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Diseases and Disorders  
of Greenhouse  
Vegetable Crops

DECEMBER 10, 2014

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Diseases Common to  
Greenhouse Vegetable Crops

- ◉ Damping-off
- ◉ Root/Crown/Stem diseases
  - *Pythium* species
  - *Rhizoctonia solani*
- ◉ *Botrytis cinerea* (Gray Mold) diseases of foliage, stems, and fruit

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Common Root Diseases

- ◉ *Pythium*
- ◉ *Phytophthora*
- ◉ *Rhizoctonia*
- ◉ *Sclerotinia*

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Soil-Borne Plant Pathogenic  
Fungi

- ◉ Are natural inhabitants of the soil and survive there indefinitely
- ◉ Cause damping-off, root rot, crown rot, and stem cankers
- ◉ Most have wide host ranges

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Soil-Borne Plant Pathogenic Fungi

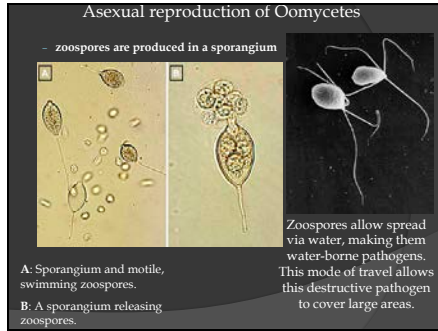
- ◉ Most don't produce air-borne spores
- ◉ Move when soil or plants move (by nature & people)
- ◉ Can contaminate soilless media and recirculating water systems
- ◉ Difficult to control, especially in field situations

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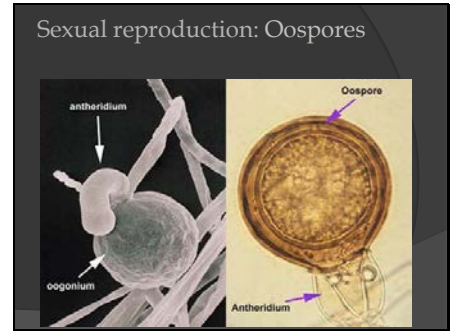
Oomycetes

- Includes both *Phytophthora* and *Pythium*, two of the most important plant diseases worldwide.
- Not true fungi, but referred to as fungal-like organisms, lower fungi or 'water molds'.

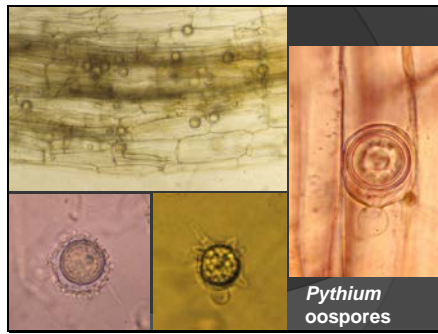
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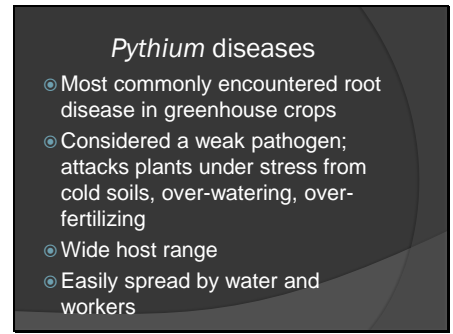
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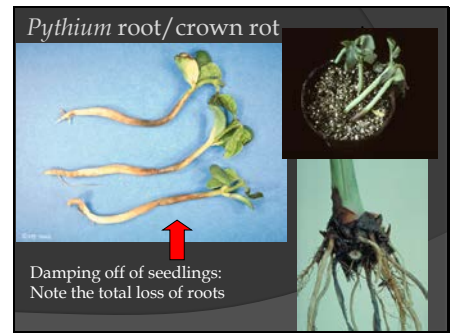
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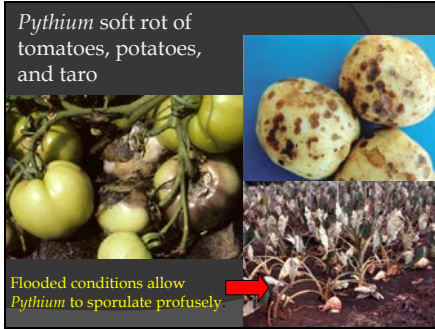


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*Pythium* soft rot of tomatoes, potatoes, and taro



Flooded conditions allow *Pythium* to sporulate profusely.

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*Phytophthora* species

- Less common in the greenhouse
- More host specific than *Pythium* species
- More aggressive than *Pythium* species
- Oospore production rare.

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*Rhizoctonia* Root, Crown and Stem Rot

- *Rhizoctonia* is a natural inhabitant of soil and can survive there indefinitely.
- Favored by drier soil and is more active in the upper portions of soil. Common cause of stem cankers

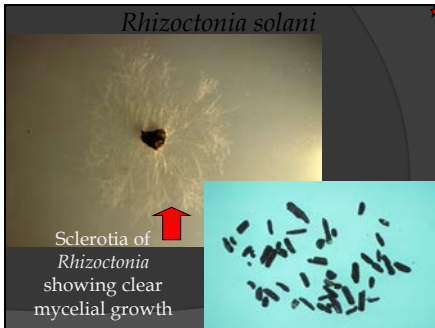
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*Rhizoctonia* Root, Crown and Stem Rot

- Wide host range
- Causes damping-off, web blight, root rot, crown rot, stem cankers, and foliar blight
- Survives as mycelium in plant debris or sclerotia: compacted masses of mycelium with a thick rind

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*Rhizoctonia solani*

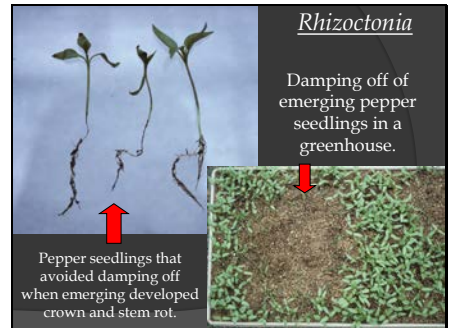


Sclerotia of *Rhizoctonia* showing clear mycelial growth

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*Rhizoctonia*

Damping off of emerging pepper seedlings in a greenhouse.



Pepper seedlings that avoided damping off when emerging developed crown and stem rot.

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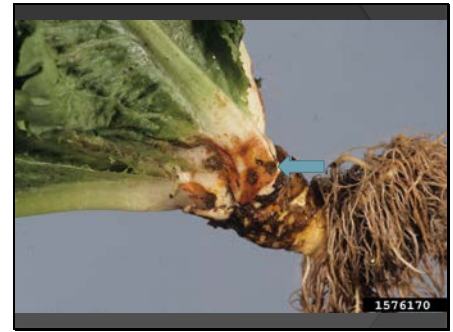
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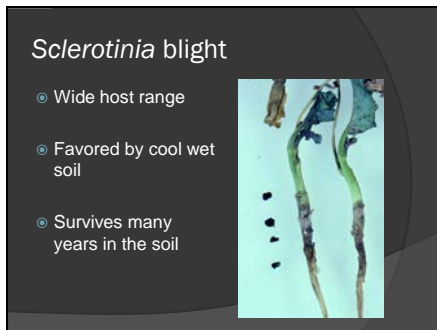
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### Managing Root/Crown Diseases

- Prophylactic applications of biological control organisms to growth media
- Transplant drenches of fungicides both conventional and biological
- Proper irrigation and fertilization
- Avoid water splash when irrigating

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### *Botrytis cinerea*

- Important problem in greenhouses. Extremely wide host range.
- Leaf spots, stem cankers, blossom blight, crown and root rot, damping-off, fruit rot and bulb rot
- Serious foliage diseases of onion family, lilies, small fruit rots and storage rots.

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### *Botrytis cinerea*

- Plants may be attacked at any stage but new tender growth, freshly injured tissues and aging or dead tissues are preferred.
- Spores are produced in abundance on lesions as well as on plant debris left on benches, the greenhouse floor and cull piles

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### *Botrytis cinerea*: Gray Mold



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### Managing *Botrytis* Diseases

- Environmental control critical
- Avoid condensation, high relative humidity and prolonged leaf wetness by heating/venting, fans, watering practices
- Sanitation
- Fungicide applications

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### Bacterial Diseases of Tomato

- Difficult to impossible to control
- Reproduce extremely rapidly
- Easily spread by water and aerosols
- No highly effective chemical control
- Very often are seedborne.

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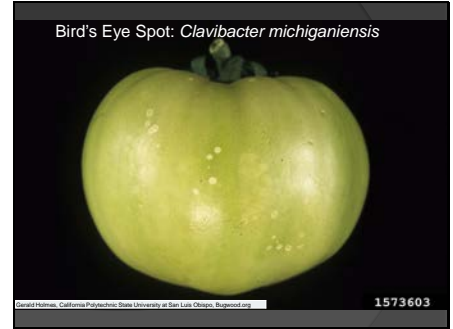


Tomato Canker caused by *Clavibacter*

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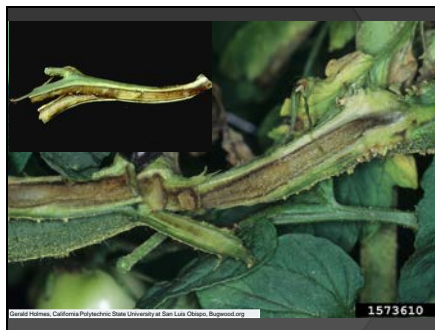
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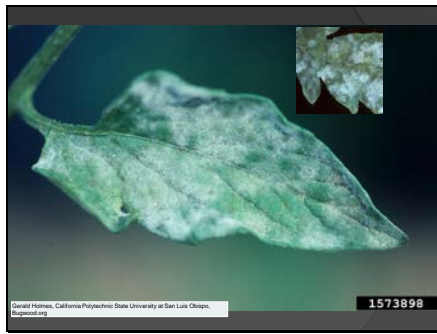


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**Powdery Mildews**

- Very conspicuous and very common.
- Obligate parasites, cannot be cultured on artificial nutrient media. Host specific.
- Powdery Mildews produce mycelium that grows on the surface of plant tissues, obtaining nutrients by sending feeding tubes into the epidermal cells of plant leaves.

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**Septoria leaf spot**

In earlier stages of the infection, spots appear as very distinct, isolated lesions. Over time these can coalesce to cover large portions of the leaf surface.

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**Early Blight of Tomato**

Dark sunken lesions on stems and fruit caused by *Alternaria solani*.

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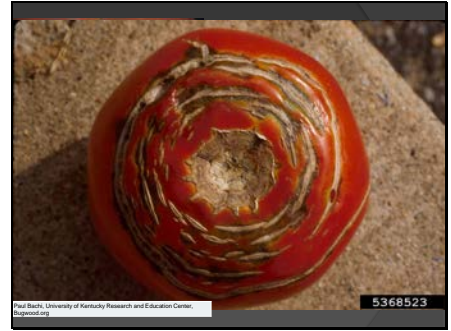
**Tomato Spotted Wilt Virus (TSWV)**



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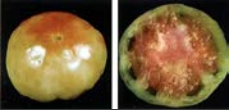


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**Gray Wall**



High Temperatures  
Potassium or Boron Deficiency  
Any environmental stress that slows growth  
Related to Yellow Shoulder



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**Edema (Oedema)**



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**Cucumber: *Penicillium* Stem Rot: *Penicillium oxalicum***



- Cosmopolitan in soil and decaying organic matter
- Infects wounds on stems and wounds on fruit
- Favored by high N and stress



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**Gummy Stem Blight *Didymella byroniae***

- First appears as lesion on fruit stub
- Infects stems, leaves, fruit, seedlings
- Survives up to years in plant debris
- Predisposed by aphids, cucumber beetles, Powdery mildew

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**Powdery mildew of cucumber *Podosphaera xanthii***

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**Downy Mildew: *Pseudoperonospora cubensis***

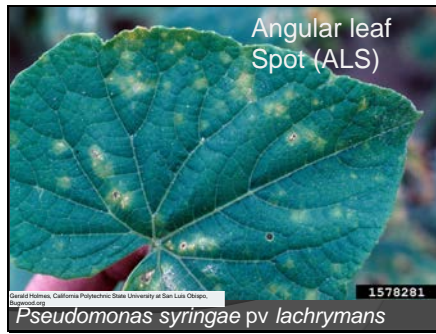
- Specific to cucurbit family
- Most severe in poorly ventilated plastic greenhouses
- Survives in protected structures or is blown northward each season



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**Cucumber Mosaic Virus**

- Cucurbits susceptible to more than 30 viruses
- Vecteded by aphids, leafhoppers, whiteflies, nematodes, humans
- Eradication of weed hosts, resistant cultivars and strict sanitation



Bob Jensen, The Ohio State University, Bugwood.org

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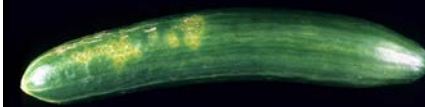
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### Physiological Disorders of Greenhouse Cucumbers

- Chilling injury
- Nutritional disorders-B, Ca, Cu, and Fe
- Premature Fruit Yellowing
  - Excessive fruit number and/or poor nutrition
- Sudden Wilt/ Root Death (no recovery)
  - Stress
  - High or low temperatures
  - Oxygen deficiency
  - Most serious in rock wool/hydroponics

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### Edema on Cucumber Fruit



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1563127

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David Holwell, California Polytechnic State University at San Luis Obispo, Burrewood, CA

1577915

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### Brassica Greens: *Xanthomonas campestris* pv. *campestris*



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### Downy Mildew on Greenhouse Greens



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### Downy Mildew on Brassicas



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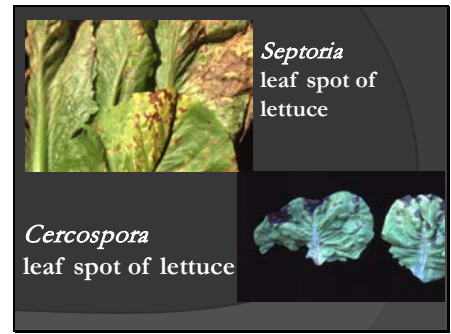
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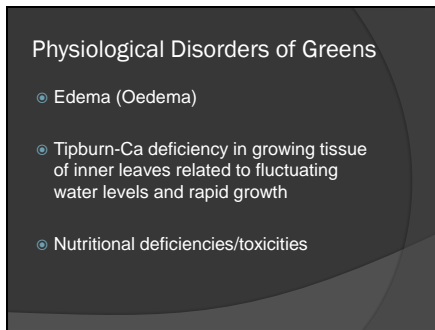
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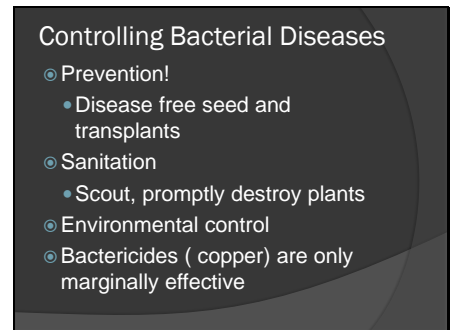
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### Controlling Downy Mildews

- ◉ Disease-free seed
- ◉ Scouting/Sanitation/Environmental control
- ◉ Resistant Varieties
- ◉ Regular, protective fungicide sprays

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### Controlling Foliar Diseases

- ◉ Reduce humidity and improve airflow
  - Horizontal fans
  - Heating and Venting
- ◉ Reduce leaf wetness
  - Water in morning or sub-irrigating
  - Avoid wetting leaves and water splash
- ◉ Sanitation
- ◉ Fungicide applications