

# Diseases of Landscape Plants

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## Downy Mildew

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Downy mildews are a group of closely related pathogens that can cause major damage in the nursery, greenhouse, and landscape in the form of leaf spots, blights, and distortions. Some common downy mildew hosts include alyssum (*Alyssum spp.*), aster (*Aster spp.*), butterfly bush (*Buddleia spp.*), coreopsis (*Coreopsis spp.*), crane's bill or hardy geranium (*Geranium spp.*), Geum (*Geum spp.*), kale (*Brassica oleraceae*), dead nettles (*Lamium spp.*), pansy (*Viola x wittrockiana*), phlox (*Phlox spp.*), rose (*Rosa spp.*), rosemary (*Rosemarinus spp.*), sage (*Salvia spp.*), snapdragon (*Antirrhinum*), veronica (*Veronica spp.*), viburnum (*Viburnum spp.*), and violets (*Viola spp.*).

This publication examines downy mildews in the home landscape and provides strategies for managing the disease.

### Downy Mildews

Although similar in name, do not confuse downy mildews with powdery mildews. Powdery mildews are true fungal pathogens that produce white, flour-like colonies — usually on upper leaves. Downy mildews, on the other hand, are a completely different kingdom of organisms, more closely related to algae than to fungi. Downy mildews produce grayish, fuzzy looking spores and mycelium on the lower leaf surfaces.

The distinction between powdery mildews and downy mildews is important, because the fungicides effective against one are not usually effective against the other — although, as with every rule, exceptions do exist.

### Symptoms Vary by Host

Although there are many different downy mildew pathogens, most downy mildews that infect ornamentals belong to either the genus *Peronospora* or *Plasmopara*. These pathogens can have a very wide or a very narrow range of hosts. For example, the downy mildew that infects roses (*Peronospora sparsa*) only infects roses. But the downy mildew that infects mint (*Peronospora lamii*) can infect several members of the mint family, including dead nettles and salvia, and possibly basil and coleus. *Plasmopara halstedii* is a different downy mildew pathogen that infects members of the daisy family, most notably *Rudbeckia* (Figure 1).

Due to the wide host range of this pathogen, symptoms vary significantly from host to host (and even between cultivars), making it difficult to make generalizations about downy



Photo by Janna Beckerman

**Figure 1.** The different strains of downy mildew can be very host specific, or it can infect many members of the daisy family, including this *Rudbeckia*.



Photo by Janna Beckerman

**Figure 2.** The large lesions caused by downy mildew can easily be mistaken for other kinds of damage.

mildew symptoms. This variability of lesion color and size, and the severity of infection often makes the disease difficult to diagnose. On upper leaf surfaces, leaf veins often delimit grayish brown spots. These spots then develop into angular lesions that can be easily misdiagnosed as chemical damage, foliar nematode damage, or bacterial leaf spot (Figure 2). As the lesions coalesce and large amounts of tissue are damaged, the leaves drop.

On roses, symptoms vary by cultivar (Figure 3). However, one thing most cultivars have in common is that there are signs of whitish to grayish, downy fungal growth on the undersides of leaves and beneath areas of upper leaf discoloration (Figure 4).

### Disease Cycle and Management

Understanding the disease cycle is critical to managing downy mildew and minimizing reliance on chemicals (Figure 5). The fungus overwinters in or on plant parts as mycelium or oospores (thick-walled, gumball-like structures that form the resting stage of the pathogen).

Temperature and humidity play key roles in the pathogen's development. During cool (50-75°F), wet conditions with high relative humidity (85 percent or higher), downy mildew outbreaks develop when germinating oospores form sporangiophores, which resemble a bunch of grapes emerging from the plant stomate. Each "grape" is a sporangium. And each sporangium is filled with dozens of zoospores that swim to susceptible plants and infect them even when just a film of free water is available.

Prolonged periods of leaf wetness promote spore germination and the disease's spread, so keeping plants dry minimizes the spread of this disease. Increasing air circulation around the plant by thinning and pruning it, reduces humidity and minimizes infection. The disease cycle, from the initial infection to the production of additional spores and secondary infection, is usually seven to ten days, but can be as short as four days under warm and humid conditions — again, this varies depending on the species of downy mildew.

#### Clean Up Infected Areas

Sanitation, however difficult, is essential for properly managing the disease. Sanitation minimizes the amount of inoculum that overwinters as mycelium or oospores in or on plant parts. Under severe infection, removing the infected plant may be the only realistic management option.

#### Prevent Water Buildup on Leaves

"Real fungi" do not produce spores that swim, so they can only spread by being blown by the wind, or moved by equipment, insects, or other means. On the other hand, downy mildews and other "water molds" produce zoospores that swim in free water on plant surfaces. They can keep swimming until they find tissue to infect — on the already infected plant or on a neighboring plant.



Photo by Janna Beckerman

**Figure 3.** Downy mildew symptoms can vary widely, even among different cultivars like these roses.



Photo by Janna Beckerman

**Figure 4.** Downy mildew causes whitish to grayish downy fungal growth on the undersides of leaves.

That means managing water is the key to managing these water molds. Leaf wetness early in the day is critical to downy mildew development. Spore release and zoospore swimming typically cease by late morning, or early afternoon — whenever the dew or leaf moisture dries up. Therefore, any action that reduces the amount of leaf moisture early in the day (such as watering in the late afternoon or changing from overhead irrigation to a soaker hose) will reduce the spread of this disease. Lower leaf surfaces cannot dry out where there is dense canopy growth and tight plant spacing, so such conditions encourage downy mildew spore production. A simple management tool, then, is to space plants properly.

#### Use Fungicides for Prevention

The role of water and this disease is obvious; downy mildew epidemics generally cease when it's hot and dry. However, keeping plants dry may prove impossible, or nearly so. When that's the case, proper fungicide use comes into play *to prevent additional infection from occurring*.

Table 1 lists fungicides labeled for managing downy mildews. Most of these fungicides are not available to homeowners — so professional applicators will need to apply these products.

**Table 1. Fungicides Labeled for Downy Mildew Control<sup>1</sup>**

Group Code <sup>2</sup>	Common Name	Trade Name
11	strobilurins: azoxystrobin, trifloxystrobin, pyraclostrobin, kresoxim,-methyl	Heritage <sup>®</sup> , Compass <sup>®</sup> , Insignia <sup>®</sup> , Cygnus <sup>®</sup>
11+7	pyraclostrobin + boscalid	Pageant
21	cyazofamid	Segway <sup>®</sup>
	fenamidone <sup>3</sup>	Fenstar <sup>®</sup>
40	dimethomorph	Stature DM <sup>®</sup>
M (33)	fosetyl-al	Aliette <sup>®</sup>
	phosphorous acid	Alude <sup>®</sup> , Biophos <sup>®</sup> , Vital <sup>®</sup> , <b>Agri-Fos<sup>®</sup></b>
M	Multisite: mancozeb	Fore <sup>®</sup> , Dithane <sup>®</sup>
	Multisite: peroxide	Zerotol <sup>®</sup>
	Multisite: copper	Phyton 27 <sup>®</sup> , Kocide <sup>®</sup> , Camelot <sup>®</sup> , <b>Liquid Copper<sup>®</sup></b>

<sup>1</sup>Fungicides set in bold are available for home use.

<sup>2</sup>The FRAC code is listed in parentheses under the EPA Group code when the codes differ. Neither system includes biofungicides.

<sup>3</sup>Different chemistry but same mode of action.

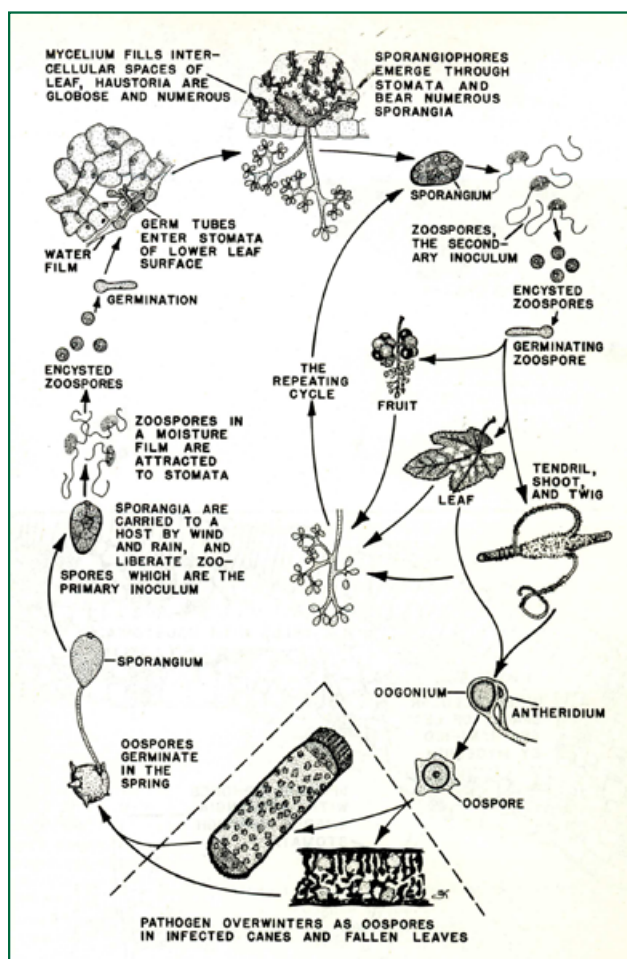


Illustration provided by C.B. Kenaga, E.B. Williams, and R.J. Green, Plant Disease Syllabus.

**Figure 5. The downy mildew disease cycle.**

Remember, successful downy mildew management relies on preventative fungicide applications — do not wait to see downy mildew symptoms before you begin spraying, as that will be too late!

Make fungicide applications every seven to ten days, being sure to rotate or tank mix fungicides with different chemical classes to prevent fungicide resistance from developing. This disease is much easier to prevent than to eradicate, so begin any spray program early and keep to a regular schedule.

### References

Agrios, G. 2005. Plant Pathology. 427-433.

Dankers, H., Kimbrough, J. W., and Momol, M. T. 2004. First report of *Plasmopara halstedii* on perennial black-eyed susan in North Florida. Online. Plant Health Progress doi:10.1094/PHP-2004-0119-01-HN.

Rossman, A.Y. Systematic Mycology and Microbiology Laboratory, ARS, USDA. 14 December 2004. Invasive Fungi. *Peronospora radii* — Downy mildew of marguerite daisy. Retrieved April 8, 2008, from <http://nt.ars-grin.gov/sbmlweb/fungi/index.cfm>.

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