

USDA, ARS Research on Powdery Mildew of Greenhouse Crops
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The USDA, ARS, Greenhouse Production Research Group recognizes that the group of foliar diseases described as “powdery mildews” continue to be one of the perennial disease problems faced in local greenhouse production. In spite of the fact that there are numerous registered fungicides that can be utilized to manage powdery mildew, the problem continues to show up especially on highly susceptible crops. As a result, our research project is addressing the causes for the failure to adequately manage this problem and is seeking user-friendly means to facilitate better management of powdery mildew. One aspect that is being pursued involves fortifying the fertilizer solution used in bedding plant production with silicon which is reported in other field and vegetable crops to induce plant resistance to the disease without the use of fungicides. These studies are in their preliminary phase, but hydroponic studies have shown that silica is taken up by most of the bedding plants studied. The next phase of the research involves determining if sufficient amounts are taken up to provide economical levels of disease reduction without the use of fungicides. Results of this research will be shared as studies are completed, but in the meantime let's review the basics of powdery mildew and how it is best managed.

Introduction

Powdery mildew is named for the grayish-white, powdery mat on leaf surfaces or other plant parts (**Fig. 1**).



The disease is one of the most widespread and destructive diseases of garden and greenhouse plants. It occurs on many different flowers, woody ornamentals, and trees including roses, snapdragons, African violets, English ivy, zinnias, oak, lilac, and begonias.

Fig. 1 The grayish-white, powdery mat on leaf surface of Zinnia

What causes powdery mildew?

There are numerous fungi that fall under the general description of a powdery mildew. Generally each species of fungus will be limited in the number of plant species that it infects. For example the species of fungus infecting zinnia will not cause powdery mildew on vinca or geranium (**Fig.2**).



Fig. 2 A powdery mildew fungus that infects a particular plant species (e.g. zinnia on the left) will rarely cause disease on a different plant species (e.g. or geranium on the right).

All the powdery mildew fungi are obligate parasites, requiring live tissue to grow and reproduce. They live largely on the outer surface of the host plant. They obtain nutrients necessary for growth and spore production from host plant cells by means of small, root-like organs, called haustoria, that feed within the epidermal cell layer of the host plant.

Symptoms

The powdery mat- consisting of fungus mycelium and masses of spores on leaf surfaces or other plant parts- may vary from white to light gray to light tan, but is distinct and not easily confused with other diseases. It might be identified incorrectly as dust that has accumulated on the leaves. Powdery mildew, however, will begin as discrete, usually circular, powdery white spots. As these spots expand they will coalesce, producing a continuous mat of mildew (similar to dirt or dust).

Injury to the plant

Injury due to powdery mildews includes stunting and distortion of leaves, buds, growing tips, and fruit. The actual injury to the plant varies greatly with the species and even the variety attacked. For instance, lilacs are typically infected late in the growing season and this does not usually cause serious injury to the plants. On the other hand, begonia may be seriously injured by even a mild infection. Yellowing of leaves and death of tissue may result in premature leaf drop and poor plant growth. Nutrients are removed from the plant by the fungus during infection and

may result in a general decline in the growth and vigor of the plant. The seriousness of the disease will depend on the susceptibility of the host and subsequent tissue injury.

Conditions Favoring Mildew

Environment plays a major role in powdery mildew development. The disease occurs during cloudy, humid conditions when days are warm and nights are cool.

Day temperatures in the 80s and high night humidity induce mildew formation. Unlike most foliar blights or leaf spot diseases, powdery mildew does not require free moisture on the foliage to infect the plant; however, high humidity is important for infection.

Powdery mildew is common in crowded plantings, in damp areas, or in shaded sites where air movement is restricted.

Management Strategies

In addition to fungicide treatment there are a number of control measures that can be integrated in order to control the spread of powdery mildew. Such simple-to-adapt measures include:

Avoid overcrowding of plants and locate susceptible plants in the most open area.

Adequately fertilize plants but avoid stimulating succulent growth. In a preliminary study we found that supplementing fertilizers with various levels of silicon appears to delay but not prevent the spread and progress of the disease on zinnia (**Fig. 3**)



Fig. 3 Incorporating various concentrations of silicon with fertilizers delayed but did not prevent the spread and progress of the disease on zinnia:

A) Nutrient Solution B) Nutrient Solution+1.7 ppm Silicon C) Nutrient Solution+3.4 ppm Silicon

Use a drip irrigation watering system

Avoid nightly sprinkling during August and September; instead, soak the soil as needed.

For outdoor ornamental plants, gather up fallen leaves in autumn and destroy them.

Where powdery mildew is a problem, resistant varieties (if available) should be grown

Maintain conditions that favor low relative humidity which will help reduce disease incidence.

Plants in shade are more prone to mildew than are those growing in sunlight. Prune to thin out any dense foliage; this will increase air movement and favor rapid drying of foliage.