MICHIGAN STATE UNIVERSITY

Don’t Let Your Roots Rot!

Thielaviopsis

Rhizoctonia

Phytophthora

Pythium

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Managing Soilborne Diseases

Happy plants = Happy life

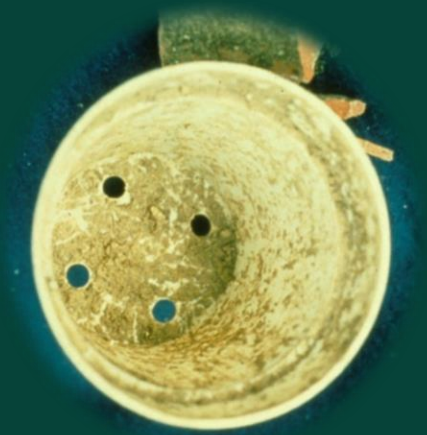
Avoid Plant Stress

- pH that is too high or too low: pH above 5.5 - 6.0 favors black rot
- High salts
- Overwatering
- Underwatering

Managing Soilborne Diseases

Sanitation = Start clean, stay clean

- Use clean containers
  - Dispose of pots from diseased plants
  - Soak cleaned pots, flats, trays in a disinfectant
  - Replenish the disinfectant frequently
- Keep walkways, benches, and equipment clean
- Dispose of mats associated with diseased plants
- Never allow cull piles on site or reuse soil



Thielaviopsis Black Root Rot

Pansy

Begonia
Cyclamen
Geranium
Gerbera
Kalanchoe
Pansy
Petunia
Poinsettia
Primula
Snapdragon
Sweet pea
Verbena
Vinca
Viola

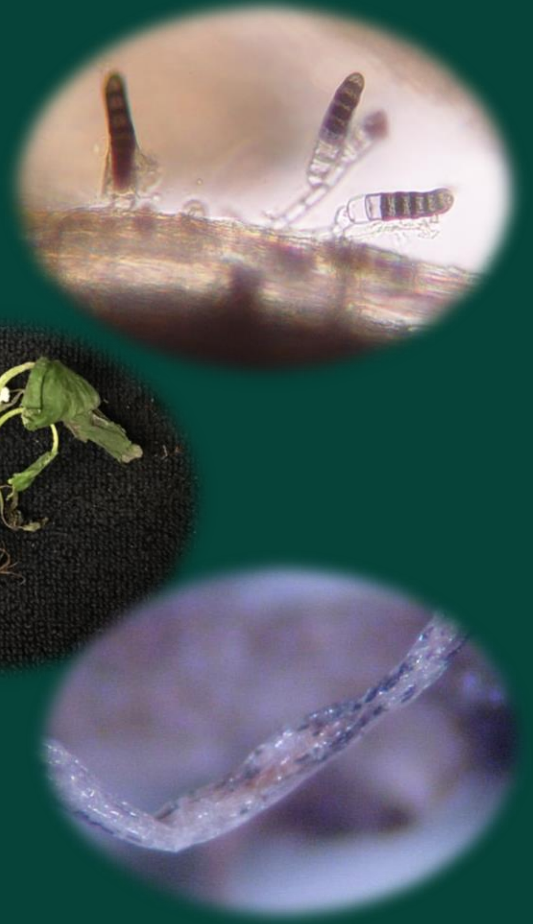
Vinca

Petunia

Thielaviopsis may mimic nutrient deficiency

Thielaviopsis Tips

- Used pots, flats, growing mats, and plug trays can carry the pathogen over from crop to crop
- Fungus gnats and shore flies can spread the pathogen
- Disease favored by cool (55 - 61 F) and wet soils



Thielaviopsis Fungicide Tips

- Use only fungicide drenches proven to be effective
- Apply fungicide drenches at the shortest labeled interval
- Always use the full labeled rate
- Alternate fungicides among the active ingredients (FRAC codes)
- Never rely on one fungicide in the treatment program

Choosing Fungicides - Thielaviopsis

Healthy

Diseased

Terraguard 50W

Choosing Fungicides - Thielaviopsis

Veranda O 11.3 WDF

OHP 6672 4.5FL

Trinity

Choosing Fungicides - Thielaviopsis

Tourney 50WDG

ZeroTol

Heritage 50WG

Thielaviopsis Fungicides

- Cleary's 3336 / OHP 6672 (thiophanate-methyl) [FRAC=1]
- Tourney (metconazole) [FRAC=3]
- Emblem/Medallion (fludioxonil) [FRAC=12]
- Terraguard SC (triflumizole) [FRAC=3]

Rhizoctonia Root Rot

Rhizoctonia Tips

- Favored by high temperatures
- Promoted by alternating wet/dry extremes
- Fungal threads (mycelium) survives harsh environments
- Can move quickly through a plug tray

Delphinium

Choosing Fungicides - *Rhizoctonia*

Untreated control

Medallion 1 oz

Choosing Fungicides - *Rhizoctonia*

Empress 3 fl oz

Heritage 0.9 oz

Choosing Fungicides - *Rhizoctonia*

Tourney 4 oz

penthiopyrad 24 fl oz

Rhizoctonia 'A' Team
First Line of Defense

- Affirm WDG (polyoxin D zinc salt) [19]
- Medallion / Spirato (fludioxonil) [12]
- Pageant (pyraclostrobin / boscalid) [11 / 7]
- Terraclor 400 (pentachloronitrobenzene) [14]
- Empress (pyraclostrobin) [11]

Rhizoctonia 'B' Team

- Captan (captan) [M04]
- 3336 / OHP 6672 (thiophanate-methyl) [1]
- Heritage 50WDG (azoxystrobin) [11]

Phytophthora Root Rot

Calibrachoa

Snapdragon

Rhododendron

English Ivy

Phytophthora Root Rot

Fuchsia

Poinsettia

Phytophthora Root Rot

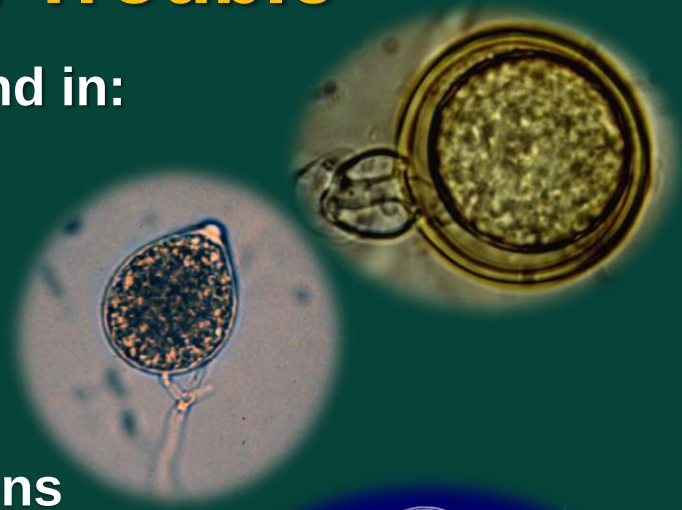
Vinca

Calibrachoa

These Spores Mean Trouble

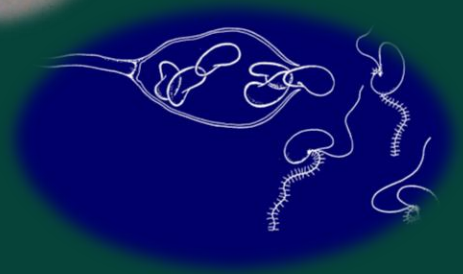
Oospores are dormant survival spores found in:

- Soil
- Plants and plant debris
- Equipment



Sporangia develop on roots, lower stems, infected leaves during wet / humid conditions

- Temperatures >55°F (12.8°C)



Zoospores form in sporangia and allow disease to ‘explode’ when soil is too wet

Choosing Fungicides - *Phytophthora*

Untreated

Alude
2.5 qt

Adorn
4 fl oz

Stature
6 fl oz

Choosing Fungicides - *Phytophthora*

Diseased - no treatment

Segovis 3.2 fl oz

Picarbutrazox 14.4 oz

Choosing Fungicides - *Phytophthora*

Daconil ZN 20 fl oz

Tril-21 64 fl oz

Bacillus amloliquefacianes
+ extract of *R. sachalinensis*

Phythophthora 'A' Team

- Adorn (fluopicolide) [FRAC=43]
- Micora (mandipropamid) [FRAC=40]
- Subdue MAXX (mefenoxam) [/FRAC=4]
- Segovis (oxathiapiprolin) [FRAC=49]

Phythophthora 'B' Team

- Alliette WDG (fosetyl-al) [FRAC=33]
- Captan (captan) [FRAC=M04]
- FenStop (fenamidone) [FRAC=11]
- Orvego (ametoctradin / dimethomorph) [FRAC=45 / 40]
- Segway SC (cyazofamid) [FRAC=21]
- Stature SC (dimethomorph) [FRAC=40]
- Terrazole L / Truban WP (etridiazole) [FRAC=14]
- Alude (phosphorous acid) [FRAC=33]

Pythium Root Rot

Pythium Root Rot

Osteos

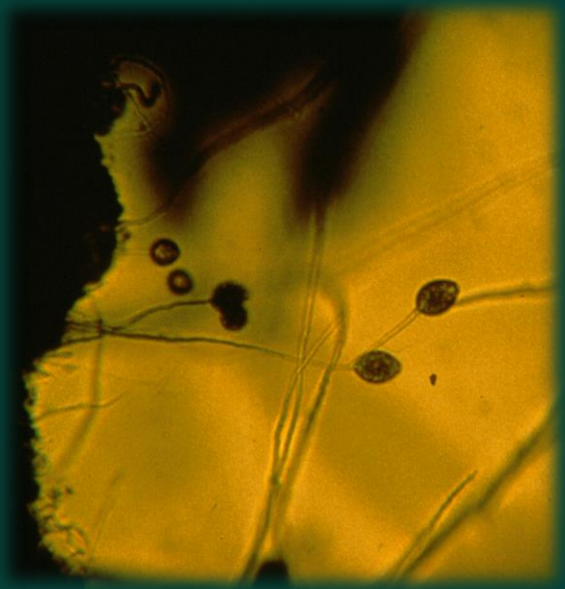
Pythium Root Rot

Poinsettia

Snapdragon

Geranium

Pythium Root Rot



Snapdragon

Choosing Fungicides - *Pythium* Root Rot

Untreated
diseased

Terrazole 35WP
8 oz / 100 gal
14 - day interval

Subdue MAXX EC
1 fl oz / 100 gal
28 - day interval

Choosing Fungicides - *Pythium* Root Rot

Micora SC
8 fl oz / 100 gal
14 - day interval

Adorn 4SC
1 fl oz / 100 gal
14 - day interval

Heritage 50WDG
0.9 oz / 100 gal
28 - day interval

Choosing Fungicides – *Pythium* Root Rot

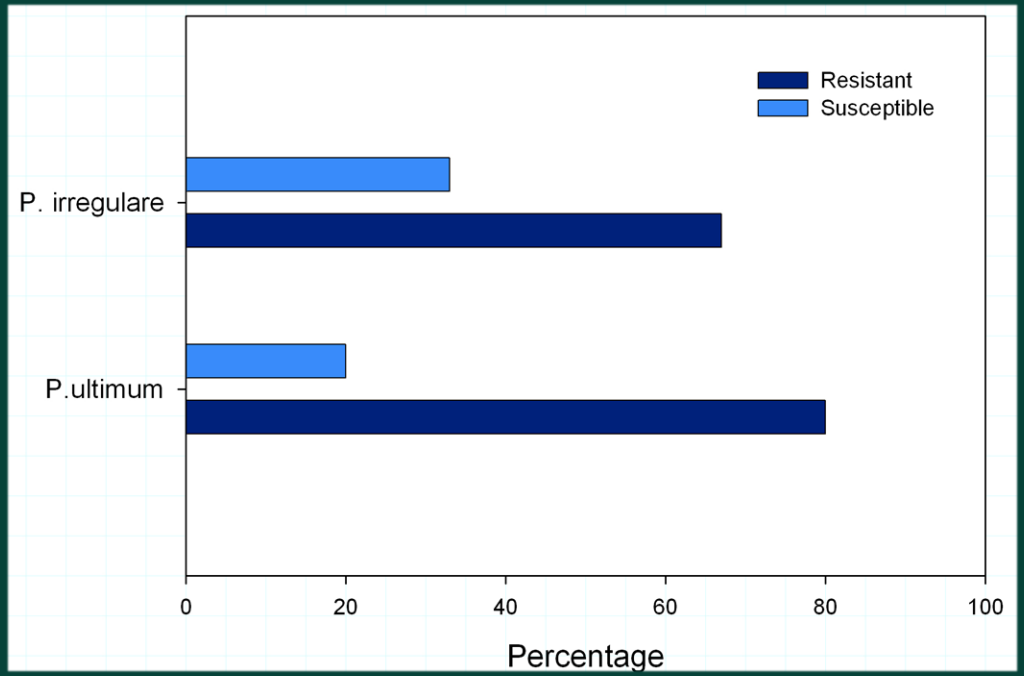
Choosing Fungicides – *Pythium* Root Rot

Pythium 'A' Team
First Line of Defense

- Terrazole L / Truban WP (etridiazole) [FRAC = 14]
- *Subdue MAXX (mefenoxam) [FRAC = 4]
- Banol (propamocarb) [FRAC = 28]

*Watch for pathogen resistance

Mefenoxam sensitivity (2011)
Pythium ultimum and *Pythium irregulare*



Pythium 'B / B-' Team

- Captan (captan) [FRAC = M04]
- Empress (pyraclostrobin) [FRAC = 11]
- FenStop SC (fenamidone) [FRAC = 11]
- Heritage 50WDG (azoxystrobin) [FRAC = 11]
- Segway SC (cycazofamid) [FRAC = 24]
- Alude (phosphorus acid) [FRAC = 33]

Biocontrol Products for *Pythium* Control

- Apply preventively, before problems begin
- Choose the correct product for the problem pathogen
- Use in combination with cultivars that are less susceptible
- Be ready to change course, if needed. When disease pressure is increasing (and too many plants have symptoms or are dying), biocontrol products alone might not be enough
- Use in an overall disease control program to limit root rot pathogens (and other pesky pathogens)

Combining Products - *Pythium* Root Rot

Rootshield

Truban

Truban + Actinovate

Choosing Biocontrols - *Pythium* Root Rot

Untreated

Actinovate

Companion 2-3-2

SoilGard

Pythium Control Tips

- Use proven fungicides and apply as a drench
- Biocontrol drenches can be alternated with fungicides and applied preventively
- Avoid overwatering
- Keep fungus gnats and shore flies out
- Less susceptible cultivars: ‘Nano White Hybrid’ , ‘Bulls Eye Cherry’ geraniums and ‘Twinny White’, ‘Candy Showers Yellow’ snaps

Fusarium Wilt

Coreopsis

Chrysanthemum

Fusarium Wilt

Fusarium Wilt and Management

- *Fusarium* spp., may infect aster, begonia, carnation, chrysanthemum, cyclamen, gerbera, gladiolus, lily, lisianthus, ranunculus and others
- Nutrition may influence: Nitrate preferred over ammonium, Ca, Cl, Si, and micronutrients may be helpful
- Fungicide options limited: Fludioxonil and thiophanate-methyl drenches may suppress disease
- Biological products may suppress the pathogen and slow disease progression

Final Words

- Sanitation and Scouting
  - Start Clean → Finish Clean
  - Inspect incoming plants for root rots
- Cultural Disease Control
  - Keep soil moisture consistent and avoid overwatering
- Diagnostics and Treatment
  - Treat susceptible plants preventively with the most effective products

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Thank you

Questions?