Pacific Northwest Carrot Diseases

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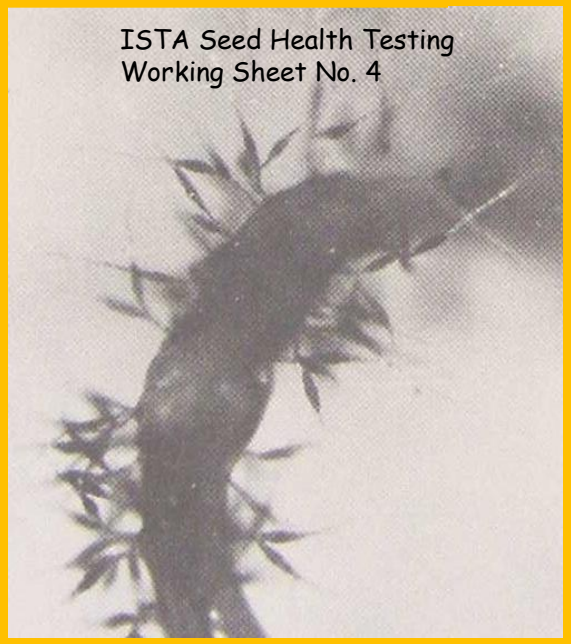
2013 Pacific Northwest Vegetable Association
Annual Convention & Trade Show, Kennewick, WA
13-14 November 2013

Bacterial blight

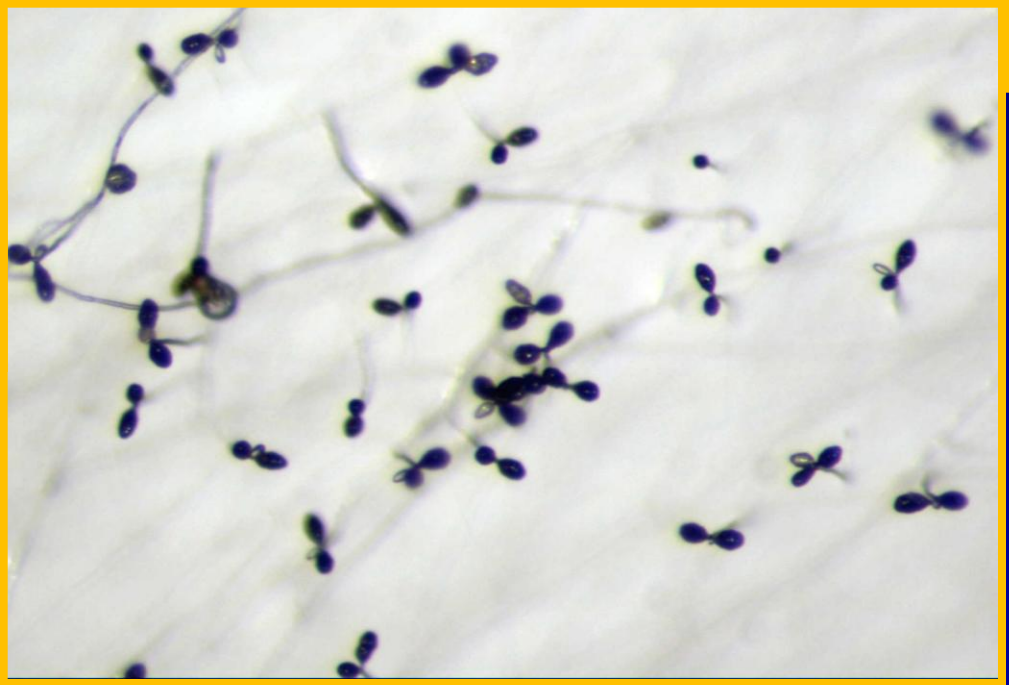
Xanthomonas hortorum pv. *carotae*

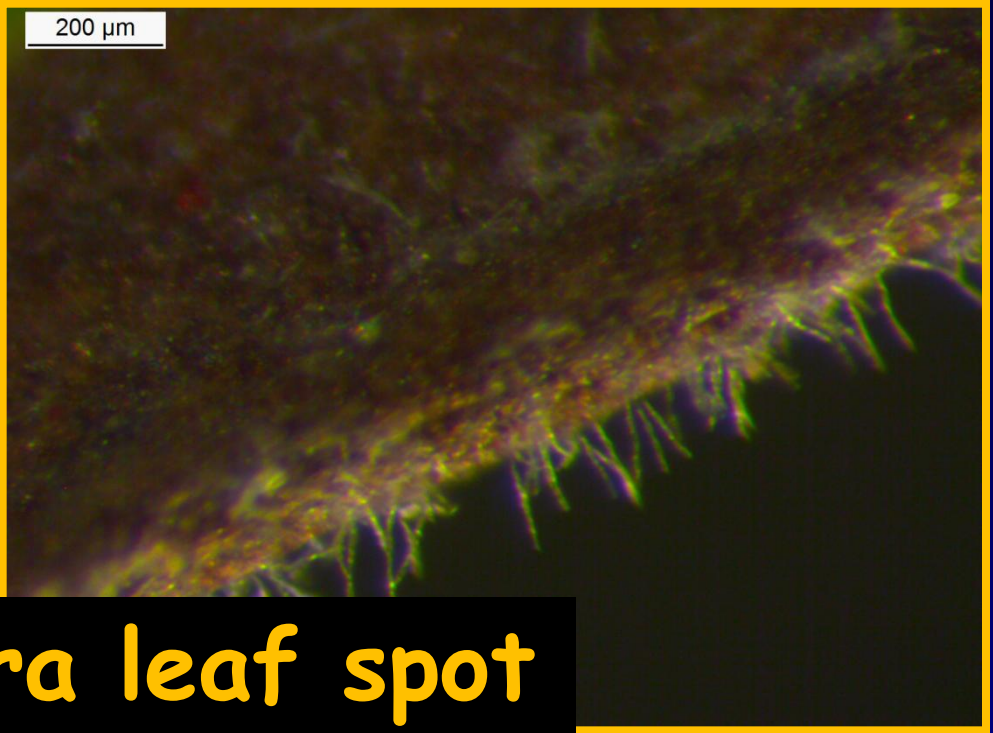


Alternaria leaf blight

Alternaria dauci

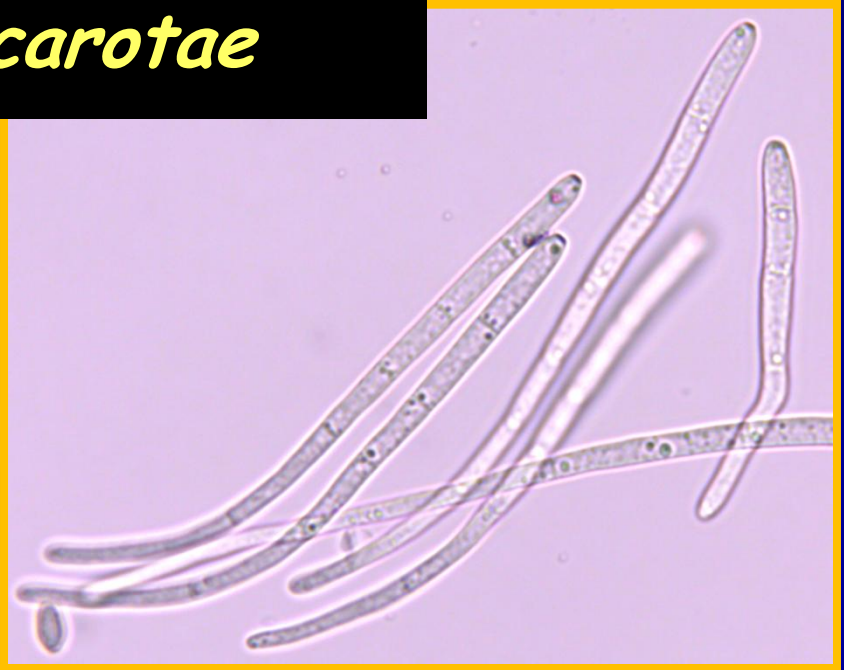
Black rot
Alternaria radicina





Cercospora leaf spot

Cercospora carotae



Survival & spread

- *Xanthomonas campestris* pv. *carotae*
  - seed (internal & external)
  - infested residues in soil (1 year)
  - splashing water, insects, seed
- *Alternaria dauci*
  - seed (internal & external)
  - infested crop residues, Umbelliferous weed hosts
  - wind, splashing water, farm machinery, workers, seed
- *Alternaria radicina*
  - seed (internal & external)
  - soil (>8 years), infested residues on soil surface
  - movement of soil, roots, seed; splashing water
- *Cercospora carotae*
  - seed (internal & external)?
  - infested residues, wild carrot, other *Daucus* species
  - wind, splashing water, farm machinery, workers, seed

Conditions favoring disease

- *Xanthomonas campestris* pv. *carotae*
  - warm, wet conditions
  - 77-86°F optimal (55-100°F, killed at 120°F)
  - 10-12 day disease cycle
- *Alternaria dauci*
  - moderate-warm, wet conditions
  - 84°F optimal (57-95°F)
  - 8-16 day disease cycle
- *Alternaria radicina*
  - cool to warm, wet
  - 84°F optimal (31-93°F)
  - storage >92% RH
  - "monocyclic" root infection; "polycyclic" foliar infection
- *Cercospora carotae*
  - cool to warm, wet conditions
  - 68-86°F optimal, >12 hours leaf wetness
  - ~10 day disease cycle

Management of bacterial blight

- Pathogen-free or hot-water treated seed (122°F, 25 min)
- 2–3 year crop rotation
- Incorporate infested residues
- Resistance? e.g., Danvers
- Bactericide applications:
  - Coppers, ManKocide
  - Preventative only
  - Thorough coverage

Management of Alternaria leaf blight

- Pathogen-free or treated seed
- 2-3 year crop rotation
- Incorporate infested carrot residues in fall
- Avoid excessive nitrogen fertility
- Partially resistant cultivars
- **Fungicides:**
  - coppers
  - chlorothalonil
  - strobilurins, fludioxonil, etc.
  - timing applications, coverage
- **Gibberellic acid** (Santos et al. 2000)
- **Seed treatments:**
  - **Maxim, Rovral, Quadris, hot water**

Management of black rot

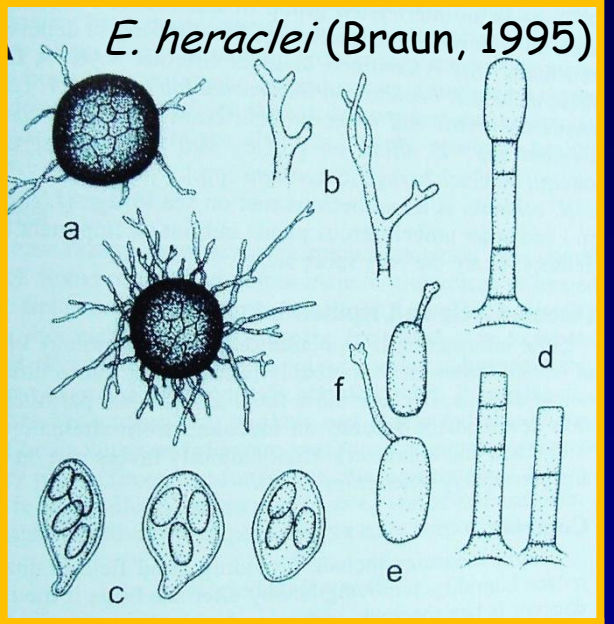
- Pathogen-free or treated seed, stecklings
- 8+ year crop rotation
- Incorporate infested carrot residues
- Irrigate so carrots dry by nightfall
- Discard infected roots before storage
- Storage: 32°F & 92% RH if infested
- Resistant cultivars?
- Fungicides:
  - Coppers, strobilurins, iprodione (Rovral), …
- Seed treatments:
  - fungicides, e.g., Rovral, Maxim, Quadris, …
  - hot water @ 122°F for 30 min
  - hot sodium chloride (0.1-1.0%, 122°F 30 m)

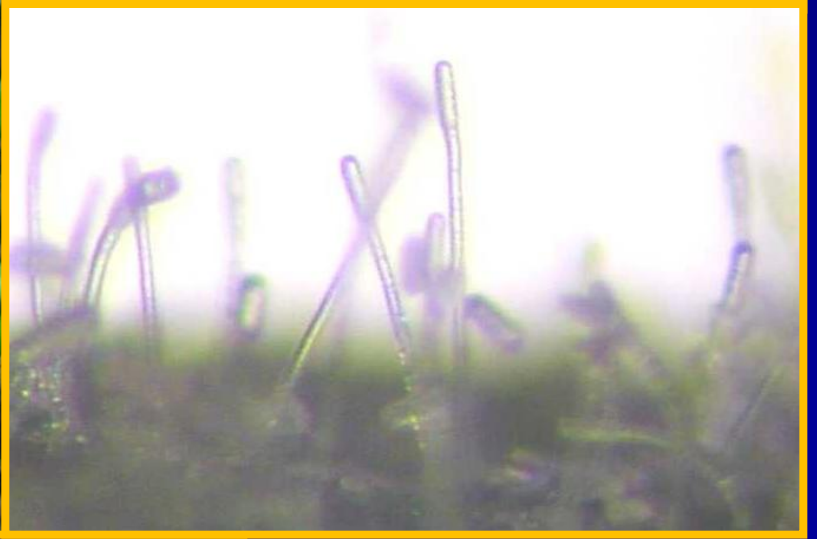
Management of Cercospora leaf spot

- 2-3 year crop rotation
- Fall incorporation of residues
- Irrigate so carrots are dry at night
- Spartan cultivars resistant, e.g., Delite, Delux, Fancy, Bonus, Classic, Winner, Premium
- Fungicides:
  - coppers, Bravo, strobilurins, …
  - prediction for sprays (Canada)
  - thorough coverage

Carrot powdery mildew

Erysiphe heraclei, Leveillula taurica



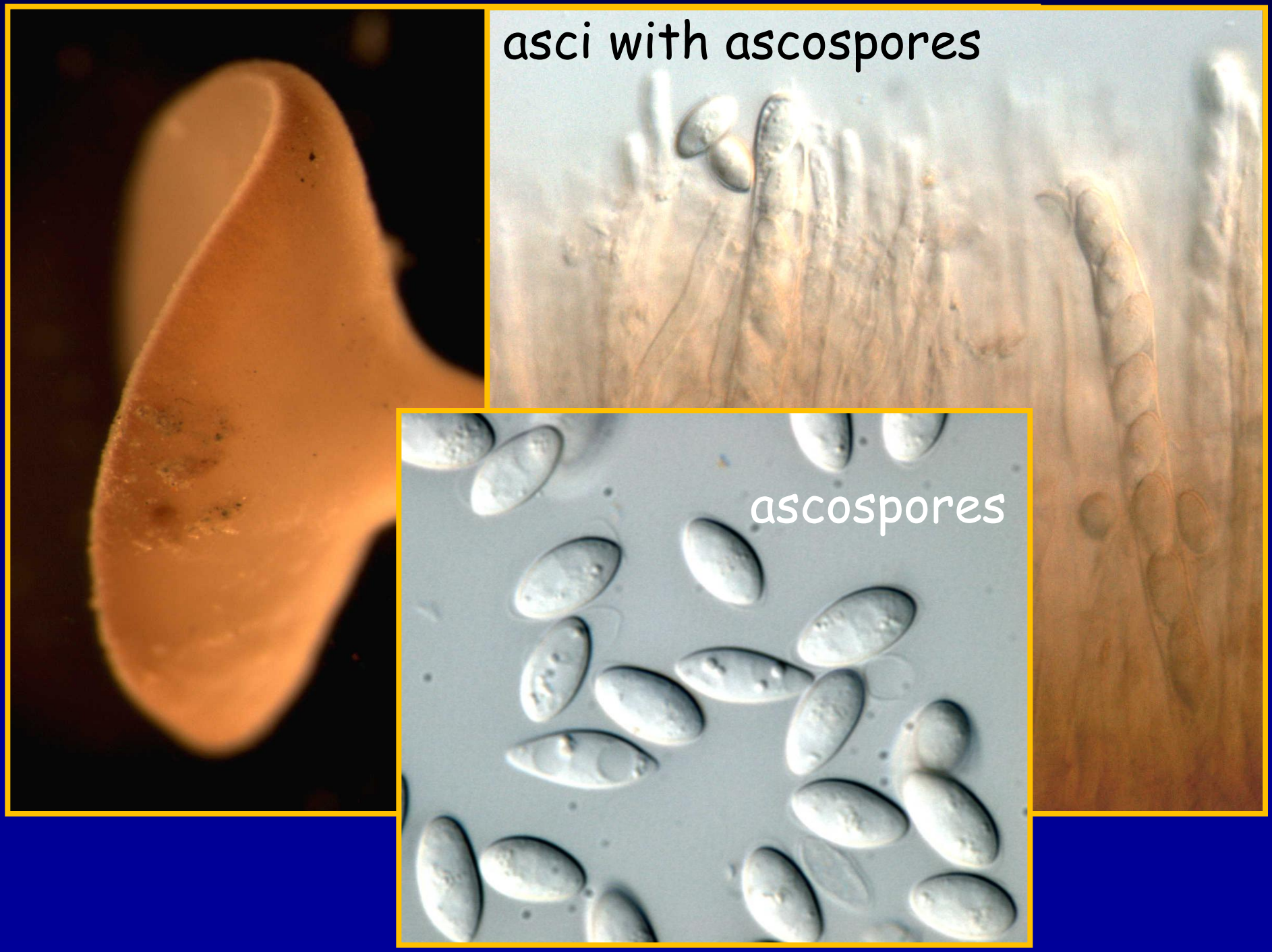


Management of powdery mildew

- Crop rotation
- Incorporate infested residues in fall
- Overhead irrigation
- Plant spacing/row orientation
- Avoid excessive nitrogen fertilization
- Avoid crop stress
- Resistance
- **Fungicides:** many choices, thorough coverage, resistance management

White mold

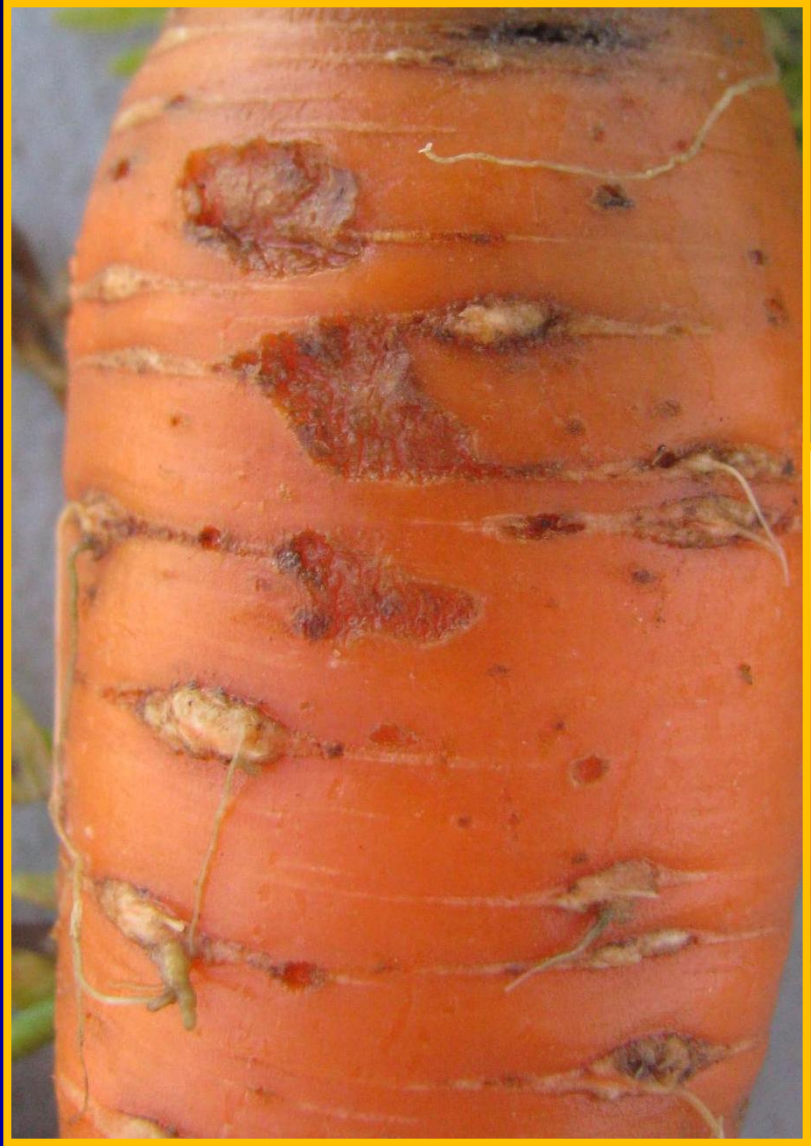
Sclerotinia sclerotiorum


asci with ascospores
ascospores

White mold

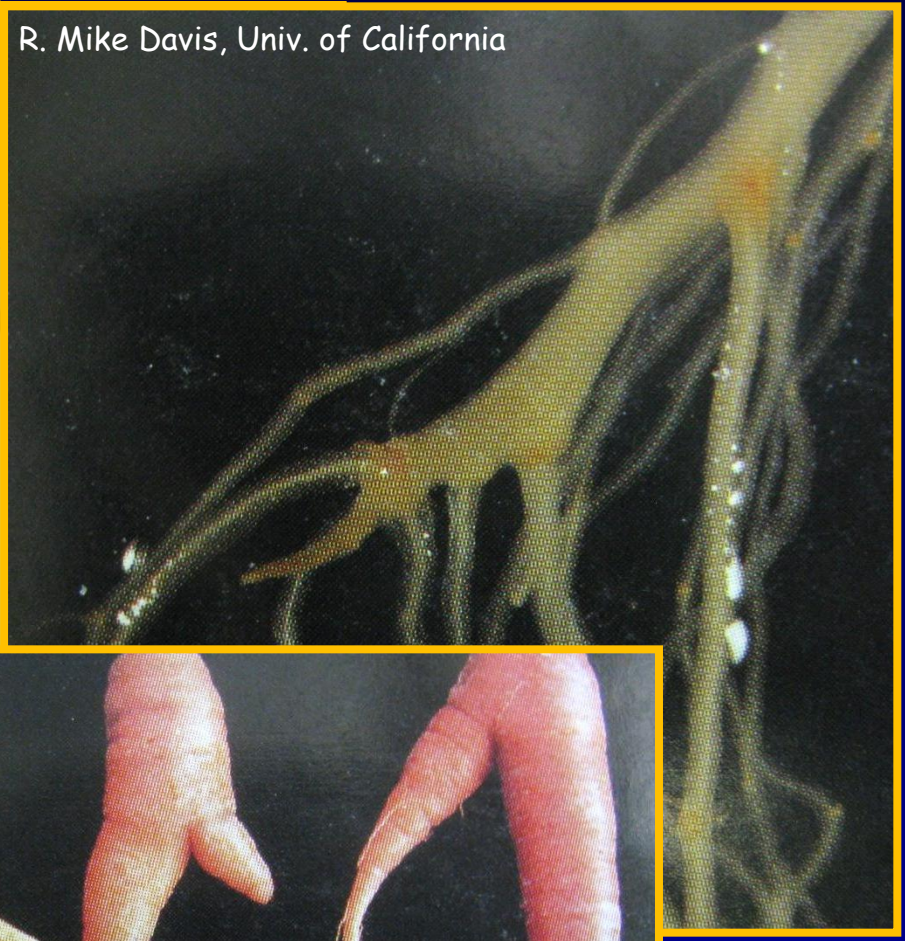
- Broad host range, persistent sclerotia
- Sclerotial germination: apothecia or mycelium
- Apothecia release ascospores aerially – foliar infections
- Favorable conditions: extended moisture, humidity
- Management:
  - rotation (non-host crops, e.g., cereals)
  - row orientation
  - trim canopy (increase air circulation)
  - irrigation management (keep top of bed dry)
  - flooding
  - broccoli, green manure crops
  - fungicides:
    - Contans (sclerotia)
    - foliar applications (boscalid, fluazinam, iprodione, thiophanate-methyl, …)
    - timing, coverage, resistance management

Pythium diseases
Cavity spot



Pythium diseases
Root tip dieback

David Langston, Univ. of Georgia,



R. Mike Davis, Univ. of California

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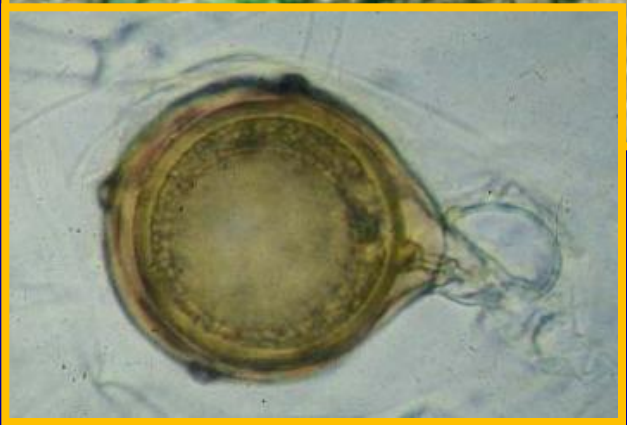
Damping-off

Pythium, Rhizoctonia, Fusarium



Management of carrot damping-off

Cultural practices

- Testing soils for damping-off risk
  - Measuring total *Pythium* or particular species did NOT work (Howard et al., 1975; Liddell et al., 1989)
  - Soil grow-out for *R. solani* predicted incidence in fields (Shlevin & Katan, 1975) – avoid fungicides in 'clean' fields
- Soil flooding, e.g., Strandberg (1985):
  - Florida for *Pythium*, short-term benefit
  - More effective at 25-30°C than 15-20°C
- Crop rotation
  - Green manure/biofumigant crops
  - Cash crops – broad host range of pathogens

  Davis & Nunez (1999), CA: alfalfa exacerbated, barley/cotton increased forking/stubbing some years, small grains reduced damping-off, interval between cover crop & carrot

Management of carrot damping-off

Chemical practices

- Conventional fungicides
  - *Pythium*–specific: e.g., metalaxyl or mefenoxam, **fenamidone (Reason), cyazofamid (Ranman), fluopicolide (Presidio)**
    - Seed treatments, drenches
    - Biodegradation in sandy soils, resistance
  - *Rhizoctonia*–specific: e.g., PCNB, strobilurins
    - Less effective as seed treatment vs. drenches or banded/incorporated
  - *Fusarium*–specific: e.g., fludioxonil, thiabendazole
- Soil fumigation: e.g., metam sodium
  - Biological fungicides: Efficacy? Diverse environments

Phytoplasmas/spiroplasmas

Aster yellows, BLTVA, purple leaf

Phytoplasmas & spiroplasmas

- Broad host range
- Vectors: aster & beet leafhoppers, etc.
- Causal agents:
  - aster yellows phytoplasma (16SrI)
  - clover proliferation (16SrVI) = BLTVA
  - *Spiroplasma citri*
- Management:
  - remove infected weeds/carrots
  - avoid planting near symptomatic crops
  - leafhopper control, e.g., Admire, Provado, Lannate, Actara, Mustang, …
  - resistant cultivars
  - "Aster Yellows Index" (Midwest)
    - leafhopper testing + carrot cv. susceptibility

Root knot nematode

Meloidogyne hapla, other species

Root knot nematode

- Infects other crops
- Worse on sandy soils, optimum development at 60-77°F
- 1-3 generations/season,
- Low tolerance: 2 juveniles of *M. hapla*/100 cm^3 soil in WA
- Management:
  - test soil before planting (fall), roots + soil
  - early planting (cool soils)
  - rotate with non-host crops (corn, cereals)
  - avoid irrigating from ponds that drain infected fields
  - resistant cultivars being developed
  - soil fumigation:
    - Vapam pre-plant
    - Vydate in-furrow at planting or chemigated post-planting/pre-emergence + subsequent applications


Play With Your Food


A
B
C
D