



DOWNY MILDEW OF CUCURBITS

Downy mildew, caused by *Pseudoperonospora cubensis*, is primarily a disease of cantaloupe, cucumber, muskmelon, squash, pumpkin, watermelon, gourdes, and West Indiana gherkin. Citron, calabash, cassaba, and vegetable-marrows are not commonly attacked, while wild cucumber and related weed hosts normally escape infection. Only members of the cucumber family (Cucurbitaceae) become infected. The disease is confined mostly to the leaves, although the fruit of infected plants may be of poor quality resulting from the loss of foliage. Downy mildew is most common and destructive during cool, moist weather. In some years the disease may destroy entire plantings of susceptible plants.



Figure 1. Downy mildew on upper leaf surface of pumpkin.



Figure 2. Downy mildew on lower leaf surface of pumpkin.

SYMPTOMS

Symptoms of downy mildew vary with the host and environment. The first symptom is usually the appearance of indistinct, pale green areas on the upper leaf surface. In this stage, the disease resembles a mosaic mottling. The pale green areas soon become yellow in color and angular to irregular in shape, bounded by the leaf veins (Figure 1). As the disease progresses the lesions may remain yellow or become brown and necrotic. On some cucurbits the lesions, as viewed on the upper leaf surface, become reddish brown to almost black. During moist weather the corresponding lower leaf surface is covered with a downy, pale gray to purple mildew (Figure 2 and 3). This mildew is made up of large numbers of sporangiophores bearing tremendous numbers of microscopic, lemon-shaped spores (sporangia). The color of the mildew ranges from white to near black. Diseased leaves soon wither, cup upward, and turn brown. Downy mildew usually first infects the older leaves nearest to the center of the hill. The time of initial infection will depend on the availability of inoculum and the favorableness of weather conditions. In rainy, humid weather the disease progresses outward from the center of the vine until the entire vine

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is killed, or only the youngest leaves at the runner tips remain alive. Downy mildew may spread so rapidly that affected vines appear to be frosted. Fruit formed on severely infected plants commonly remain dwarfed and have poor flavor. With the loss of foliage, fruit can become sunscalded.

Disease Cycle

Primary infections in the field or garden generally come from sporangia (spores) produced on southern-grown crops and carried progressively northward on moist air currents during the spring and summer. The lemon-shaped sporangia are borne on the gracefully curved and pointed tips of branched sporangiophores (Figure 4). The sporangia are disseminated locally from plant to plant and from field to field by splashing rains, moist air currents, insects, tools, farm equipment, the clothing of workers, and through the handling of infected plants. Heavy dews, fogs, frequent rains, and high humidity favor infection and rapid multiplication of the pathogen.

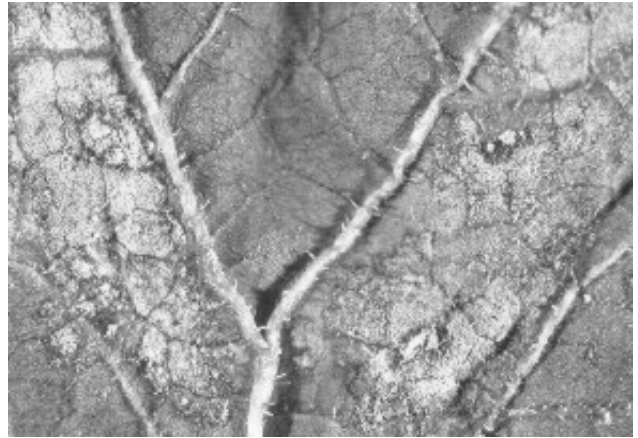


Figure 3. Close-up of downy mildew on the lower surface of a muskmelon leaf. (Courtesy Purdue University)

When a film of moisture is present on a leaf surface, the sporangia germinate and give rise to motile spores (zoospores) which swim about for a while before they encyst and produce germ tubes that penetrate cucurbit leaves. Infection on cucumber leaves can occur following dew periods of 2 hours at 68°F (20°C), 6 hours at 59° to 68°F (15° to 20°C), 12 hours at 50° to 59°F (10° to 15°C), and 24 hours at 41° to 50°F (5° to 10°C).

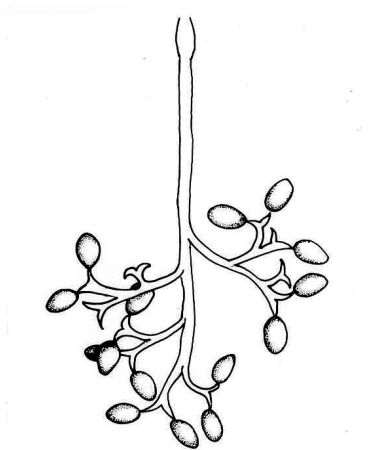


Figure 3. *Pseudoperonospora cubensis*, the downy mildew fungus, as it would appear under a high-power microscope. Note the "tree-like" sporangiophore bearing the lemon-shaped sporangia. (Drawing by Lenore Gray).

Sporangia are produced in greatest numbers at daytime temperatures of 59° to 68°F (15° to 20°C) and night time temperature of 59°F (15°C). The minimum time for sporangia to be formed on lesions is 6 hours at the optimum temperature of 59° to 68°F with 70 percent of the sporangia produced within 12 hours at this temperature range. Most mature sporangia are released into the air between 6:00 a.m. and 12 noon with the maximum at about 8:00 a.m. The infectivity of sporangia decreases when the temperature is high after being dispersed. The sporangia survive longer at 41° to 63°F (5° to 17°C) than at 75° to 86°F (24° to 30°C). The sporangia must remain wet until they germinate or they die.

Once infection occurs a new crop of sporangia are produced in 4 to 12 days, depending on temperature and day length. Because cucurbit plantings can become diseased so rapidly and severely, the symptoms are often mistaken for frost damage. Temperature is not as critical as it is with many other vegetable diseases. Infection may occur over the relatively wide temperature range of 41° to 86°F (5° to 30°C), the optimum being 61° to 72°F (16° to 22°C). Extended periods of hot, dry weather tend to inhibit the spread of the disease.

Five pathotypes have been described for *P. cubensis*. All described pathotypes infect susceptible cucumber and netted melon cultivars, but are not compatible with watermelon, squash, or pumpkin. This

explains why cucumber and netted melons are sometimes heavily infected, while nearby watermelon, squash, or pumpkin are not affected.

The downy mildew pathogen does not overwinter in plant debris in Illinois. The pathogen may overwinter in some areas as thick-walled oospores which are capable of withstanding extremes in temperature and dryness. It is not clear if these oospores play any role in disease development.

CONTROL

1. Whenever possible plant varieties that are resistant to downy mildew. High levels of resistance are available in commercial cucumber varieties. Lower levels of resistance are available in melon and watermelon. Strain specific resistance is available in some pumpkin and squash varieties, so these varieties will be resistant to some strains of the pathogen, but very susceptible to other strains.
2. Fungicide applications may be necessary on susceptible varieties during humid weather (61° to 72°F or 16° to 22°C). It is especially important to get good coverage of the lower leaf surfaces, as infections commonly occur on the undersides of leaves. Both systemic and protectant fungicides are available for control of downy mildew. Protectant fungicides are less effective when used on susceptible varieties or when disease pressure is heavy. Systemic fungicides should be used in combination with protectant fungicides to reduce the chance of developing fungicide resistant strains of the pathogen. Consult the “Midwest Vegetable Production Guide for Commercial Growers” for use of effective fungicides.
3. Wide spacing between plants, choosing planting sites with good soil and air drainage and exposure to all-day sun, maintaining ample but not excessive nitrogen fertility, and control of cucurbit weeds are recommended.
4. Avoiding overhead irrigation or irrigating only in the early morning hours will limit the amount of time that leaves are wet. This will help reduce the amount of time in which conditions are favorable for spores of the pathogen to germinate and infect the plant.

For further information on downy mildew of cucurbits, refer to the “Compendium of Cucurbit Diseases,” published by the American Phytopathological Society, St. Paul, Minnesota.

The above mentioned publications are available from University of Illinois Ag Services, P345, 1917 South Wright St., Champaign, IL 61820 (1-800-345-6087).