



2001 Update on POWDERY MILDEW CONTROL

By
A. R. Chase

The beginnings of a crop disease outbreak can slip even the most scrutinizing eye — find out which fungicides make the grade for effective control of powdery mildew.

Powdery mildew diseases cause serious damage to many floral and ornamental crops in nurseries, greenhouses and landscapes both outdoors and indoors. The diseases are very similar, with symptoms initially appearing as small, white, powdery or dusty colonies (1/4 to 1/2 inch) that form in circular patches on upper or lower sides of leaves, stems, petioles and even flower petals (see Figure 1). In severe infections, the entire leaf surface can become covered with the white spores (conidia) of the fungal pathogen. Curling and distortion can occur when leaves are severely infected with powdery mildew. Sometimes conditions are not good for spore development and symptoms are confined to purplish or reddish discoloration (see Figure 2). This symptom can be confused with nutrient deficiency, phytotoxicity or, on some plants, chilling injury. Early infections are easy to miss unless plants are carefully examined at least once a week.

Although the names sound similar, powdery mildews are not closely related to the downy mildews, which are related to pythium and phytophthora. Powdery mildew diseases are similar to each other in many respects. However, the species that infects rose will not infect African violet — thus some powdery mildew diseases are specific to a single crop or group of closely related plants. In contrast, the species that attacks Gerber daisy (*Erysiphe cichoracearum*) also attacks the plants listed in Table 1 and a multitude of others. This can make prevention of powdery mildew a challenge for growers producing a large variety of ornamental crops.

Powdery mildew fungi (oidium, sphaerotheca and erysiphe) are obligate parasites that cannot live in the absence of a plant host. It is

sometimes possible to eradicate the pathogen from a growing area when the crop it has been infecting is removed. However, leaving even one apparently healthy plant makes it possible for the powdery mildew fungus to survive. This is further complicated when the host range is wide, such as that described for *E. cichoracearum*. It is rarely practical to eliminate all host plants from a greenhouse or landscape. The list of hosts for this powdery mildew includes a wide range of common weeds that can serve as inoculum reservoirs even in the absence of a cultivated host.

Conditions favoring powdery mildew diseases are very similar and some generalizations can be made regarding their control. Low to moderate relative humidities and moderate temperatures favor powdery mildew fungi. However, not all will appear at the same time, since each has its personal preference for humidity and temperature. In California, hydrangeas with powdery mildew are often found in the fall while crape myrtle powdery mildew occurs earlier in the summer or even the spring. Sometimes the stage of the crop is most important. Poinsettia powdery mildew, for example, generally appears during the final stage when the plant canopy is dense and the relative humidity is ideal. In any event, all powdery mildew diseases do not appear

Table 1. Some ornamentals commonly affected by *Erysiphe cichoracearum*.

Bedding plants	Garden flowers	Cut flowers
Ageratum	Achillea (yarrow)	Aster
Antirrhinum (snapdragon)	Centaurea (bachelor's button)	Chrysanthemum
Begonia	Coreopsis	Delphinium
Calendula	Dahlia	Hypericum
Gerbera	Gaillardia (blanket flower)	Liatris
Nemophila	Monarda (bee balm)	Solidago
Nicotiana	Penstemon	Zinnia
Salvia	Phlox	
Verbena	Stokesia	

simultaneously in a single environment and scouting year-round is advisable.

Disease control strategies remain the same for most ornamentals. The most important method is careful examination of new plants as they come into a growing range. Maintain a strict scouting and roguing program to identify and destroy disease outbreaks before they become widespread.

FUNGICIDE UPDATE

The first recorded fungicide applied to control powdery mildew was a combination of sulfur and soap in 1824. Since that time, many other chemicals have been developed for control of powdery mildews. Benzimidazoles (such as benomyl) were introduced in the late 1960s.

Benomyl was a widely used powdery

mildew fungicide that had problems with resistance development soon after its introduction. This has also been seen occasionally with the benzimidazole fungicides still in use on ornamentals. One of the biggest breakthroughs in products for powdery mildew came when the triazoles were introduced in the late 1970s and throughout the past 20 years.

The most recent introduction is the strobilurin chemistry. Some of these products work primarily for powdery mildew diseases while others are broad-spectrum and can be used for

many foliar and some soil-borne pathogens. It is interesting that some of the most recent techniques used to control powdery mildews in modern production of floral crops are soap products applied as sprays, and elemental sulfur applied by heating as a vapor (in enclosed structures like greenhouses).

Rotation of products is a special concern for any disease caused by a fungus that makes as many spores as powdery mildew fungi. Resistance development is common in this group. The products listed in Table 2 are in a number of different

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Top: Powdery mildew on Gerber daisy flowers. Middle: Powdery mildew infections are sometimes purple or red markings on leaves and stems, such as on this marigold. Bottom: Distortion of rose leaves is common when powdery mildew infections are severe. (Photos courtesy of A.R. Chase.)

Table 2. Efficacy of fungicides for control of powdery mildew on ornamentals.

Fungicide	Chemical class	Result
Actigard	SAR triazole	A (single trial)
Banner Maxx	Triazole	A
Camelot	Copper	B
Cinnamite	Plant Extract	B
Compass	Strobilurin	A-
Decree	Hydroxylanilide	C+
Eagle	Triazole	A
Erase	Botanical extract	A
FirstStep	Bicarbonate	A
Heritage	Strobilurin	B+
Junction	Copper and carbamate	B-
Kaligreen	Bicarbonate	A (single trial)
Milsana	Plant Extract	B
Phyton 27	Copper	A-
Pipron	Piperalin	A-
PlantShield	Biological	C+
Rubigan	Pyrimidine	A
Strike	Triazole	A-
Systhane	Triazole	A-
Terraguard	Triazole	A-
Triact	Plant Extract	A-
3336	Benzimidazole	B

These tests were performed on azalea, crape myrtle, Gerber daisy (over 50 percent of the tests), hydrangea, miniature rose, spearmint, scabiosa and verbena. Some were performed as preventatives while others were performed as eradicants.

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chemical classes and switching from one to another would be an effective rotation. The letter grades in the table indicate the relative effectiveness we saw in our trials and are not a compilation of other researcher trials. I have used the typical grading system we are all familiar with from our school days; thus the difference between an "A" and "A-" is slight but significant. In many situations, use of a "B" product will give good control of the powdery mildew disease. In other diseases that might be more damaging to the crop, or if the disease is not detected early, you should consider use of an "A" product. Those products that received less than a "B" would best be used for the main target disease with the knowledge that some powdery mildew suppression will occur as well.

It appears to be critical to use wetting agents with some of these products to improve their ability to control powdery mildew diseases. We have been able to demonstrate the benefits of using a nonionic surfactant with certain strobilurins (Compass and Heritage). Since their labels dictate use of these additives, it is a necessary as well as beneficial precaution. Be sure to read fungicide labels completely prior to use since they change periodically. There is a remarkable range of products available for use on powdery mildew diseases on ornamentals. Wise use according to the label will prolong the benefits these products afford. GPN

Editor's Note: The use of specific trade names in this publication does not constitute endorsement of these products in preference to others containing the same active ingredients. The use of trade names is solely for the purpose of providing specific information and does not signify that they are approved to the exclusion of others. Mention of a product does not constitute a guarantee or warranty of the product by the author or magazine.

A.R. Chase is a plant pathologist and president of Chase Research Gardens Inc., Mt. Aukum, Calif. Further information on disease control is available at www.chaseresearchgardens.com.

A.R. Chase will be speaking about powdery mildew and other greenhouse crop diseases at the FarWest Conference and Trade Show in Portland, Ore., August 23, 2001. This special session, sponsored by GPN and Syngenta, will be free of charge to those registered for the conference. For more information, call (847)391-1004.

Some Key Points About Powdery Mildew

1. Powdery mildew colonies appear on both surfaces of leaves, petioles, stems and flowers.
2. Some powdery mildew fungi are host specific — the one on rose cannot attack Gerber daisies and vice versa. However, others are very broad in their host range.
3. Powdery mildew is most common in the spring and fall outdoors and can appear year-round indoors. Whenever conditions are moderate (humidity and temperature), the chance of a powdery mildew outbreak exists.
4. Powdery mildew spores (conidia) move by air currents, such as wind or fans from heating and cooling.
5. Rotate between chemical classes to stop resistance development. Use the "A" products when disease is severe or the crop is especially sensitive to powdery mildew.
6. Use the products according to their labels. Add surfactants, but do not exceed the rate or decrease the interval.