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# Powdery Mildew on Succulents Is Not What You Would Expect

Powdery mildew on succulents can appear more like sun scald or edema. In this alert, we will show you what to look for and the fungicides labeled to treat powdery mildew. Remember, when in doubt, submit a sample to a diagnostic lab for confirmation.

From 1998 to 2019, cacti and succulent production for containers, crafts, and floral arrangements has increased by over 75% (\$78.6 million USD) and is expected to continue to increase due to continued consumer interest in house plants. In terms of production challenges, the biggest complaint from greenhouse growers is their slow growth and limited production and pest management information. Generally, succulents have few pest or physiological issues. The most common include: mealy bugs, scale, powdery mildew, edema, and sun scald.



Figure 1. Severe powdery mildew infection on peony.

Signs of powdery mildew infection are fairly easy to recognize when the pathogen is advanced or severe on most crops (Fig. 1). This includes, white-grey, talcum-like colonies of fungal growth on the upper leaves of most susceptible plants.

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The infection usually starts small, but under certain environmental conditions, can rapidly blight and damage leaves, stems, and flowers. The white, powdery or fluffy appearance is created by conidia (spores) that give this fungus its name (Fig. 1). In Table 1, we identify the most common greenhouse crops that are susceptible to powdery mildew fungi.

Identifying the disease can be difficult on some crops, as it mimics symptoms of sun scald (Fig. 2), physiological disorders (Fig. 3), or nutrient deficiencies (yellow or purple leaves). Withering and death of leaves in the center of the crop or stunted plant growth are other symptoms.

Unfortunately, the genera and species of fungi that cause powdery mildew are diverse and highly mobile; they can be dispersed long distances by wind. However, unlike most other fungal foliar diseases affecting greenhouse crops, they do not need free water to germinate and infect their hosts. Relative humidity greater than 90% and temperatures between 65 to 85 °F can prompt epidemics in the greenhouse and in the landscape. Therefore, you should always scout your crops for powdery mildew and other pathogen symptoms, but be especially vigilant during the spring and fall when the weather often favors this disease.

In succulents, light and dark brown scabby spots, lesions or bumps are an indication of powdery mildew infection (Figs. 6, 7, 8, and 9). Unfortunately, these are the same symptoms that we often associate with sun scald and edema on succulents (Figs. 2 and 3). Additionally, *Botrytis* on *Aeonium* (Fig. 4) and *Alternaria* and *Cladosporium* infection on *Kalanchoe* can resemble powdery mildew (Fig. 5). Succulents in the genus *Kalanchoe* are the most susceptible to powdery mildew infection. Given that succulents are slow growing and desired for their foliage, severely diseased plants should be discarded.



Figure 2. Sun scald on this succulent mixed container that was moved from an indoor to outdoor retail display. [Photo: Anthony Soster, Michigan State University (MSU)]



Figure 3. *Echeveria* exhibiting symptom of edema. (Photo: Anthony Soster)



Figure 4. *Botrytis* on *Aeonium*. (Photo: Anthony Soster, MSU)



Figure 5. *Alternaria* and *Cladosporium* infection on *Kalanchoe* 'Villosa' that resembles a powdery mildew infection. (Photo: Roberto Lopez, MSU)



Figure 6. Scab-like lesions on *Echeveria* from a powdery mildew infection. (Photo: Roberto Lopez, MSU)



Figure 7. Close up of *Kalanchoe thyrsiflora* 'Flapjacks' leaves with non-typical powdery mildew symptoms. (Photo: Roberto Lopez, MSU)



Figure 8. *Kalanchoe thyrsiflora* 'Flapjacks' is the only plant that has signs of powdery mildew infection in this succulent combination planter. (Photo: Erin Hill, MSU)



Figure 9. *Crassula* with powdery mildew symptoms. (Photo: Garrett Owen, UK)

Table 1. Greenhouse crops that are susceptible to powdery mildew.

Bedding plants	Potted crops	Perennials
begonia	African violets	aster
calibrachoa	chrysanthemums	bee balm
dahlia	gerbera	coreopsis
pansy	kalanchoe	peony
petunia	poinsettia	phlox
snapdragon	roses	rudbeckia
verbena	sunflower	scabiosa
zinnia		sedum

Growing powdery mildew susceptible ornamental crops can be a challenge. However, fungicides can be helpful if effective products are chosen and applied early. The Fungicide Resistance Action Committee (FRAC) assigns alphanumeric codes that are based on the mode of action of the active ingredient. When utilizing fungicides, always rotate among products with different FRAC codes to reduce the possibility of resistance developing in the powdery mildew pathogen.

Multiple trials conducted at MSU were conducted to create Table 2. It contains "A" and "A-/B" Team recommended fungicides for powdery mildew on ornamentals.

Ornamental products listed in the "A Team" table consistently provide effective control.

Note that all the products in the "A Team" have the FRAC code 3, but have different active ingredients (myclobutanil, metconazole and triflumizole). These active ingredients all act on the powdery mildew fungus in a similar way; to lessen the risk of the fungus developing resistance, relying on them is not recommended. Therefore, you should alternate among the products in the "A and A-/B Teams" as they have different FRAC codes. It's important to test these products for phytotoxicity on a small group of succulents before treating the entire crop as they are more susceptible than other plants. Do not mix the fungicides with a surfactant, insecticides, or fertilizer when treating succulents as this could increase the risk of phytotoxicity.

Table 2. MSU tested fungicides to control powdery mildew on ornamentals.

Powdery Mildew A Team		
Product	Active ingredient	FRAC code
Eagle EW/WP	myclobutanil	3
Terraguard SC	triflumizole	3
Tourney	metconazole	3
Powdery Mildew A-/B Team		
Product	Active ingredient	FRAC code
Compass O	trifloxystrobin	11
Heritage	azoxystrobin	11
Mural	azoxystrobin/ benzovindiflupyr	11/7
Orkestra	fluxapyroxad/ pyraclostrobin	7/11
Pageant Intrinsic	pyraclostrobin/ boscalid	11/7
Palladium WDG	fludioxonil/ cyprodinil	9/12
Strike	Triadimefon	3
Strike Plus	trifloxystrobin/ triadimefon	11/3

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