VEGETABLE CROPS
CORNELL COOPERATIVE EXTENSION
IPM Integrated Pest Management

Powdery Mildew of Cucurbits

Margaret Tuttle McGrath
Department of Plant Pathology
Long Island Horticultural Research Laboratory

Powdery mildew is a common disease of cucurbits under field and greenhouse conditions in most areas of the world. All cucurbits are susceptible, but symptoms are less common on cucumber and melon because many commercial cultivars are resistant. The disease can be a major production problem. Yields are reduced because of a decrease in the size or number of fruit, or a shortened harvest period. Premature senescence of infected leaves can result in lower market quality because fruit become sunburned or ripen prematurely or incompletely. Winter squash so affected often exhibit inferior storage characteristics; fruit, particularly melons, may have low soluble solids with consequent poor flavor; and pumpkins often have poor rind color and shriveled, discolored handles (fig. 1). Stress from disease can lead to imperfections on fruit rinds such as speckling (fig. 2), raised indentations, and edema. In addition, powdery mildew infection predisposes plants to other diseases, in particular, gummy stem blight (see fact sheet on *Gummy Stem Blight of Cucurbits*, 7/92, page 732.70).

Sphaerotheca fuliginea and *Erysiphe cichoracearum* are the two most commonly recorded fungi causing cucurbit powdery mildew. Prior to 1958, *E. cichoracearum* was considered to be the primary causal organism throughout most of the world. Today, *S. fuliginea* is more common. A shift in the predominance of the two fungi may have occurred or the causal organism may have been misidentified. *S. fuliginea* is a more aggressive pathogen than *E. cichoracearum*. *E. cichoracearum* may have a lower optimum temperature since the species is mainly found during the cooler spring and early summer months, while *S. fuliginea* appears to progress most rapidly during the warmer months. The conidia of *E. cichoracearum* and *S. fuliginea* are difficult to distinguish and cleistothecia, the sexual fruiting bodies, are rarely observed. As a result, these fungi often have been confused. The name of the fungus frequently has been reported without valid confirmation. Criteria for differentiating these fungi using the conidial stage were not identified until the 1960s, the main criterion being the presence of fibrosin bodies in conidia of *S. fuliginea*. Based on those criteria, *S. fuliginea* was found to be the predominant fungus, rather than *E. cichoracearum* as previously claimed in several countries. During recent surveys in New York and other eastern states *E. cichoracearum* was found infrequently and only at the start of disease development

Symptoms and Signs

White, powdery fungal growth develops on both leaf surfaces, petioles, and stems (fig. 3). The growth is primarily asexual spores called conidia. It usually develops first on crown leaves, on shaded lower leaves, and on leaf undersurfaces. Yellow spots may form on upper leaf surfaces opposite powdery mildew colonies (fig. 4). Older plants are affected first. Infected leaves usually wither and die. Plants may senesce prematurely. Fruit infection is rare on watermelon and cucumber. Cleistothecia (figs. 5, 6) are dark brown, minute structures (about 0.003 inches in diameter), barely discernible without a hand lens, that develop late in the growing season and protect the sexual spores within from adverse conditions.


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5

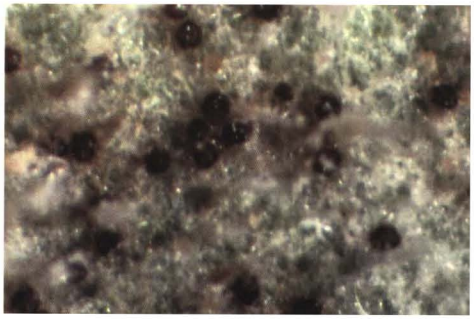
Figure 6

Disease Cycle

Sources of initial inoculum for powdery mildew in New York have not been determined. The primary initial inoculum is believed to be airborne conidia originating in southern states, where cucurbit crops are grown earlier in the year. Conidia remain viable for 7–8 days. The causal fungi are obligate parasites and cannot survive in the absence of living host plants, except as cleistothecia. Possible local sources of initial inoculum include conidia from greenhouse-grown cucurbits, cleistothecia, and alternate hosts. Cleistothecia have been sporadically reported in the United States, however, even when present they can be easily overlooked. In New York, they have been observed every year that researchers actively searched for them since 1989. Both mating types required for sexual reproduction have been found throughout the United States, including New York. Although *S. fuliginea* and *E. cichoracearum* are described as having broad host ranges, strains of these fungi are host-specific. The role of non-cucurbit hosts as sources of inoculum cannot be ascertained without further research.

Powdery mildew develops quickly under favorable conditions because the length of time between infection and the appearance of symptoms is usually only 3–7 days and a large number of conidia can be produced in a short time. Favorable conditions include dense plant growth and low light intensity. High relative humidity (RH) is favorable for infection and conidial survival, but infection can take place at RH levels as low as 50%. Dry conditions are favorable for colonization, sporulation, and dispersal. Rain and free moisture on the plant surface are unfavorable, however, disease development occurs in both the presence or absence of dew. Infection can occur at 50–90°F; mean temperatures of 68–80°F are favorable. Powdery mildew development is arrested at daytime temperatures of 100°F or higher. Plants in the field are often not affected until after fruit initiation. The leaves are most susceptible 16–23 days after unfolding.

Pathogenically distinct races of *S. fuliginea* on cucurbits have been detected. Three races have been differentiated on muskmelon in the United States. Race 1 is the most common one in the eastern part of the country.

Cultural and Biological Controls

Genetic resistance is used extensively as a control measure in cucumber and melon, and is being incorporated into other cucurbit crops. Yield potential should be considered when selecting varieties because some resistant summer squash varieties produce less fruit than susceptible varieties that have not been treated with fungicides. Resistant varieties of pumpkin and winter squash are under development. Successive cucurbit plantings should be physically separated because older plants can serve as a source of conidia. Use of antagonistic fungi for biological control is being investigated.

Chemical Control

Fungicides should be applied every 7–10 days beginning early in disease development following detection through an IPM scouting program. Inspect plants weekly beginning in July and after fruit initiation (when plants become more susceptible). Examine upper and under surfaces of five older leaves at ten separate sites or until symptoms are found. Initiate a weekly spray program when symptoms are found. Spring plantings of summer squash will become infected first, so, when available, they may be used as an indicator of when to begin scouting vine crops and later plantings of summer squash. For a preventive schedule, applications should begin when plants start to run and/or to produce fruit. To obtain adequate control, fungicide is needed on the undersurface of the leaves and on leaves low in the plant canopy because those surfaces are optimum for the development of the fungus. Control is best accomplished by using systemic materials (i.e. triadimefon, benomyl, thiophanate-methyl). Another approach is to improve the efficacy of contact materials (i.e. chlorothalonil, copper) by maximizing spray coverage on undersurfaces of leaves. Air-assist sprayers are one of the most effective means for increasing coverage and deposits on all leaf surfaces. Coverage obtained with traditional hydraulic boom sprayers can be maximized by either decreasing nozzle spacing (10 inches is better than 20 inches), increasing volume (75 gpa works well), increasing pressure (at least 80 psi), or by changing to smaller nozzle tips that direct sprays at an angle to the canopy. Use water-sensitive paper to check spray coverage. Refer to the current *Cornell Pest Management Recommendations for Commercial Vegetable Production* for an updated list of available fungicides and follow label directions. Oils, bicarbonates, and other biocompatible fungicides are being evaluated.

Development of fungicide resistance and consequent control failure is always a concern with systemic fungicides. Strains of the powdery mildew fungus resistant, or insensitive, to such fungicides have been found throughout the United States, including New York. Reduced sensitivity to fungicides from several chemical groups has also been detected in other areas of the world. To minimize the possibility of inadvertent selection of resistant pathogen strains, appropriate tactics should always be employed: apply systemic fungicides with contact fungicides; apply them only when needed most to protect yield (usually at the start of disease development); use highest labeled rates; and, when possible, alternate between systemic fungicides with different modes of action (benomyl and thiophanate-methyl have the same mode of action). In addition, maximize spray coverage and use nonchemical control practices. At the start of powdery mildew epidemics, the frequency of strains resistant to systemic fungicides usually has been low enough to enable a single application of one of these fungicides to suppress powdery mildew. This situation could change in the future. The frequency of resistant strains can increase rapidly following treatment.

Acknowledgments

Appreciation is extended to Thomas A. Zitter and to Richard C. Derksen for comments on the first draft and to Thomas A. Zitter for the photograph used for figure 2. Some information in this publication was obtained through research funded by the New York State Integrated Pest Management Program and Hatch Project 153-445.

Cornell Cooperative Extension

Helping You Put Knowledge to Work

Produced by Media Services at Cornell University.

102GFSVC732.30 84/150 2/97 2M JCP MS50717