

Powdery Mildew



Powdery mildew is a common term for a disease that occurs on the above-ground parts of many plants. The name refers to the white, powdery appearance of infected leaves and stems – they often look as though someone has sprinkled them with talcum powder or powdered sugar.

People have had to put up with powdery mildew for a long time: the disease on roses was mentioned in 300 B.C. An epidemic of powdery mildew on grapes spread rapidly through Europe during the 1840s and 1850s, threatening the wine industry. The fungus responsible was probably introduced from the U.S., where it occurs on the native grapes (but these grapes have some resistance to it). Powdery

mildew is still a scourge on many ornamentals and food crops around the world every year.

This disease occurs on many herbaceous perennials, shrubs and trees, but does not affect conifers. Some garden plants that commonly get powdery mildew include apple, ash, bee balm, chrysanthemum, cosmos, crabapple, dahlia, delphinium, honeylocust, honeysuckle, hydrangea, lilac, maple, phlox, roses, snapdragon, sweetpea and zinnias.

Powdery mildew is caused by many closely related species of fungi that belong to several genera in the family Erysiphaceae. They are fairly host specific, so the fungus species that infects lilac is not the same that infects phlox. In some cases the fungi are so particular that they only infect certain cultivars of plants! However a few plants are susceptible to more than one type of powdery mildew. Most powdery mildews found in the U.S. are in the following groups:

- The genus *Erysiphe* causes powdery mildew on many vegetable crops and flower plants and can have a dramatic impact on production or appearance. *E. cichoracearum* is found on aster, bee balm, helianthus, phlox, squash, verbena and zinnia. *E. cruciferarum* affects crucifers. *E. polygoni* can cause powdery mildew on beans, beets, cabbage, cantaloupe, clovers and other legumes, cucumber, delphinium, and hydrangea.
- Fungi in the genus *Blumeria* were once classified in the genus *Erysiphe*, but have been reclassified in their own group. They are the only genus of powdery mildew fungi that affect monocots (corn and grasses). *B. graminis* causes powdery mildew on barley and wheat.
- The genus *Phyllactinia* is found primarily on trees, but generally causes only minor damage. *P. corylea* causes



Powdery mildew is common on many garden plants.



Powdery mildew on bee balm.

powdery mildew disease of ash, birch, dogwood, elm and oak. *P. guttata* causes powdery mildew disease on beech, birch, dogwood, elm, honeylocust, magnolia, oak and pecan.

■ The genus *Sphaerotheca* causes powdery mildew on roses, hops, berries, tree fruits, and some vegetables, and even dandelions. *S. macularis* causes powdery mildew on hops and strawberry; *S. pannosa* causes powdery mildew disease on roses, peach, nectarine, and apricot; and *S. fuliginea* attacks zucchini and other squash, and cucurbits.

■ The genus *Podosphaera* is found mainly on fruit trees. *P. leucotricha* causes powdery mildew on apple, pear, and quince, while *P. oxyacanthae* attacks apricot, cherry, peach and plum.

■ The genus *Microsphaera* causes powdery mildew on ash, birch, blueberry, dogwood, elm, lilacs, oaks, pecan, rhododendron, and viburnum. *M. penicillata* affects dogwood, lilacs, oaks, pecan, and rhododendron. *M. calocladophora* is found only on oaks.

■ The genus *Uncinula* commonly affects grapes, and some trees. *U. necator* infects grapes.



Powdery mildew on zucchini leaf.



Powdery mildew on scarlet sage.

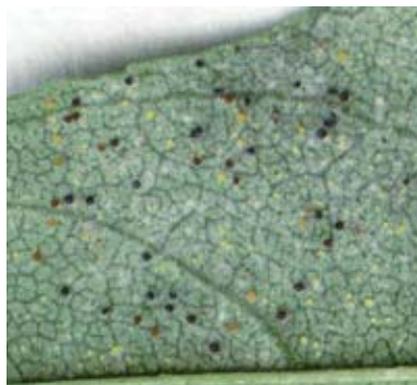
Powdery mildews are easily identified by microscopic examination of the different fungal structures (cleistothecia, conidia, and conidiophores; see next paragraph for definitions). A Key to the Genera of Powdery Mildew Fungi (https://www.cals.ncsu.edu/course/pp318/profiles_mirror/pm/key.html) is available for those so inclined to know exactly what type of fluffy white fungus is attacking their plant.

All of these fungal species have similar life cycles and cause infection under the same conditions.

Powdery mildew-causing fungi overwinter in a dormant state on plant debris and, in the case of woody plants, on buds. The fungi produce spores that the wind spreads to new hosts. Additional spores are produced throughout the spring and summer, infecting new plants.



The fungus that causes powdery mildew grows mainly on the leaf surface.



The black cleistothecia can sometimes be seen on the underside of the leaves in fall.

The fungus grows primarily on the leaf surface and puts specialized feeding structures (called haustoria) into the epidermal layer of the plant to absorb water and nutrients. Powdery mildews are obligate parasites (i.e., they require living plant tissue to grow). The characteristic powdery white material on infected leaves is a conglomeration of structures that produce spores (conidiophores) and the spores themselves (conidia). Tiny, yellow (younger) to black (older), sexual fruiting structures (cleistothecia) are sometimes seen late in the



High humidity promotes the development of powdery mildew, as on this peony.

season on the lower surface of leaves. This is the structure that usually overwinters in cold areas like Wisconsin.

When weather conditions are favorable, the disease often develops on a wide range of plants. High humidity promotes disease development, making it a common disease in the Midwest this time of year, especially when cool, damp evenings follow warm days. These fungi are unusual compared to most plant disease fungi because they do not cause infection when the leaves are wet; they just require high humidity during infection. However, they produce more spores when the humidity is low.

Young growth is most susceptible on most plants. The fungus can grow on all aboveground parts of plants, including both sides of the leaves, stems, flowers, and fruit. Many powdery mildew fungi only grow on the top side of the leaf, but some will grow on both sides. Fungal growth may completely cover the leaf, or may appear only in patches. Severely infected foliage may be yellow, distorted or stunted.

Disease can spread rapidly (3 days) when conditions are optimal, but it usually takes 7-10 days from infection until symptoms develop and secondary spore production occurs.

Fortunately, powdery mildew is only a cosmetic problem on most plants. It will make the plant look a little ragged, but it doesn't kill the plant.

Cultural controls will help minimize problems with powdery mildew:

- Select powdery mildew-resistant varieties when available. This won't completely eliminate the disease, but it will help disease severity.
- Reduce humidity around the plants. Obviously you can't change the weather, but you can change the microhabitat around your plants. Increase the spacing between plants to increase air flow. Place plants where they will receive morning sunshine and dry out more quickly, if possible. And don't overwater.
- Avoid overfertilizing, since high nitrogen promotes tender leaf formation, and promotes dense stands that are more likely to become infected.
- Remove and destroy severely infected plants, if possible.
- Clean up infected plant debris in the fall to reduce overwintering fungal structures that will produce spores during the next growing season.

In some cases and for some plants, however, powdery mildew can cause severe leaf loss and yield reduction in vegetables. In this case fungicide applications may be necessary to reduce or prevent injury. A number of fungicides are registered for use against powdery mildew. Regardless of which type you select,



Powdery mildew causing curling on rose leaves.



Severe, repeated infection of valuable plants may require fungicide treatments.

be sure to READ THE LABEL and FOLLOW THE INSTRUCTIONS to make sure you use the fungicide in the most effective manner possible. Note that not all products are registered for use on vegetable crops, and sulfur can be damaging to some squash and melon varieties! Begin treatment on valuable plants when symptoms appear to prevent the disease from spreading.

An alternative to commercial fungicides is to spray approximately once a week with a solution of baking soda (1.5 tablespoon/gallon) and horticultural oil (3 tablespoons/gallon).

– Susan Mahr, University of Wisconsin – Madison

Additional Information:

- Powdery Mildew – Trees & Shrubs – University of Wisconsin Garden Facts X1005 at <http://hort.uwex.edu/articles/powdery-mildew-trees-shrubs/>
- Powdery Mildew of Ornamentals – University of Wisconsin publication A2404 at <http://learningstore.uwex.edu/Powdery-Mildew-of-Ornamentals-P382.aspx>
- Powdery Mildew – University of Minnesota Extension at <http://www.extension.umn.edu/garden/yard-garden/trees-shrubs/powdery-mildew/>
- Comparison of Powdery Mildew Resistance Among Bee Balm Cultivars - A University of Vermont research study at <http://www.uvm.edu/~pass/perry/bctmon.html>