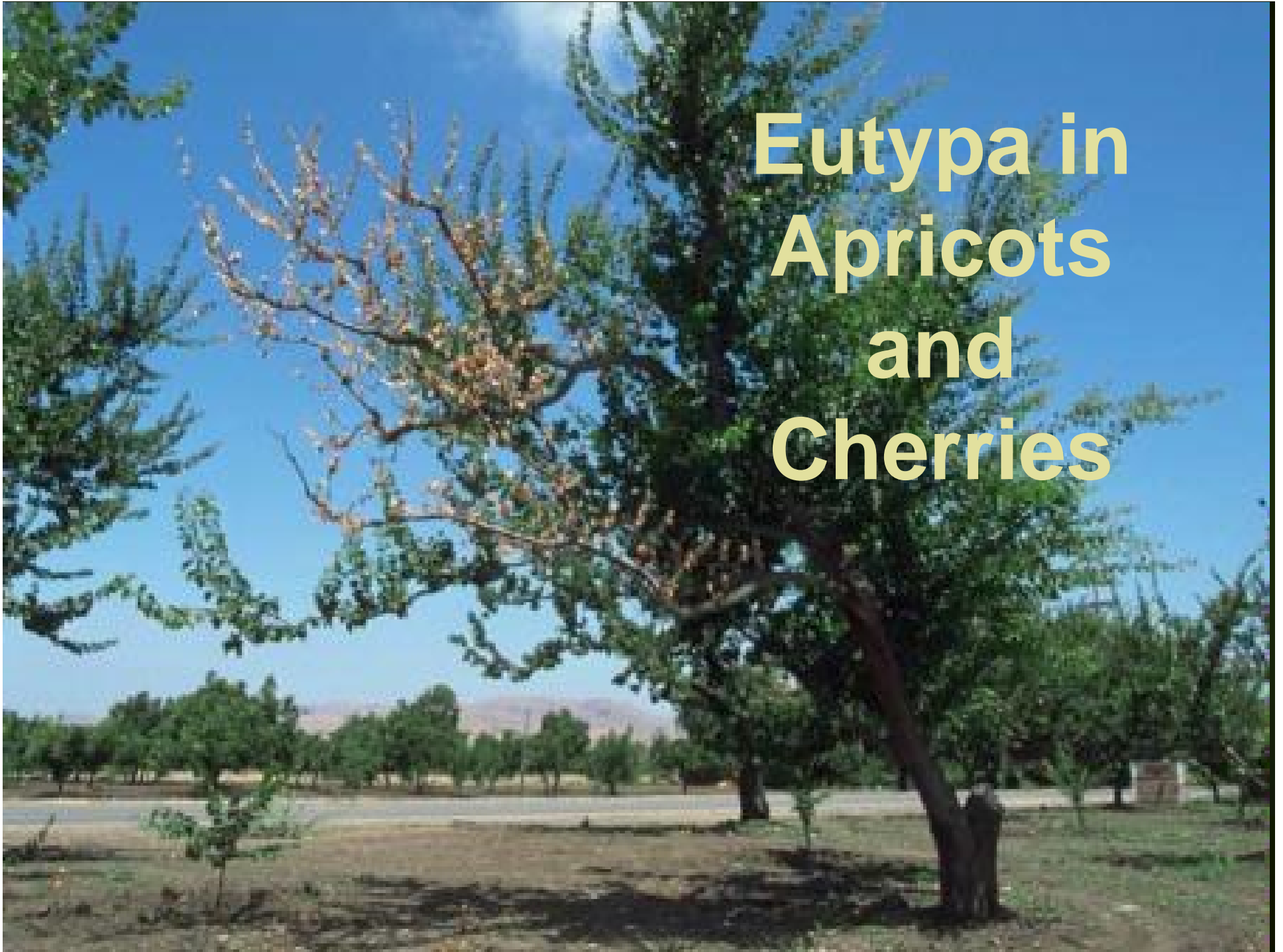
- This winter the population should crash
- Oaks can normally take repeated defoliation
  - It looks worse than it is
- Bt to control early in cycle if damage not tolerable
- Perhaps spinosins later in the summer

# Pine Pitch Canker

- *Fusarium circinatum*
- Monterey pine (others)
- No evidence for Agri-Fos efficacy
- Acquired resistance
  - Takes years
  - Via asymptomatic infection in roots?
  - Pine has to live long enough
  - Keep inoculum pressure low?



# Eutypa in Apricots and Cherries





# Eutypa

- Naturally infects fresh leaf abscission scars in rainy weather
  - Physiological weak point (reliable)
- Loves pruning wounds in winter
- Prune in summer after harvest
- If you have to prune in wet weather, cauterize with torch





# Eutypa

- Gummosis
- Whole branch dieback
- Wood discoloration
- Symptoms appear in summer
- UC IPM website





# Tortoise Shell Beetle

- Semi-circular cuts out of leaf margins
- Powerful jaws
  - Careful when dragging brush
- Can be hard to find



# Tortoise Shell Beetle

- $\frac{1}{4}$  -  $\frac{1}{2}$  inch long
- 2 similar species
  - *Trachymela sloanei*
  - *Chrysophtherta m-fuscum*
- Treatment:
  - No insecticides shown effective
    - But few tested

# Tortoise Shell Beetle

- Treatment:

- Foliar sprays difficult on large trees
- Systemics typically less effective on chewing insects
- Summer water with soaker hose (1x/mo)
- No fertilizer
- No major harm to tree
  - Perhaps Eucs will just have a “tattered” phase in late summer

# Root Disease Diagnosis

- Problems we've discussed so far have been clear
- Sometimes they're more cryptic
  - Or not ...



# Root Disease Diagnosis

- Finding signs & symptoms
  - Sharp tools
  - Disinfectant
  - What does healthy tissue look like?
    - Small cuts just into bark tissue
    - Excavate root crown





# Root Disease Diagnosis

- Finding signs & symptoms
  - Abiotic
  - Infectious
  - Often some combination



# Root Disease Diagnosis

- Armillaria
  - “Oak Root Rot”
  - White mycelia
  - Usually bark is soft where disease is advanced
  - Smells like fresh mushrooms
    - Often subtle
  - Sometimes clumps of tan mushrooms
    - White spores



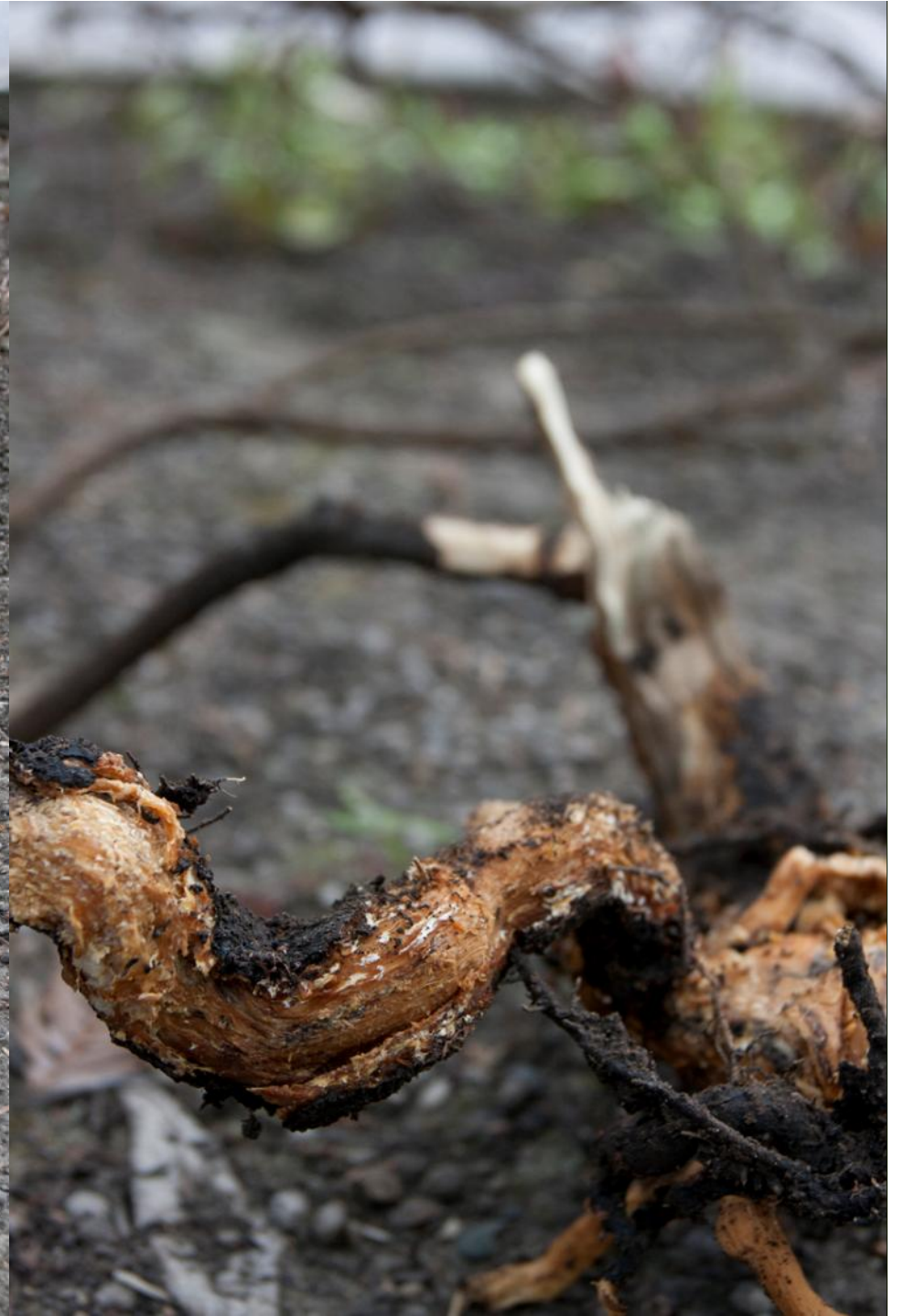
Photo: Beryt Oliver

















# Armillaria Treatment

- Water
  - Timing, amount, and location
- Chemical Tx not shown effective
  - Despite labels
- Removal
- Air spade
  - If caught early enough



Photo: Bob Ray Co., Inc.

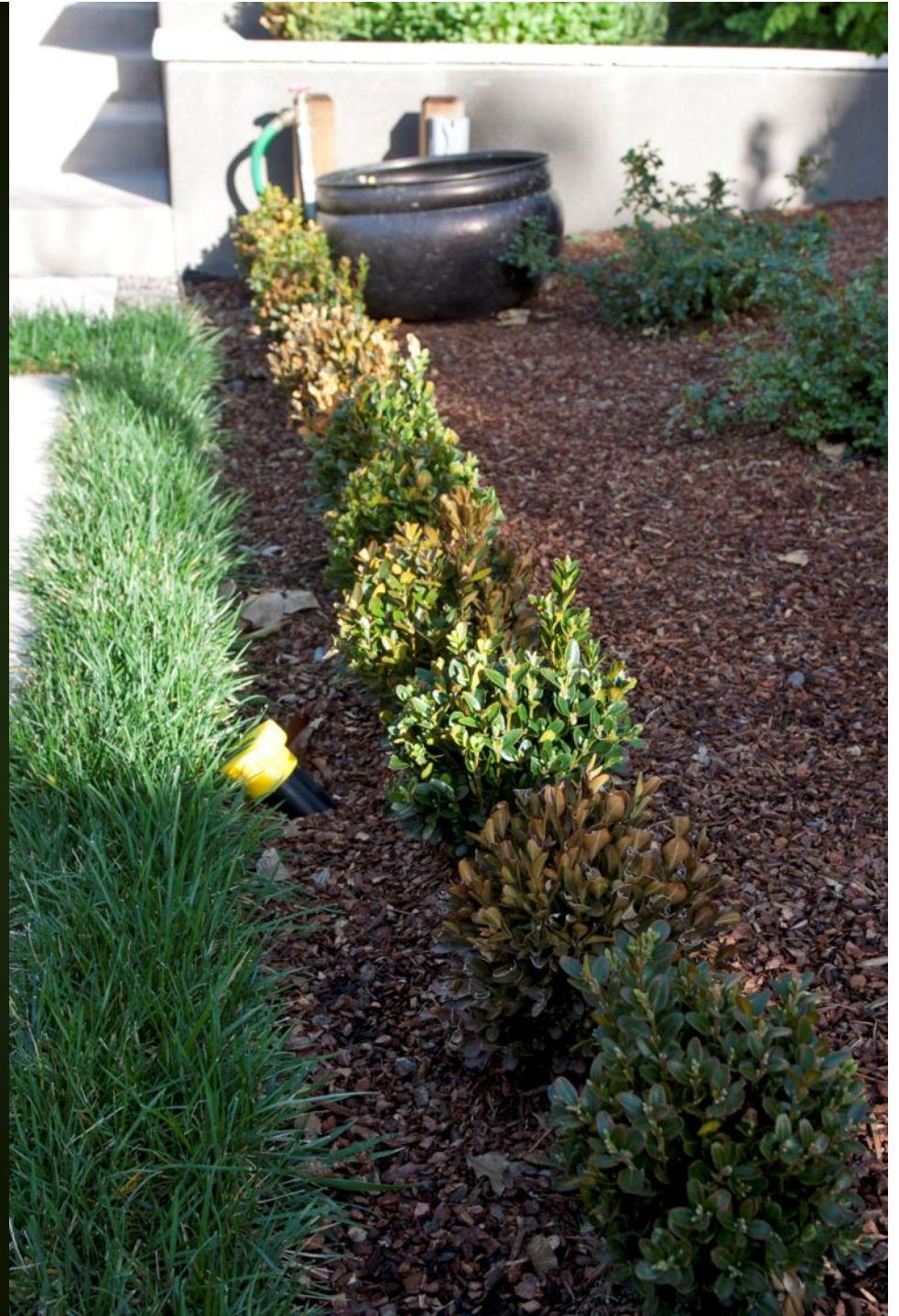
# Root Disease Diagnosis

- Phytophthora root rots
  - No visible fungal structures
  - Usually dark demarcation of infected tissues
  - Infected bark isn't typically degraded



# Phytophthora root rot Tx

- Water
  - Timing, amount, and location
- Bio-fungicides, e.g:
  - *Streptomyces lydicus*
  - *Bacillus subtilis*
- Traditional fungicides, e.g:
  - Mefanoxam
    - RESISTANCE
  - Phosphoric acids



# Root Disease Diagnosis

- Dematophora root rots
  - Comparatively rare
  - Also called Rosellinia
  - Appears similar to Armillaria, except
    - White fungal patches
      - On bark
      - In surrounding soil
    - No mushroom-like odor when scratched
    - Mycelia darken with age (to grey/black)



# Treatment of Dematophora

- Essentially the same as Phytophthora, but:
  - Allow area to dry
  - Then solarize soil mid-summer
    - Or fumigate



# Root Disease Diagnosis

- Verticillium wilt
  - Vascular wilt
    - Starts in roots
    - Often only one
  - Black streaks in wood
    - Except olives
  - Bark not typically degraded



# Treatment of Verticillium

- Water
  - Timing, amount, and location
- Fertilizer
- Bio-pesticides?
  - Clearly effective in some situations







*Solve your pest problems with UC's best science*

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- o [UC IPM Web site begins makeover](#)
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- o [Green Bulletin November 2011 issue](#)
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<a href="#">Metrosideros</a>	<i>Metrosideros</i> spp.	Myrtaceae (Myrtle family)
<a href="#">Mexican blue palm</a>	<i>Brahea armata</i>	Arecaceae (Palm family)
<a href="#">Mexican fan palm</a>	<i>Washingtonia robusta</i>	Arecaceae (Palm family)
<a href="#">Mexican orange</a>	<i>Choisya ternata</i>	Rutaceae (Rue family)
<a href="#">Mimosa</a>	<i>Albizia</i> spp.	Fabaceae (Pea family)
<a href="#">Mock orange</a>	<i>Choisya ternata</i>	Rutaceae (Rue family)
<a href="#">Monkey flower</a>	<i>Diplacus</i> spp.	Scrophulariaceae (Figwort family)
<a href="#">Monkey flower</a>	<i>Mimulus</i> spp.	Scrophulariaceae (Figwort family)
<a href="#">Monkey puzzle tree</a>	<i>Araucaria</i> spp.	Araucariaceae (Araucaria family)
<a href="#">Mountain ash</a>	<i>Sorbus</i> spp.	Rosaceae (Rose family)
<a href="#">Mountain mahogany</a>	<i>Cercocarpus</i> spp.	Rosaceae (Rose family)
<a href="#">Mugwort</a>	<i>Artemisia</i> spp.	Asteraceae (Sunflower family)
<a href="#">Mulberry</a>	<i>Morus</i> spp.	Moraceae (Mulberry family)
<a href="#">Myoporum</a>	<i>Myoporum</i> spp.	Myoporaceae (Myoporum family)
<a href="#">Myrtle</a>	<i>Melaleuca</i> spp.	Myrtaceae (Myrtle family)
<a href="#">Nandina</a>	<i>Nandina domestica</i>	Berberidaceae (Barberry family)
<a href="#">Natal plum</a>	<i>Carissa grandiflora</i>	Apocynaceae (Dogbane family)
<a href="#">Natal plum</a>	<i>Carissa macrocarpa</i>	Apocynaceae (Dogbane family)
<a href="#">New Zealand Christmas tree</a>	<i>Metrosideros</i> spp.	Myrtaceae (Myrtle family)
<a href="#">Norfolk island pine</a>	<i>Araucaria</i> spp.	Araucariaceae (Araucaria family)
<a href="#">Oak</a>	<i>Quercus</i> spp.	Fagaceae (Beech family)
<a href="#">Oleander</a>	<i>Nerium oleander</i>	Apocynaceae (Dogbane family)
<a href="#">Olive</a>	<i>Olea europaea</i>	Oleaceae (Olive family)
<a href="#">Orchid tree</a>	<i>Bauhinia</i> spp.	Fabaceae (Pea family)
<a href="#">Oregon grape</a>	<i>Mahonia</i> spp.	Berberidaceae (Barberry family)
<a href="#">Oregon myrtle</a>	<i>Umbellularia californica</i>	Lauraceae (Laurel family)
<a href="#">Ornamental pear</a>	<i>Pyrus</i> spp.	Rosaceae (Rose family)
<a href="#">Palm</a>	Many species	Arecaceae (Palm family)
<a href="#">Palmetto palm</a>	<i>Sabal palmetto</i>	Arecaceae (Palm family)
<a href="#">Palo verde</a>	<i>Cercidium</i> spp.	Fabaceae (Pea family)
<a href="#">Paperbark</a>	<i>Melaleuca</i> spp.	Myrtaceae (Myrtle family)
<a href="#">Pepper tree</a>	<i>Schinus molle</i>	Anacardiaceae (Sumac family)
<a href="#">Pepperwood</a>	<i>Umbellularia californica</i>	Lauraceae (Laurel family)
<a href="#">Persimmon</a>	<i>Diospyros</i> spp.	Ebenaceae (Ebony family)
<a href="#">Photinia</a>	<i>Photinia</i> spp.	Rosaceae (Rose family)
<a href="#">Pindo palm</a>	<i>Butia capitata</i>	Arecaceae (Palm family)
<a href="#">Pine</a>	<i>Pinus</i> spp.	Pinaceae (Pine family)
<a href="#">Pittosporum</a>	<i>Pittosporum</i> spp.	Pittosporaceae (Pittosporum family)
<a href="#">Podocarpus</a>	<i>Podocarpus</i> spp.	Podocarpaceae (Podocarpus family)
<a href="#">Pongamia</a>	<i>Pongamia pinnata</i>	Fabaceae (Pea family)

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## Oak—*Quercus* spp. Family Fagaceae (Beech family)

### Plant identification

Oaks are deciduous or evergreen trees with acorns.

### Optimum conditions for growth

Oaks grow in various climatic zones and do well in full sun.



Leaves of valley oak

© 1995 Br. Alfred Brousseau, Saint Mary's College of California



Fall color of pin oak

## Pests and disorders of *Quercus* spp.

### Invertebrates

- [Acorn moth](#)
- [Aphids](#)
- [Armored scales](#)
  - [Obscure scale](#)
- [Bark beetles](#)
  - [Ambrosia beetles](#)
  - [Oak bark beetles](#)
- [Carpenterworm](#)
- [Clearwing moth borers](#)
  - [Sycamore borer](#)
- [Filbertworm, filbert weevil, and acorn moth](#)
- [Flatheaded borers](#)
  - [Flatheaded apple tree borer](#)
  - [Goldspotted oak borer](#) (5 MB, PDF)
  - [Oak twig girdler](#)
  - [Pacific flatheaded borer](#)
- [Foliage-feeding caterpillars](#)
  - [California oakworm](#)
  - [Fruit tree leafroller](#)
  - [Tent caterpillars](#)
  - [Tussock moths](#)
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  - [Leafminers](#)
  - [Oak ribbed casemaker](#)
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- [Fuller rose beetle and Live oak weevil](#)
- [Gall and blister mites](#)
  - [Live oak erineum mite](#)
- [Gall makers](#)
  - [California gallfly](#)
  - [Cynipid gall wasps](#)
  - [Ichneumonid wasps](#)
  - [Jumping oak gall wasp](#)
  - [Twohorned oak gall wasp](#)
- [Glassy-winged sharpshooter](#)
- [Mesoleius](#)

### Invertebrates (cont.)

- [Roundheaded borers](#)
  - [Roundheaded oak twig borer](#)
- [Soft scales](#)
  - [Kermes scales, black-punctured kermes](#)
  - [Oak lecanium scale](#)
- [Spider mites](#)
  - [Sycamore spider mite](#)
- [Treehoppers](#)
  - [Oak treehopper](#)
- [Whiteflies](#)
  - [Crown whitefly](#)
  - [Gelatinous whitefly](#)
  - [Stanford whitefly](#)
- [Woolly aphids](#)
  - [Woolly oak aphid](#)

### Diseases

- [Anthracnose](#)
- [Armillaria root rot](#)
- [Canker diseases](#)
  - [Hypoxylon canker](#)
  - [Nectria canker](#)
- [Drippy oak acorns](#)
- [Foamy canker](#)
- [Oak branch dieback](#)
- [Oak leaf blister](#)
- [Oak twig blight](#)
- [Powdery mildew/Witches' broom](#)
- [Root and crown rots](#)
- [Rusts](#)
- [Sudden oak death](#)
- [Wetwood](#)
- [Wood decay](#)

### Environmental disorders

- [Leaf burn](#)
- [Leaf scorch](#)
- [Mineral deficiencies](#)

## How to Manage Pests

### Pests in Gardens and Landscapes

## Powdery Mildew on Ornamentals

Revised 4/09



#### In this Guideline:

- [Identification and damage](#)
- [Life cycle](#)
- [Management](#)
- [About Pest Notes](#)
- [Publication](#)
- [Glossary](#)

Powdery mildew is a common disease on many types of plants and is prevalent under the diverse conditions that cause disease on different plants. These fungi tend to infect either plants in the same family or only one

### IDENTIFICATION AND DAMAGE

You can recognize this disease by the white, powdery mycelial and spore growth that forms on [leaf surfaces](#) may infect new or old foliage. This disease can be serious on woody species such as rose, crape myrtle, [flowers](#), and leaves. New growth may be [dwarfed](#), distorted, and covered with a white, powdery growth. [Healthy leaves](#).

### LIFE CYCLE

All powdery mildew fungi [require living plant tissue to grow](#). On perennial hosts such as roses, powdery mildew forms buds or as spherical fruiting bodies, called [chasmothecia](#), on the bark of branches and stems.

Most powdery mildew fungi grow as [thin layers of mycelium](#) on the surface of the affected plant parts. Spores have a powdery appearance of this fungi and are produced in chains on upper or lower leaf surfaces or on flower parts. This fungal disease that produces visible powdery growth, has spores that grow on [branched stalks](#) and look like a fine powder on leaf surface. Environmental conditions that favor the growth of downy mildew are different from those that favor the growth of powdery mildew, which require a relative humidity of 90% or higher, and free moisture.

Wind carries powdery mildew spores to new hosts. Although relative humidity requirements for germination are low, the absence of free water. In fact, water on plant surfaces for extended periods inhibits germination and kills spores. Temperatures of 60° to 80°F and shady conditions generally are the most favorable for powdery mildew development. Powdery mildew is killed by sunlight, and leaf temperatures above 95°F may kill the fungus.

### MANAGEMENT

The best method of control is prevention. Avoiding the most susceptible cultivars, placing plants in full sun, and avoiding mildew in many situations. Some ornamentals do require protection with fungicide sprays if mildew conditions are severe on crape myrtle. (See Table 1.) For a list of other common ornamentals susceptible to powdery mildew, see Table 2.

**Table 1. Host Plants and Control Measures for Powdery Mildew Species.**

Fungus species	Hosts
<i>Gaiovinomyces cichoracearum</i>	begonia, Composite family (chrysanthemum, dahlia, phlox, sunflower, and zinnia)
<i>Erysiphe lagerstroemiae</i>	crape myrtle
<i>Sphaerotheca pannosa</i>	rose

**Table 2. Common Ornamentals Susceptible to Powdery Mildew.**

Common Name	Scientific Name	Susceptible
aster	<i>Aster</i>	crape myrtle
azalea (deciduous)	<i>Rhododendron</i>	dahlia

# Cenicilla

**Puntos de un blanco cenizo en las hojas y brotes pueden ser señal de cenicilla.** Esta enfermedad afecta muchas plantas y puede ser causada por diferentes tipos de hongos. Para combatir la cenicilla use variedades de plantas resistentes a este hongo y altere el ambiente en que crecen. En algunos casos, ciertas especies de plantas susceptibles a estos hongos requerirán tratamiento con fungicidas.

### Los síntomas pueden variar de una especie a otra.

- Use piedra lisa o baldosas, adoquines o concreto permeable para senderos y patios en lugar de superficies impermeables como el concreto y asfalto.
- Las hojas se tornan amarillentas o café y se caen, exponiendo a la planta o fruto a las quemaduras del sol.
- En algunos casos, las hojas o los brotes se tuercen o distorsionan.
- Las frutas y verduras usualmente no se ven afectadas, pero los manzanos, vid y otras frutas con hueso pueden desarrollar unas marcas rojizas en forma de telaraña o áreas suberosas.

### La cenicilla es común en condiciones cálidas y secas.

- A diferencia de muchas enfermedades, la cenicilla no necesita de condiciones húmedas para desarrollarse y su crecimiento es inhibido por el agua en la primavera.
- Las temperaturas moderadas (60°F a 80°F) y la sombra favorecen el desarrollo de la enfermedad.

### Haga a las plantas menos susceptibles alterando el ambiente en el que crecen.

- Cultive las plantas en sitios soleados.
- Poda el exceso de follaje para permitir el paso del aire.
- No fertilice en exceso con nitrógeno ya que el follaje frondoso y la sombra favorecen a la enfermedad.

### Plante variedades resistentes.

Las variedades de plantas muy susceptibles que son resistentes o menos susceptibles, incluyen:

- Las ornamentales: mirto, rosa, platanero, rododendro y zinnia.
- Frutas: manzano, duraznero y frambuesa.
- Verduras: melones, calabazas, pepinos, frijoles y chícharos.



### Considere usar métodos sin el uso de materiales químicos.

- Rocíe las plantas infectadas con agua. Para prevenir problemas con otras enfermedades, haga esto a media mañana para que se sequen rápidamente. Agregue un poquito de jabón al agua para puede aumentar la efectividad.
- Durante la temporada en la que no se produce fruto, corte las partes y los brotes que muestren una infección leve. Asegúrese de sacar de su jardín cualquier material infectado para que las esporas no se esparzan a nuevas áreas.

### Las variedades susceptibles de algunas plantas pueden requerir el uso de fungicidas.

- Las plantas que requieren de tratamiento con mayor frecuencia son los manzanos, zarzamora, vid, rosales y cucurbitáceas.
- Controle las infecciones leves a moderadas de la cenicilla usando aceite de horticultura o aceites a base de plantas como el de árbol de neem o de jojoba, o fungicidas a base de bicarbonato de sulfuro. No aplique los aceites en donde haya usado bicarbonato de sulfuro o cuando la temperatura rebase los 90°F.
- Prevenga las infecciones usando sulfuros solubles en agua, en especial los que vienen listos para usarse y formulados con agentes tensoactivos parecidos al jabón. Estos productos son ineficaces si se aplican cuando la infección ya ha aparecido. Podría ser necesario repetir la aplicación.
- Existen otros fungicidas para otros tipos de plantas, pero la mayoría se deben aplicar antes de que aparezcan los primeros brotes de la enfermedad.

Para mayores detalles en inglés, vea Pest Notes: [Powdery Mildew on Fruits and Berries](#), [Powdery Mildew on Ornamentals](#), and [Powdery Mildew on Vegetables](#) a [www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu), o visite las oficinas de Extensión Cooperativa.



Reduzca al mínimo el uso de pesticidas que contaminan nuestros canales. Utilice alternativas sin químicos o productos pesticidas menos tóxicos siempre que sea posible. Lea las etiquetas de los productos cuidadosamente y siga las instrucciones sobre el uso, almacenamiento y desecho correcto.

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**¡Lo que usted usa en sus paisajes afecta nuestros ríos y océanos!**

# UC IPM

- Environmental themes mentioned in management section
- Many other treatment options too
- Cultural and design options a good starting point
  - Especially if you can cure more than one problem

All powdery mildew fungi require living plant tissue to grow. On perennial hosts such as roses, powdery mildew survives from one season to the next as vegetative strands in buds or as spherical fruiting bodies, called chasmothecia, on the bark of branches and stems.

Most powdery mildew fungi grow as thin layers of mycelium on the surface of the affected plant parts. Spores, which you can see with a hand lens, are part of the white, powdery appearance of this fungi and are produced in chains on upper or lower leaf surfaces or on flowers, fruits, or herbaceous stems. In contrast, downy mildew, another fungal disease that produces visible powdery growth, has spores that grow on branched stalks and look like tiny trees. Also, downy mildew spores occur mostly on the lower leaf surface. Environmental conditions that favor the growth of downy mildew are different from those that favor powdery mildew and include low temperatures of 50° to 70°F, a relative humidity of 90% or higher, and free moisture.

Wind carries powdery mildew spores to new hosts. Although relative humidity requirements for germination vary, all powdery mildew species can germinate and infect in the absence of free water. In fact, water on plant surfaces for extended periods inhibits germination and kills the spores of most powdery mildew fungi. Moderate temperatures of 60° to 80°F and shady conditions generally are the most favorable for powdery mildew development. Powdery mildew spores and mycelium are sensitive to extreme heat and sunlight, and leaf temperatures above 95°F may kill the fungus.

## MANAGEMENT

The best method of control is prevention. Avoiding the most susceptible cultivars, placing plants in full sun, and following good cultural practices will adequately control powdery mildew in many situations. Some ornamentals do require protection with fungicide sprays if mildew conditions are more favorable, especially susceptible varieties of rose and crape myrtle. (See Table 1.) For a list of other common ornamentals susceptible to powdery mildew, see Table 2.

Table 1. Host Plants and Control Measures for Powdery Mildew Species.

Fungus species	Hosts	Control
<i>Golovinomyces cichoracearum</i>	begonia, Composite family (chrysanthemum, dahlia, phlox, sunflower, and zinnia)	water
<i>Erysiphe lagerstroemiae</i>	crape myrtle	resist
<i>Sphaerotheca pannosa</i>	rose	resist neces

Table 2. Common Ornamentals Susceptible to Powdery Mildew.

Susceptible Plant		Control
aster	crape myrtle	oa
azalea (deciduous)	dahlia	pa
begonia (tuberous)	delphinium	ph
calendula	euonymus	ra
California poppy	forget-me-not	ro



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- [Birds, mammals, and reptiles](#): vertebrate pests



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