
POWDERY MILDEW ON ORNAMENTALS

Integrated Pest Management for Home Gardeners and Landscape Professionals

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

IDENTIFICATION AND DAMAGE

You can recognize this disease by the white, powdery mycelial and spore growth (Figs. 1a-1c) that forms on leaf surfaces and shoots and sometimes on flowers and fruits. Powdery mildews may infect new or old foliage. This disease can be serious on woody species such as rose, crape myrtle, and sycamore where it attacks new growth including buds, shoots, flowers, and leaves. New growth may be dwarfed, distorted, and covered with a white, powdery growth. Infected leaves generally die and drop from the plant earlier than healthy leaves.

LIFE CYCLE

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. The life cycle and stages of the fungus that causes powdery mildew on roses are shown in Figure 2.

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 fungus 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.



Figure 1a. Powdery mildew (*Microspora alni*) caused white patches and distorted these sycamore leaves.



Figure 1b. Powdery mildew growth covers the underside of this oak leaf.



Figure 1c. The upper surface of this dahlia leaf is supporting extensive white growth from powdery mildew infections.

Table 1.

Host Plants and Control Measures for Some Powdery Mildew Species.

Fungus Species	Hosts	Controls
<i>Golovinomyces cichoracearum</i>	begonia, Composite family (chrysanthemum, dahlia, phlox, sunflower, and zinnia)	water sprays; fungicides if necessary
<i>Erysiphe lagerstroemiae</i>	crape myrtle	resistant cultivars
<i>Sphaerotheca pannosa</i>	rose	resistant cultivars; fungicides if necessary

Resistant Varieties

Cultivars resistant to powdery mildew are available for some susceptible plants including rose, crape myrtle, euonymus, and sycamore (Table 3). Choose resistant varieties to reduce the likelihood of having to apply sprays.

Cultural Practices

Shade and moderate temperatures favor most powdery mildews. Locate plants in sunny areas as much as possible, provide good air circulation, and avoid excess fertilizing or use a slow-release fertilizer. Overhead sprinkling actually may reduce the spread of powdery mildew, because it washes spores off the plant. Also, if spores land in water, they die. The best time to irrigate is mid-morning, so plants dry rapidly, reducing the likelihood of infections by other fungi, such as ones that cause rust or black spot on roses. As new shoots begin to develop on perennial plants, watch closely for signs of powdery mildew.

Fungicide Applications

In some situations, especially when growing roses, you may need to use fungicides, which function as protectants, eradicants, or both. A protectant fungicide prevents new infections from occurring, whereas an eradicant can kill an existing infection. Apply protectant fungicides to highly susceptible plants before the disease appears. Use eradicants at the earliest signs of the disease. Once mildew growth is extensive, controlling the situation with any fungicide becomes more difficult.

Fungicides. Several least-toxic fungicides are available, including horticultural

oils, neem oil, jojoba oil, sulfur, potassium bicarbonate, and the biological fungicide Serenade. With the exception of the oils, these materials are primarily preventive, although potassium bicarbonate has some eradicant activity. Oils work best as eradicants but also have some protectant activity.

Oils. To eradicate mild to heavy powdery mildew infections, use a horticultural oil such as JMS Stylet Oil, Saf-T-Side Spray Oil, Sunspray Ultra-Fine Spray Oil, or one of the plant-based oils such as neem oil (e.g., Powdery Mildew Killer) or jojoba

oil (e.g., E-rase). Be careful, however, never to apply an oil spray within 2 weeks of a sulfur spray, or it may injure plants. Also, you never should apply oils when temperatures are above 90°F or to water-stressed plants. Some plants may be more sensitive than others, and the interval required between sulfur and oil sprays may need to be even longer. Always consult the fungicide label for any special precautions. Of the horticultural oils, JMS Stylet Oil is the most highly refined and therefore the least likely to damage plants, but it may be more difficult to obtain than the others.

Sulfur. Sulfur products have been used to manage powdery mildew for centuries but are effective only when applied before the disease appears. The best sulfur products to use for powdery mildew control in gardens are wettable sulfurs that are specially formulated with surfactants similar to those in dishwashing detergent (e.g., Safer Garden Fungicide). However, you shouldn't use dishwashing detergent with sulfur. Additionally, sulfur

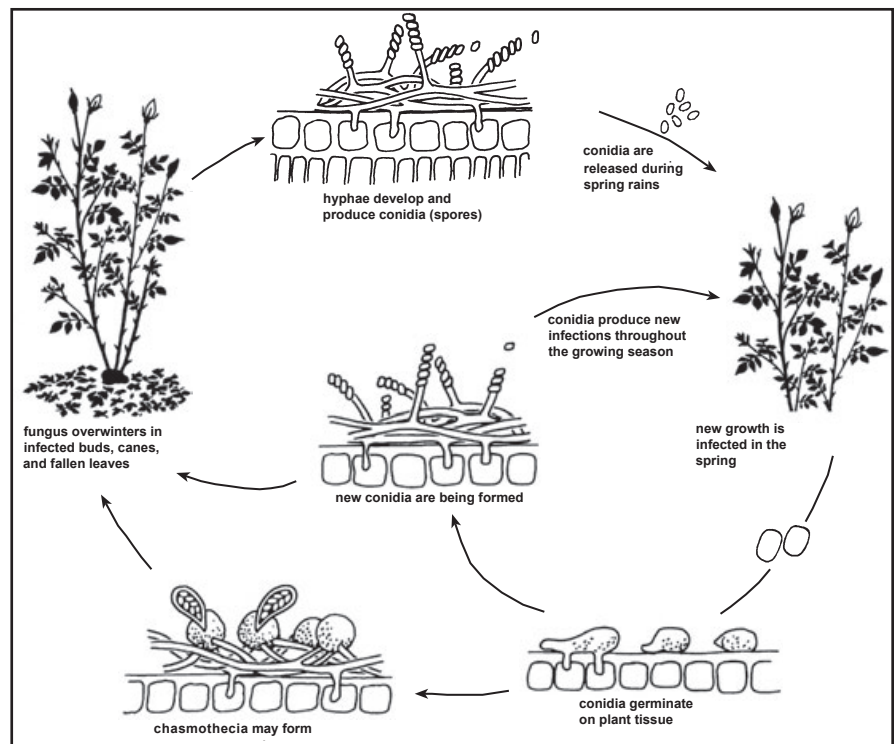


Figure 2. Life cycle and stages (magnified) of *Sphaerotheca pannosa* infecting a rose.

Table 2.

Common Ornamentals Susceptible to Powdery Mildew.

Susceptible Plant		
aster	crape myrtle	oak
azalea (deciduous)	dahlia	pansy
begonia (tuberous)	delphinium	phlox
calendula	euonymus	ranunculus
California poppy	forget-me-not	rose
China aster (<i>Callistephus</i>)	gaillardia	rhododendron
chrysanthemum	hydrangea	rudbeckia
Clarkia	lilac	snapdragons
columbine	London plane tree	sweet pea
coral bells (<i>Heuchera</i>)	lupine	verbena
corn flower	mint	vinca
cosmos	monarda	zinnia

Table 3.

Ornamentals with Resistant Cultivars.

Susceptible Plant	Resistant Cultivars
crape myrtle	those with Native American names, e.g., 'Catawba,' 'Cherokee,' 'Hopi'
euonymus	variegated varieties more resistant than nonvariegated types
London plane tree	'Yarwood,' 'Columbia,' 'Liberty'
monarda	'Marshall's Delight,' 'Blaustrumph,' 'Colrain Red'
phlox	<i>Phlox maculata</i> 'Natasha,' <i>P. glaberrima</i> 'MorrisBerd,' <i>P. paniculata</i> 'Robert Poore,' 'David'
rose	'Simplicity' and 'Meidiland' roses, <i>Rosa rugosa</i> varieties
rhododendron	<i>R. yakushmanum</i> , <i>R. macrophyllum</i> , <i>R.</i> 'Nova Zembla,' <i>R.</i> 'Palestrina'
zinnia	Pulcino and African zinnias

can damage some ornamental cultivars. To avoid injuring any plant, do not apply sulfur when the temperature is near or higher than 90°F, and do not apply it within 2 weeks of an oil spray. Other sulfur products, such as liquid lime sulfur or sulfur dust, are much more difficult to use, irritate skin and eyes, and are limited in the types of plants you safely can use them on.

Bicarbonates. Also available to licensed applicators only is a fungicide containing potassium bicarbonate (e.g., Kaligreen). Sprays of potassium bicarbonate can injure the plant, so use these products with caution.

Biological Fungicides. Biological fungicides (e.g., Serenade) are commercially available beneficial microorganisms formulated into a product that, when sprayed on the plant, destroys fungal pathogens. The active ingredient in Serenade is a bacterium, *Bacillus subtilis*, that helps prevent the powdery mildew from infecting the plant. These products have some effect in killing the powdery mildew organism but are not as effective as the oils or sulfur in controlling it.

Synthetic Fungicides. Myclobutanil (Immunox) also is available to the home gardener and functions as an eradicant and protectant against both powdery mildew and rust.

How to Use. Apply protectant fungicides to susceptible plants before or in the earliest stages of disease development. Once mildew growth is mild to moderate, it generally is too late for effective control with protectant fungicides. These are effective only on contact, so applications must thoroughly cover all susceptible plant parts. As plants grow and produce new tissue, additional applications may be necessary at 7- to 10-day intervals as long as conditions favor disease growth.

If mild to moderate powdery mildew is present, you can use horticultural and plant-based oils such as neem or jojoba oil.

REFERENCES

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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