

NEW POWDERY MILDEW ON TOMATOES

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POWDERY MILDEW BIOLOGY

- Powdery mildew fungi are obligate, biotrophic parasites of the phylum Ascomycota of the Kingdom Fungi.
- The diseases they cause are common, widespread, and easily recognizable
- Individual species of powdery mildew fungi typically have a narrow host range, but the ones that infect Tomato are exceptionally large.



Photo from APS Net



POWDERY MILDEW BIOLOGY

- Unlike most fungal pathogens, powdery mildew fungi tend to grow superficially, or **epiphytically**, on plant surfaces.
- During the growing season, hyphae and spores are produced in large colonies that can coalesce
- Infections can also occur on stems, flowers, or fruit (but not tomato fruit)
- Our climate allows easy overwintering of inoculum and perfect summer temperatures for epidemics

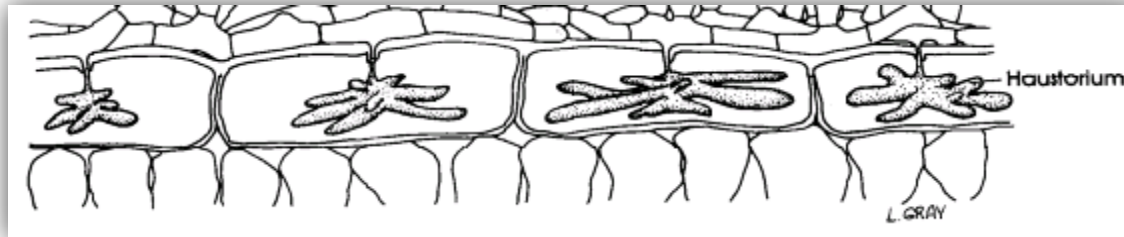


UC Statewide IPM Project
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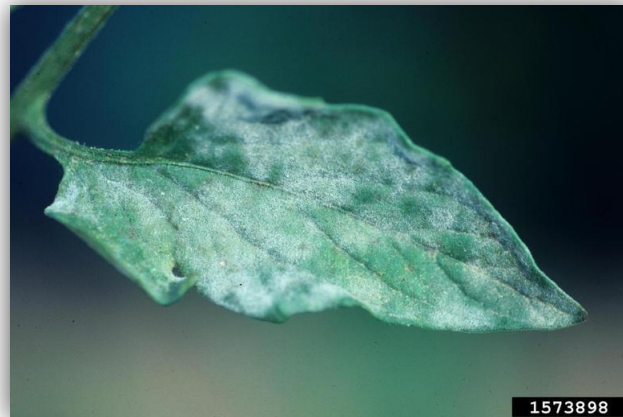


POWDERY MILDEW BIOLOGY

- Specialized absorption cells, termed **haustoria**, extend into the plant epidermal cells to obtain nutrition.



- Powdery mildew fungi can completely cover the exterior of the plant surfaces (leaves, stems, fruit)



POWDERY MILDEW BIOLOGY

- **Conidia** (asexual spores) are also produced on plant surfaces during the growing season.
- The conidia develop either *singly* or in *chains* on specialized hyphae called **conidiophores**.
- Conidiophores arise from the epiphytic hyphae. This is the **Anamorph**.

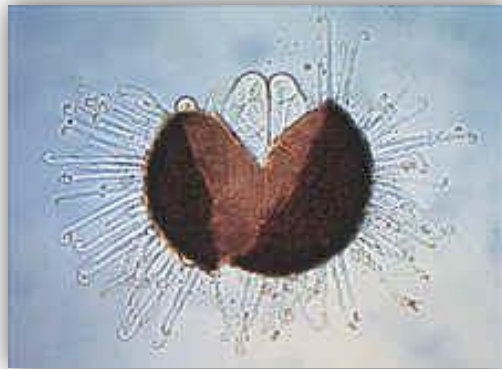


Courtesy J. Schlesselman



POWDERY MILDEW BIOLOGY

- Some powdery mildew fungi produce sexual spores, known as **ascospores**, in a sac-like **ascus**, enclosed in a fruiting body called a **chasmothecium** (old name **cleistothecium**). This is the **Teleomorph**

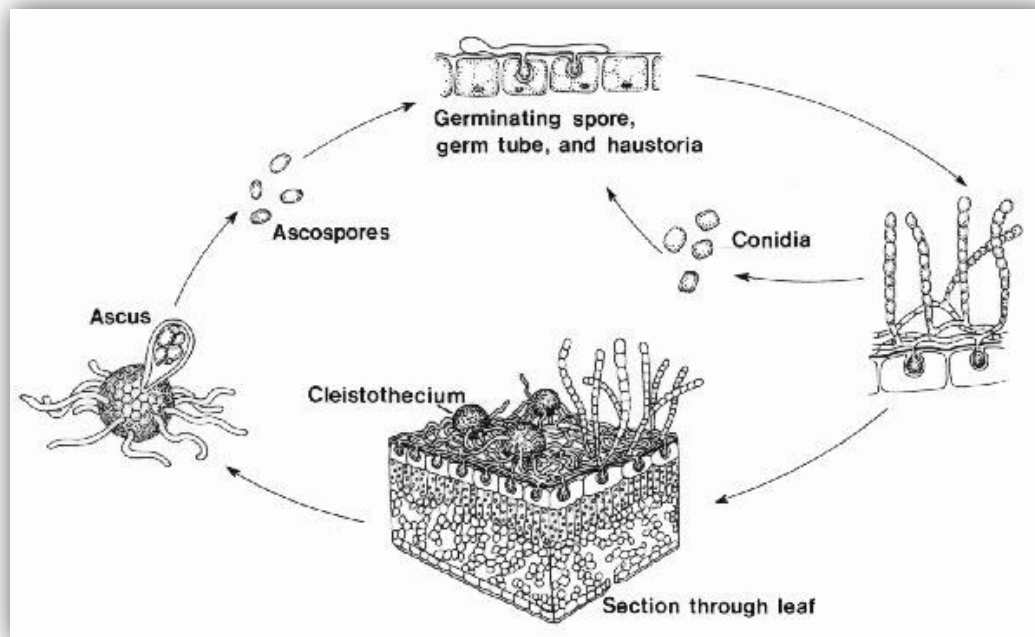


- **Chasmothecia** are generally spherical with no natural opening; asci with ascospores are released when a crack develops in the wall of the fruiting body. This type of fruiting body is unique among the **Ascomycota**.



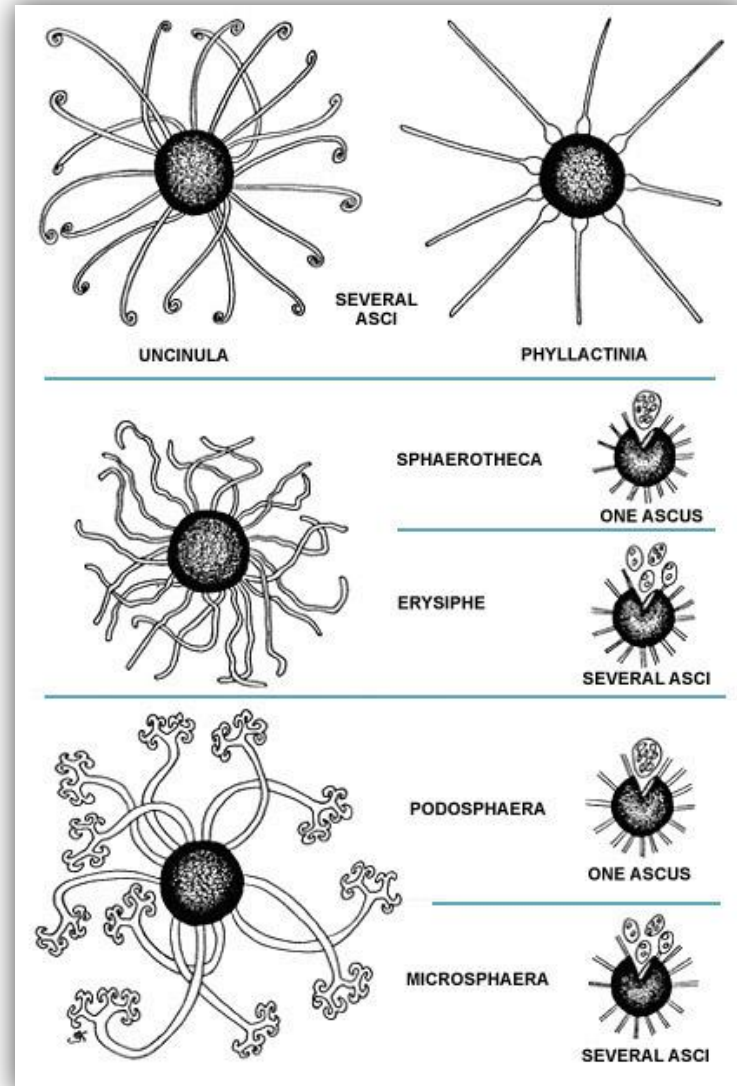
POWDERY MILDEW BIOLOGY

- Powdery mildews are **polycyclic** diseases that can impair photosynthesis, stunt growth, and increase the rate of senescence of host tissue.
- The diseases they cause may be slight or, in some situations if left untreated, they may result in severe economic losses on crops (such as tomatoes)



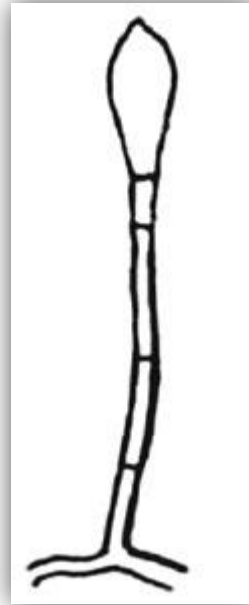
POWDERY MILDEW TAXONOMY (EASIEST)

- A variety of appendages occur on the surface of the **chasmothecia**
- These and the number of **asci** are useful in identification
- Unfortunately, **chasmothecia** are rare in temperate climates

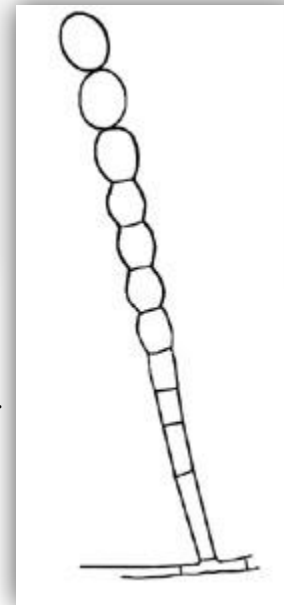


POWDERY MILDEW TAXONOMY (HARDER)

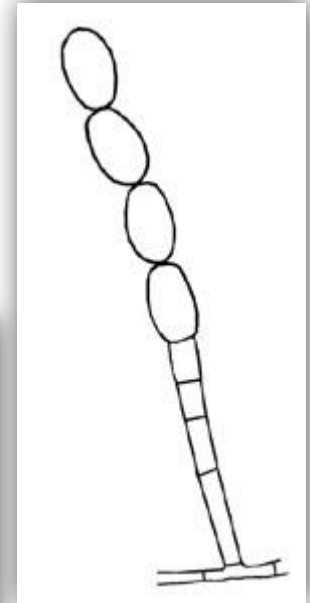
- Conidia are produced **singly** or in **chains**.
- This distinction can be difficult to observe
- In some genera, particularly in the **Erysiphae**, conidia that are produced singly can “stick together” as **pseudochains**, which are not true chains.



conidiophore producing a **single** conidium.



conidiophore producing conidia in a **pseudochain**



conidiophore producing conidia in a **true chain**.



POWDERY MILDEW TAXONOMY (INVISIBLE)

- The taxonomy of powdery mildew fungi (order **Erysiphales**) recently underwent extensive revision based on DNA sequence data.
- Previously, identification was based largely on the **teleomorph** (sexual stage) and the morphology of the **chasmothecium** and its appendages, but the morphology of structure is not as conserved as originally assumed.
- Other characteristics that aid in classification are the location of mycelium on the plant and host specificity, which is often not well studied, esp. for novel species



POWDERY MILDEW TAXONOMY (INVISIBLE)

- With the new taxonomy, identification of powdery mildews now also requires attributes of the **anamorph** (asexual stage), so that it incorporates characteristics of the whole fungus (**anamorph + teleomorph = holomorph**).
- This has been very helpful for species where the **teleomorph** has been lost or is unknown
- Powdery mildew genera are now grouped into five tribes, and some genera have been added or merged: *Phyllactineae*, *Erysipheae*, *Blumeriae*, *Golovinomyceteae*, *Cystothecae*



POWDERY MILDEW TAXONOMY (SUMMARY)

<u>Tribe</u>	<u>New holomorphic genus</u>	<u>Anamorphic genus</u>	<u>Former teleomorphic genus</u>	<u>Common Hosts</u>
Phyllactineae	<i>Phyllactinia</i>	<i>Ovulariopsis</i>	<i>Phyllactinia</i>	trees and shrubs
	<i>Leveillula</i>	<i>Oidiopsis</i>	<i>Leveillula</i>	Solanaceae
Erysipheae	<i>Erysiphe</i> section <i>Erysiphe</i>	<i>Oidium</i>	<i>Erysiphe</i> section <i>Erysiphe</i>	legumes
	<i>Erysiphe</i> section <i>Microsphaera</i>	<i>Oidium</i>	<i>Microsphaera</i>	trees and shrubs
	<i>Erysiphe</i> section <i>Uncinula</i>	<i>Oidium</i>	<i>Uncinula</i>	trees and shrubs
Blumeriae	<i>Blumeria</i>	<i>Oidium</i>	<i>Blumeria</i> / <i>Erysiphe</i>	grasses
Golovinomyceteae	<i>Golovinomyces</i>	<i>Oidium</i>	<i>Erysiphe</i> section <i>Golovinomyces</i>	cucurbits and composites
Cystotheceae	<i>Podosphaera</i> section <i>Podosphaera</i>	<i>Oidium</i>	<i>Podosphaera</i>	Rosaceae
	<i>Podosphaera</i> section <i>Sphaerotheca</i>	<i>Oidium</i>	<i>Sphaerotheca</i>	



TOMATO POWDERY MILDEW IN CA

- UC IPM advises on Powdery Mildew of “**Coastal and Greenhouse Tomatoes**” named *Oidium neolycopersici*. Placed in *Erysiphe*, but no chasmothecia are known
- 13 families can be alternative hosts, incl. crop plants and weeds
- Can be serious under high RH
- Infects *upper* leaf surface and stems



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Photo by D. Blancard



TOMATO POWDERY MILDEW IN CA

- UC IPM advises on Powdery Mildew of “**Field – grown Tomatoes**” named *Leveillula taurica* (*Oidiopsis taurica*)
- *Placed in Phyllactineae*, but no chasmothecia known
- *Oidiopsis* is considered a much more serious and aggressive pathogen
- Infects peppers, tomatillos, and eggplants
- Infects the *underside* of the leaf and is harder to diagnose



Photo by APSnet



TOMATO POWDERY MILDEW IN SBC

- Received samples in June from Goleta – grower reporting severe defoliation, dropping fruit, sunburned fruit, leaves and especially stems heavily colonized by white epiphytic mycelium
- Asked the usual question: is it *Oidium* or *Oidiopsis*?
- Answer was *Oidium*, but not the expected one

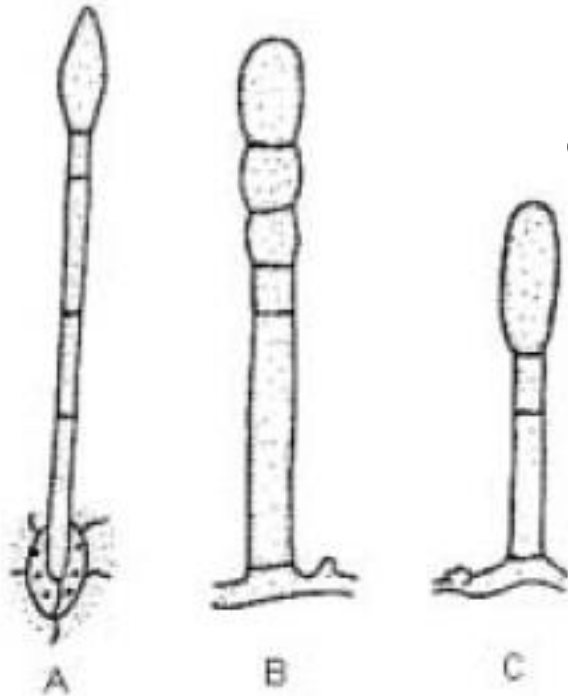
*Powdery mildew confirmed to be **Oidium lycopersicum** by PCR. Not previously rated but probably has been confused with morphologically similar **Oidium neolycopersici**.*

Recommend Z rating until a permanent C can be given.



“NEW” TOMATO POWDERY MILDEW SBC

Oidiopsis taurica
(Single)



Oidium neolycopersici
(Pseudochain)

Oidium lycopersicum
(Chain)

Drawing by K. Levente

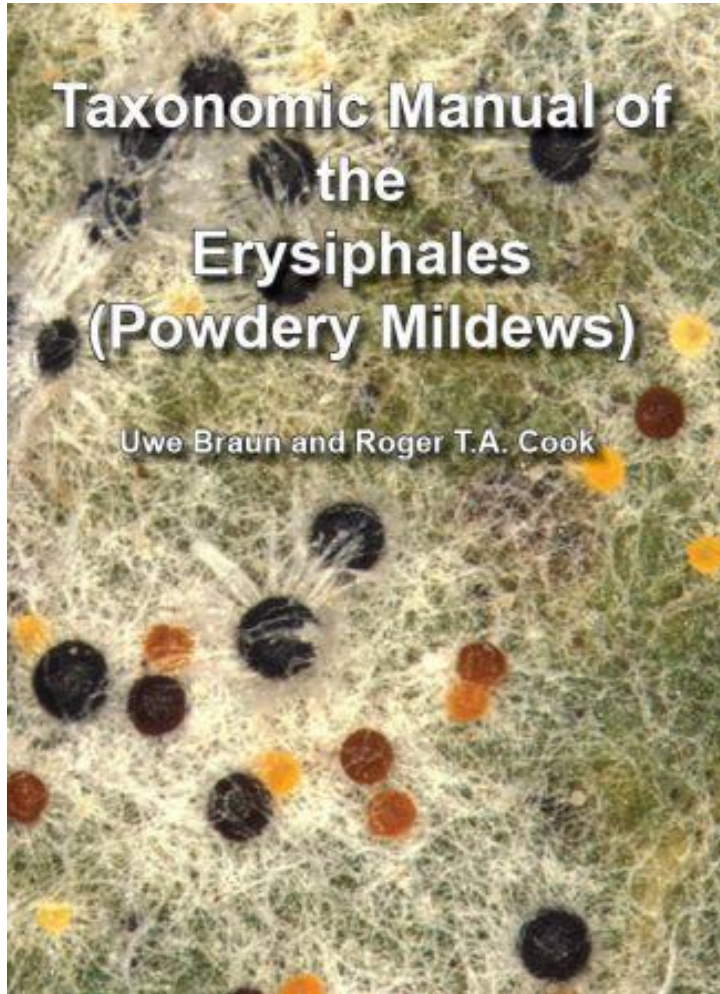


NEW TOMATO POWDERY MILDEW

- First report of *Oidium lycopersicum* in California
- Important to know because
 - different host ranges between species in the literature
 - different sources of resistance genes
 - slightly different life cycles
 - different geographical ranges
 - may vary in susceptibility to fungicides



TOMATO POWDERY MILDEW (CONTINUED)



New Book:
*Taxonomic Manual of the
Erysiphales (Powdery Mildews)*
By Braun and Cook



TOMATO POWDERY MILDEW (CONTINUED)

- Two new sections added for *anamorphic* groups for which no *teleomorphs* have been found
- *Euoidium* and *Pseudoidium*.
- So now our Tomato Oidiums are named:
 - Euoidium lycopersicum***
(conidia mature gradually within a chain)
 - Pseudoidium neolycopersici*** &
(conidia mature one at a time)
- anamorphs belong to different genetic lineages
-more evidence they are different fungi



TOMATO POWDERY MILDEW

- submit samples to AGWM for identification

