

# Powdery Mildew, Downy Mildew: *What's The Difference?*

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Most growers recognize powdery mildew when it occurs on their crops. But, recently I have had several growers tell me that they have been fighting a powdery mildew problem for weeks and none of the fungicides that they used seemed to control the disease. The reason for

the lack of control was that the mildew they were seeing was not powdery mildew, but downy mildew.

Powdery mildew infection is easily recognized by the powdery white to light gray-colored spots on leaf, stem, bud or flower tissue. Eventually, the infection can cover the entire leaf or stem. Infected tissues can be stunted, chlorotic, curled, and deformed. Young succulent tissue is most susceptible to infection. Older infections often cause necrosis and premature senescence of leaves.

Powdery mildew seldom kills the plant, but its infection can severely limit the plant's growth and reproduction and if severe enough can cause significant plant decline. As the fungus grows over the leaf tissue, it produces hyphae and columns of spores (conidia) that give the leaf a white to gray appearance. It then penetrates the leaf epidermal cells forming structures (haustoria) within the cells to act as anchors and absorb water and nutrients from the plant.

Powdery mildew infection peaks under warm day and cool night conditions (typically, 81°F daytime temperatures with 40-70% relative humidity and nighttime temperatures of 61°F with 95-99% relative humidity). Unlike other foliar fungal diseases which are normally favored by wet leaf surfaces, powdery mildew is favored by dry conditions. In fact, powdery mildew spore germination is inhibited by moisture on leaves.

Throughout the growing season new infections may develop on plants that continue to produce new, succulent shoots. Severe pruning and cutting back of plants to promote new growth actually favors powdery mildew infection. The fungus is spread by conidia that are dispersed by air currents or splashing water in greatest number during the middle of the day.

Powdery mildew is actually caused by numerous different fungi although symptoms of infection are identical. Some fungi are host specific; others can infect several hosts.

Control for powdery mildew is the same regardless of fungal species present. Since the disease is favored by high humidity and poor air circulation, increase plant spacing, avoid watering late in the day which can increase humidity levels and reduce humidity by increasing air circulation and venting the greenhouse late in the day to exchange warm, wet air with drier air from the outside to reduce infection.

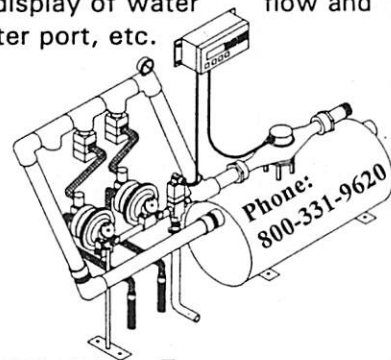
Fungicides are important and useful in preventing and controlling powdery mildew. Several systemic fungicides including fenarimol (Rubigan), myclobutanil (Systhane), propiconazole (Banner), thiophanate methyl (Cleary 3336, Domain), triadimefon (Bayleton, Strike), and triforine (Triforine, Funginex) provide good powdery mildew control. Fungicide resistance to some of these products has been identified in powdery mildew fungi. So if there is no improvement in disease development, resistance may be a factor and use a different product. Resistance is less likely with protectant fungicides such as chlorothalonil (Daconil 2787), piperalin (Pipron), trinimizole (Terraguard), or wettable sulfur; all of which also provide good powdery mildew control.

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For the most part, fungicides are preventive. They prevent infections from occurring, they do not get rid of existing infections. The white to gray powdery growth on the leaf will remain even after fungicide use. In addition, repeated applications are necessary to control powdery mildew.

Downy mildew is very different from powdery mildew. Downy mildew is in the same class of fungi as the root rotters *Pythium* and *Phytophthora* and is considered a "water-mold." This is why the cultural controls and fungicides to control powdery mildew are ineffective on downy mildew.

Downy mildew on flowering potted plants is relatively rare. It is much more common on perennial and garden plants such as *Coreopsis*, *Centaurea*, *Rudbeckia*, *Pelargonium*, pansy, and roses. Downy mildew produces its characteristic symptoms on the leaf underside. The fungus sporulates on the underside of the leaf from leaf stomata. The sporulation is seen as fuzzy, white to grayish patches. On the upper surface of the leaf, pale green to yellow spots may appear opposite the areas of sporulation. Older leaves are affected first and often turn completely brown from infection.

Under severe downy mildew infections, the fuzzy, white sporulation can develop on the upper leaf surface and can look like powdery mildew infection. Identification of the pathogen can be made microscopically or with a 20x hand lens (with practice). Powdery mildew conidia are formed in chains, one on top of the other, from the fungal mat (mycelial mat) on the leaf surface. Downy mildew

spores (sporangia) are formed on branched stalks (sporangiophores) that form the most common species of downy mildew on herbaceous plants, *Peronospora*, look similar to deer antlers. The cluster of sporangia on the branched sporangiophores often looks like the fuzzy growth of the gray-mold pathogen, *Botrytis*.

Downy mildew infection is favored by high humidity, long durations of leaf wetness, and cool weather (daytime temperatures ranging from 60 to 74°F). The sporangia produced on the sporangiophores are easily dislodged and spread by wind and splashing water. Downy mildew fungi survive in infected plant debris in the soil, related weed species, and through seed. To control downy mildew infections once identified, remove the infected plants and weeds from the area, avoid long durations of leaf wetness, do not water late in the day or at night, increase plant spacing, and reduce humidity levels.

Fungicides to control downy mildew are metalaxyl (Subdue) and fosetyl-Al (Chipco Aliette). Resistance to metalaxyl has been identified, and often metalaxyl is tank mixed with mancozeb to reduce resistance potential. Plants severely affected with downy mildew rarely recover from infection. Fungicides are used to prevent the spread of the disease to non-infected plants and to new growth when symptoms first appear.

\*\*Please note: Mention of specific fungicides within this article do not necessarily imply a recommendation of that product, but are included as a reference for the reader. Check fungicide label for host listing and restrictions.

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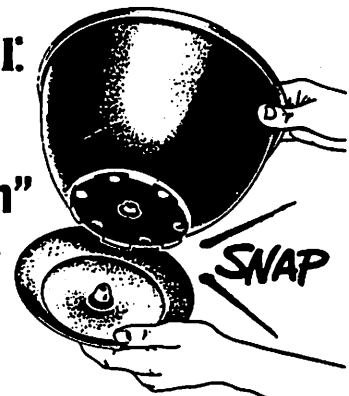
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