



Downy Mildew on Ornamentals

Introduction

Downy mildew diseases are of emerging concern to the horticulture industry. Reproduction and spread are rapid causing serious losses to many susceptible crops. Downy mildews are difficult to control once established. They should not be confused with powdery mildews, for all “mildews” are not the same. Downy mildews are caused by many different species of water molds (“oomycetes”) that are more closely related to *Pythium* and *Phytophthora* or algae than to true fungi. In many cases, downy mildew infections are systemic whereas powdery mildew infections are not. Downy mildews must be managed preventively with different classes of fungicides than powdery mildews.

Symptoms

Symptoms vary depending upon the specific downy mildew pathogen, the host plant, and environmental conditions. Some of the more common symptoms of downy mildew infection include yellow, red or brown patches on the leaves that may be bounded by leaf veins. At first glance, these angular lesions may be confused with bacterial leaf spots or the injury caused by foliar nematodes. However, with downy mildew infections, a coating of sporulation (either white, gray or violet) may be seen on the leaf undersides, especially during humid conditions. Diseased plants or their new growth may be stunted with systemic infections. Because of the abundant sporulation, sometimes growers confuse downy mildew with *Botrytis* gray mold. However, *Botrytis* sporulates on weakened or dying plant tissue whereas downy mildew emerges from stomata in areas of the leaf that are not yet dead and brown.

Causal Organisms and Host Ranges

Downy mildews are obligate parasites that need a living host to grow and reproduce. Pathogens such as *Peronospora*, *Plasmopara*, *Bremia*, and *Basidiophora* may cause downy mildews on ornamental plants. Most of the downy mildews are host specific and infect only closely related plants. Some ornamental annuals prone to infection include snapdragons, salvia, alyssum, pansy, rose, primula, osteopermum, garden impatiens, coleus, statice, verbena, ornamental cabbage, perilla and cleome.

Herbaceous perennials such as aster, agastache, butterfly bush, coreopsis, hardy geranium or cranesbill, foxglove, poppy, rudbeckia, geum, lamium, veronica and viola are also susceptible to different downy mildews.

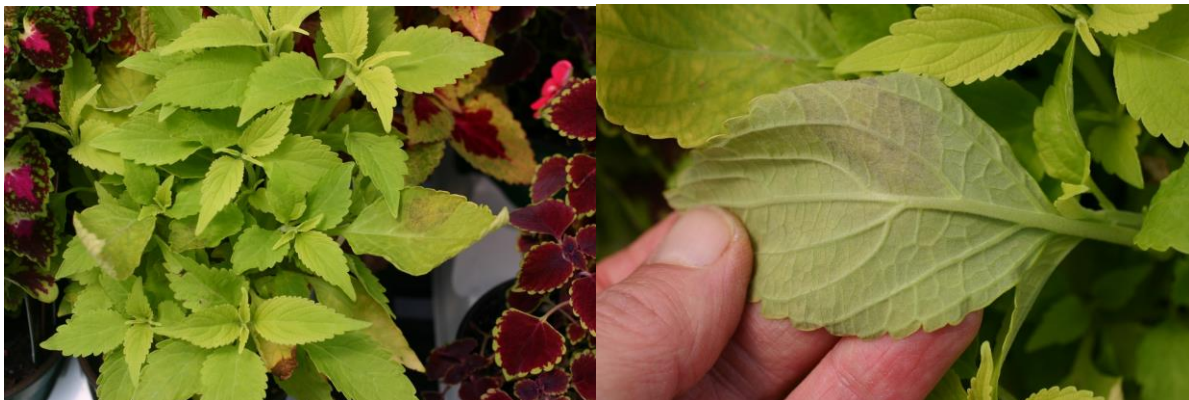
Downy mildews on coleus, garden impatiens, and rudbeckia have been especially troublesome in recent years.

Downy mildew on basil has been widespread in Connecticut since 2008. Fungicides registered for edible crops such as basil may differ from those labeled for ornamentals. See the fact sheet, [Downy Mildew on Basil in the Greenhouse](#) for more information.

Coleus Downy Mildew

Downy mildew of coleus, caused by *Peronospora sp.* was first detected in New York and Louisiana in 2005; by 2006, it was present throughout the US. Symptoms include brown, irregular lesions on coleus leaves, leaf drop, and stunting of seedlings. Because the lesions are irregular, infection can cause leaves to twist and distort. In cool, wet, humid conditions, sporangia may be visible as a downy gray to purplish growth on the underside of leaves. Constant temperatures of 59° F and 68° F promote this disease, with warmer temperatures of 77° F resulting in minimal infection and no disease occurs at 86° F.

Do not overwinter coleus plants from one season to the next because they may be carrying the disease without showing obvious symptoms. Seed and vegetatively propagated types of coleus are susceptible, as well as agastache and perilla. Cultivars of coleus vary in their reactions to downy mildew, so choosing less susceptible varieties is an important management tool. See Special Research Report #136 from the American Floral Endowment: [Disease Management Coleus Cultivars and Downy Mildew](#) for more information on coleus varieties less susceptible to downy mildew.



Figures 1 & 2: Look for brown, irregular lesions on leaves, and leaf drop. Gray sporulation on coleus leaf underside. Photos by L. Pundt

Impatiens Downy Mildew

Impatiens downy mildew caused by *Plasmopara obducens* was first observed on *Impatiens walleriana* in the United Kingdom in 2002. During the 2012 growing season, impatiens downy mildew was widespread in Connecticut gardens. Early symptoms include yellowing or yellow stippling of the leaves and downward cupping of the upper leaves. White sporulation develops on leaf undersides. As this disease progresses, flowers and leaves drop, eventually leaving bare stems that completely collapse and the plant dies. During greenhouse production, a preventive fungicide program is needed when growing susceptible varieties. By the time you see any symptoms, it is too late to save the plants.

Susceptible hosts include garden impatiens, double impatiens and any hybrids of *I. walleriana*. Although balsam or garden balsam (*Impatiens balsamina*) is also susceptible, the symptoms primarily include yellow leaf spots. Downy mildew resistant garden impatiens include the Beacon impatiens and Imara XDR series. New Guinea impatiens (*Impatiens hawkeri*), as well as hybrids such as SunPatiens® and Bounce™ are also resistant to impatiens downy mildew.

Impatiens downy mildew can survive on plants in frost free zones in southern states and as resting spores known as “oospores” inside stems in northern locations.



Figures 3 & 4: Off-color and downward cupping of leaves. White sporulation on underside of garden impatiens leaves. Photos by L. Pundt

Rudbeckia Downy Mildew

Symptoms of downy mildew on rudbeckia caused by *Plasmopara halstedii* are blotchy, necrotic patches on the upper leaf surface. Fuzzy, grayish white sporulation develops on the leaf undersides. *P. halstedii* is also reported to infect centaurea, coreopsis, erigeron, and helianthus.



Figures 5 & 6: Patches of discolored foliage and white sporulation on underside of Rudbeckia leaves. Photos by L. Pundt

Poppy Downy Mildew

Symptoms of downy Mildew on poppy caused by *Peronospora arborescens* are necrotic, angular leaf spots with profuse sporulation on the underside of the leaves.



Figure 7 & 8: Angular leaf spots (right) and with profuse sporulation on underside of leaves (left). Photos by L. Pundt

Foxglove Downy Mildew

Symptoms of downy mildew on foxglove caused by *Peronospora digitalidis* are light green, rectangular lesions that are bound by leaf veins. Spots eventually turn brown and necrotic. Purple gray sporulation occurs on the lower leaves. *Digitalis purpurea* Alba, Apricot and Foxy hybrids appear to be very susceptible to this disease.

Conditions Favoring Downy Mildew

Downy mildews develop during cool (50-75° F), wet conditions with high relative humidity above 85% at the leaf surface. Prolonged periods of leaf wetness favor downy mildew sporulation, spread and infection.

Monitoring

Look on underside of leaves, early in the day. Scout routinely, at least once a week. Use a hand lens to look for blooms of sporangia (they may resemble branched trees with lemons.)

Disease Cycle

The pathogen overwinters in or on plant parts as mycelium. Some species such as impatiens downy mildew may overwinter as “oospores” (a thick walled resting stage). Downy mildews produce sporangia on sporangiophores that are distinct from mycelium in how they branch. Sporangiophores emerge in groups from small openings in the plant leaves (stomata). The disease cycle from initial infection to production of additional spores is usually about 7 to 10 days but can be shorter under warm and humid conditions.

Management

- Inspect incoming plugs or plants carefully for signs of downy mildew upon arrival.
- Select less susceptible cultivars, if available.
- Monitor susceptible plants at least once a week.
- Promptly remove diseased plants and debris.
- Reduce humidity levels in the greenhouse by using proper plant spacing.
- In the greenhouse, proper environmental management with the use of computerized controls, HAF fans, heating and venting to reduce humidity levels is necessary. For more, see [Reduce Greenhouse Humidity](#)
- Water early in the day.
- Avoid overhead irrigation and use drip irrigation whenever possible.

- Thoroughly sanitize the greenhouse or production area before new plants are introduced and between crop cycles.

Chemical Controls

Plan on preventive programs for highly susceptible varieties of coleus, foxglove, rudbeckia and garden impatiens or on plants that you have had a problem with in the past.

Specific schedules and programs have been developed for the highly susceptible garden impatiens during greenhouse production. However, not all fungicides work equally well against all the different downy mildew diseases. For example, some materials that work well against downy mildew on impatiens do not work as well against coleus downy mildew.

The Rutgers IR-4 Program published Ornamental Horticulture Program Downy Mildew Efficacy Reports in 2017. This summarizes research reports on the latest downy mildew trials on coleus, garden impatiens, lamium, rose, snapdragon, and viburnum. For more see:

<http://ir4.rutgers.edu/Ornamental/SummaryReports/DownyMildewDataSummary2017.pdf>

Consult the most recent edition of *New England Greenhouse Floriculture Guide: A Management Guide for Insects, Diseases, Weeds and Growth Regulators* for up-to-date recommendations. Available from [Northeast Greenhouse Conference and Expo](#).

Rotate among different FRAC (mode of action) codes to slow down the development of resistance. Over-reliance on systemic fungicides leads to the development of resistant populations and many of the systemic fungicides have specific resistant management guidelines on their labels.

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