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## Powdery Mildew on Rosemary

*Powdery mildew is one of the more easily recognizable plant diseases. The fungus is seen on the leaf surface as a white powdery growth; however, it may go unnoticed on lower and shaded leaves.*

Be watchful of powdery mildew disease on herbs at this time of the year. Recently, an outbreak of powdery mildew was observed on greenhouse-grown rosemary plants. Large temperature fluctuations of warm days and cool nights with high relative humidity favors powdery mildew development. Unlike other fungal foliar pathogens that need prolonged periods of leaf wetness, powdery mildew is inhibited by wet leaves. Drier, but humid conditions, with relative humidity levels above 75% is required for powdery mildew fungi to infect and produce new spores.



Figure 1. White, powdery patches of powdery mildew infection on rosemary leaves. (Image by J. Williams-Woodward)

Powdery mildew fungi are obligate pathogens, meaning they grow in and absorb nutrients from living cells. This is one of the reasons that powdery mildew infection does not cause necrotic lesions like other fungal leaf spot pathogens. Rather, powdery mildew grows inside the host, and often causes yellowing or purpling patches similar to nutrient deficiency symptoms, until conditions are favorable for fungal hyphal and spore growth and development. It is a network of hyphae and single-celled spores produced in chains that gives powdery mildew its distinctive white, powdery appearance on infected plant surfaces (Figure 1). Most often, powdery mildew is seen on leaves, but it can also infect

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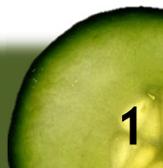
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stems, flowers, and fruit. Heavily infected rosemary leaves turn brown, shrivel, and drop from the plant (Figures 2, 3, and 4).

Powdery mildew spores are primarily spread by wind, but can also be water-splashed. Infection and development of the new spores and hyphae can be rapid under favorable environmental conditions. Growers and pest managers should scout for powdery mildew weekly in the spring and fall. Look on both the upper and lower sides of leaves for the white, powdery growth (Figure 4). Concentrate in areas where temperature within the greenhouse may fluctuate more readily such as near vents and doors.

Powdery mildew fungi are mostly host-specific. There are some species that infect hosts across a plant family; however, many infect a single plant species. Rosemary is in the Lamiaceae family, which is a large plant family containing numerous ornamentals (monarda, coleus, salvia, etc.), as well as culinary herbs including sage, oregano, mint, marjoram, and thyme. The particular species of powdery mildew infecting rosemary in the US is not entirely known, and needs more research. It is likely that same species that infects other members of the Lamiaceae family, which is *Golovinomyces monardae*.

Infected rosemary plants should be removed to reduce spreading the disease to surrounding plants of the same species/plant family. Remove infected leaves, stems, or whole plants. Infected tissues should be bagged and disposed off-site. Powdery mildew can potentially survive on closely related weed species, so keep weeds in and around the greenhouse to a minimum.



Figure 2. Terminal shoots of rosemary stems completely covered in powdery mildew hyphae and spore. (Image by J. Williams-Woodward)



Figure 3. Powdery mildew growth can be dense and may be confused with an insect infestation. Spore growth can be in chains and spores may fall onto the leaves below. (Image by J. Williams-Woodward)



Figure 4. White radiating hyphae producing spores in chains on the leaf surface. Severely infected leaves may turn brown and shrivel (upper left in the image). (Image by J. Williams-Woodward)

Powdery mildew infection is more severe in plants with high nutrition with new growth flushes. Monitor plant nutrition and avoid excess nitrogen fertilization. Growers may also want to apply fungicides to reduce powdery mildew spread. Be careful on fungicide selection as some products are only labeled for use in greenhouse/high tunnels for transplant production or for field use. Most are not labeled for the production of edible commodities, of which rosemary and other herbs belong. Mostly fungicides labeled for use on culinary rosemary include azoxystrobin, copper, biofungicides, and oils. These products are not curative and need to be applied preventively or the first sign of disease to be effective. Below is a table containing some products listed for use on rosemary within greenhouses. It is not an all-inclusive list.

**Please Note: The mention of specific active ingredients and products does not constitute an endorsement or recommendation of, nor discrimination against similar products not mentioned. ALWAYS READ PRODUCT LABELS AND USE THEM AS DIRECTED ON THE LABEL.**

Active Ingredient	Product Name
Azoxystrobin	Heritage®
Potassium bicarbonate	MilStop®, Kaligreen®
Copper sulfate pentahydrate	Phyton® 35
<i>Pseudomonas chlororaphis</i> strain AFS009	Howler®
<i>Bacillus subtilis</i> strain IAB/BS03	Aviv™
Neem oil	Trilogy®

### Powdery Mildew Management Summary:

- Scout for early signs of infection
- Follow good sanitation practices and remove infected plants and weeds
- Monitor plant nutrition as excess nitrogen can increase powdery mildew development
- Manage humidity levels and keep below 70%
- Increase plant spacing and good air flow around plants
- Use chemical and biological control products preventively; they will not rescue an infected crop

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