

Cucurbit Downy Mildew

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Pathogen

Cucurbit downy mildew is caused by the fungus-like oomycete pathogen *Pseudoperonospora cubensis* (*P. cubensis*).

Host crops and plants

Cucurbit crops such as cucumber, watermelon, melon, cantaloupe, squash and pumpkin.

Host parts affected

Leaves are severely affected, which can result in yield reduction or plant death.

Identification

Downy mildew causes angular, yellow to brown lesions on top of the leaves that are restricted by leaf veins. When conditions are favorable, for example early in the morning when moisture is higher, lesions observed on the underside of the leaf may be covered in dark "down" (Fig. 1). This downy growth is masses of pathogen spores called sporangia, which can be seen in the field with a 20X hand lens. These spores germinate to produce the pathogen and infect leaves.



Fig. 1: Angular, yellow lesions on topside of the leaves that are bound by leaf veins (upper panel). Dark spores on underside of the leaf (lower panel) (Photo, Gerald Holmes, Valent USA Corporation, Bugwood.org).

Identification of downy mildew can be more difficult in watermelon and cantaloupe than in cucumber since lesions do not always have the characteristic angular shape (Fig. 2),

but spores on the underside of the leaf can provide additional evidence of the pathogen.

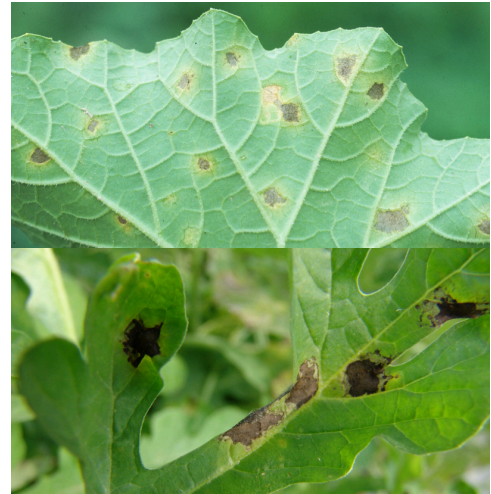
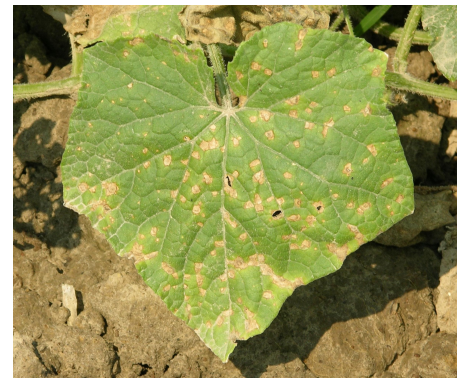


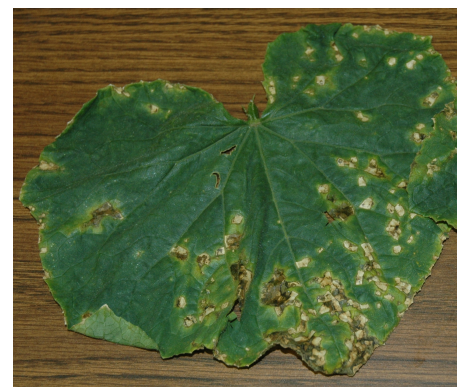
Fig. 2: Cucurbit downy mildew on cantaloupe (leaf underside, upper panel) and watermelon (leaf topside, lower panel) are not always angular in shape (Photo, Gerald Holmes, Valent USA Corporation, Bugwood.org).

Similar diseases

Downy mildew is often confused with other foliar diseases such as:



Alternaria leaf blight, *Alternaria cucumerina* (Photo, Don Ferrin, Louisiana State University, Bugwood.org).



Angular leaf spot, *Pseudomonas psyringae* pv. *lachrymans* (Photo, Kelly Ivors, North Carolina State University).



Anthracnose, *Colletotrichum orbiculare* (Photo, Jason Brock, University of Georgia, Bugwood.org).



Powdery mildew, *Podosphaera xanthii*, *Erysiphe cichoracearum*, note white powdery growth on the leaf surface (Photo, Gerald Holmes, Valent USA Corporation, Bugwood.org).

Favorable environmental conditions for the disease

- High-humidity and moisture (6-12 hours of moisture are ideal and usually occur as morning dew, rain or overhead irrigation).
- Cool temperatures (~60F).
- In NC, the disease typically begins in June and lasts throughout the growing season.

Disease transmission

Pathogen spores can be transported from state to state through air currents. The pathogen needs a living host to survive and it can only overwinter on plants in sites with warm weather such as the Southern US and greenhouses. Spores come to NC every year from infected plants in surrounding states or in greenhouses with year-round production.

Disease management

- Plant early in the season to escape high disease pressure
- Do not allow water to remain on leaves for long periods of time
- Scout plants often and remove infected plants
- Sign up to receive alerts at the Cucurbit Downy Mildew IPM Pipe website
- Plant tolerant varieties when possible
- Protect the crop with fungicides

Fungicides are required to control cucurbit downy mildew. Two different programs should be utilized; the first program is for prevention and should be followed before downy mildew is found in your county. The second program should be adopted after downy mildew has been found in your county or field. Before disease appears apply fungicides at 7-day interval for cucumbers and 10-day intervals for other cucurbits. After disease is detected in your area apply fungicides at 5-day interval for cucumbers and 7-day intervals for other cucurbits. Alternate products and tank mix with mancozeb or chlorothalonil to avoid generating fungicide-resistant strains.

Products for cucurbit downy mildew control:

Active ingredient	Example product	PHI (day)	Group
Cyazofamid	Ranman 3.6SC*	0	21
Fluopicolide	Presidio 4FL**	2	43
Ametoctradin/dimethomorph	Zampro	0	45+40
Famoxadone/cymoxanil	Tanos 50WG	3	11+27
Propamocarb	Previcur Flex	2	28
Mancozeb/zoxamide	Gavel 75WG***	5	22+M
Mancozeb	Dithane	5	M
Chlorothalonil	Bravo/Equus	0	M

* When disease pressure is severe, an organosilicone surfactant should be tank mixed with Ranman.

**Presidio did not perform as well in 2012 trials in some southern states due to the appearance of less sensitive strains

***Use Gavel only before disease

Fungicide labels are legal documents, always read and follow the label.

For example, before disease in cucumber you can use: Previcur Flex + Bravo, or Tanos + Bravo, or Gavel every 7 days in rotation. After disease you can use: Presidio + Bravo, or Ranman + Bravo every 5 days in rotation.

Useful resources

- The NCSU Plant Disease and Insect Clinic provides diagnostics and control recommendations: <http://www.cals.ncsu.edu/plantpath/extension/clinic/>
- The Cucurbit Downy Mildew IPM Pipe provides forecasts and reports of disease outbreaks: <http://cdm.ipmpipe.org/>
- The Plant Pathology Extension Portal provides information on crop disease management: <http://plantpathology.ces.ncsu.edu/>
- The 2013 Southeastern US Vegetable Crop Handbook provides information on vegetable disease management: <http://www.thegrower.com/south-east-vegetable-guide/>