TURF DISEASE DIAGNOSIS AND MANAGEMENT

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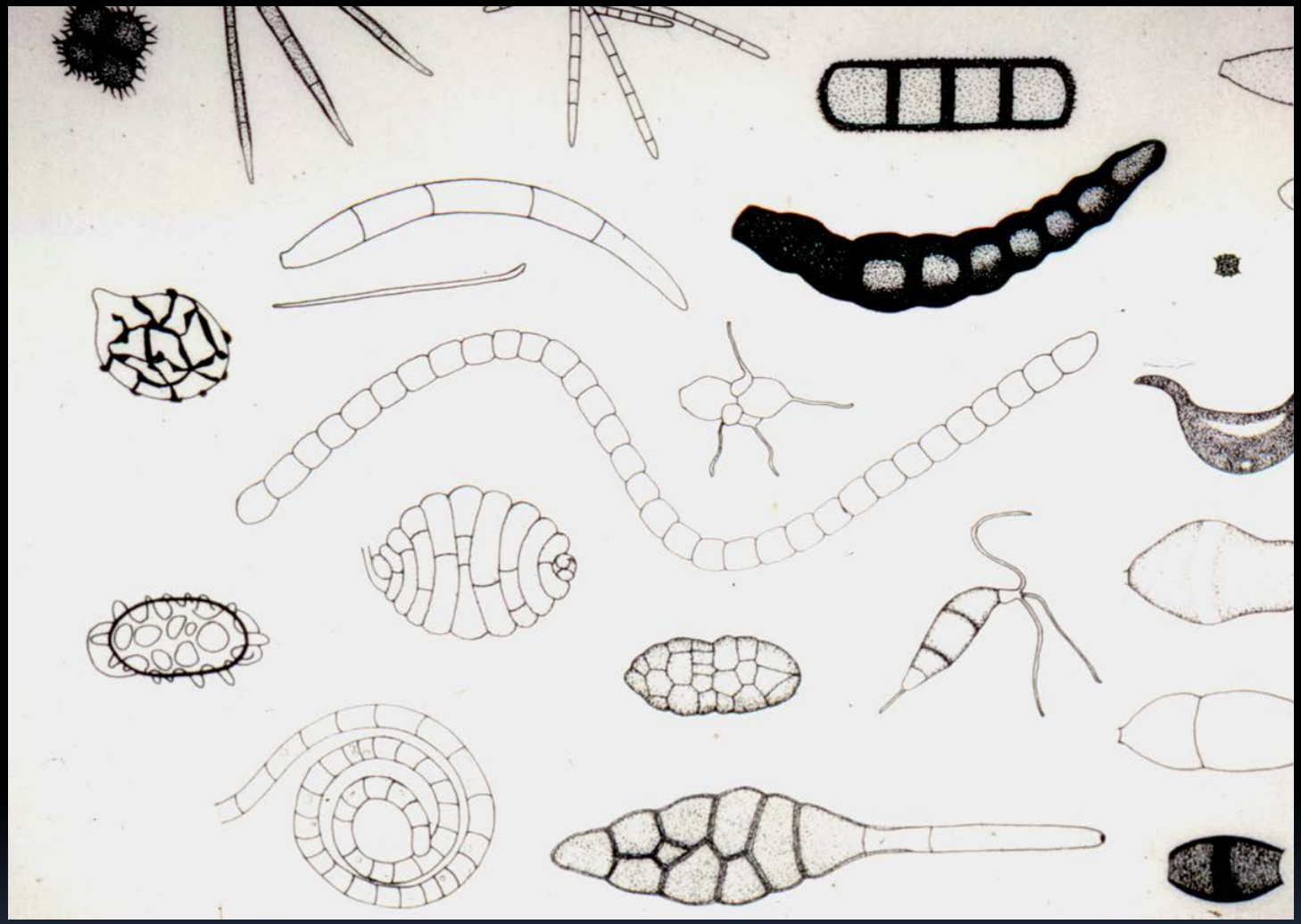
Organisms That Cause of Infectious Diseases of Turf

- Fungi
  - Most common group of pathogens, cause most turf diseases
- Bacteria
  - *Xanthomonas* on golf greens
- Nematodes
  - Common but rarely a problem on residential turf - can be serious on golf greens and sandy soils

Major Groups of Fungi

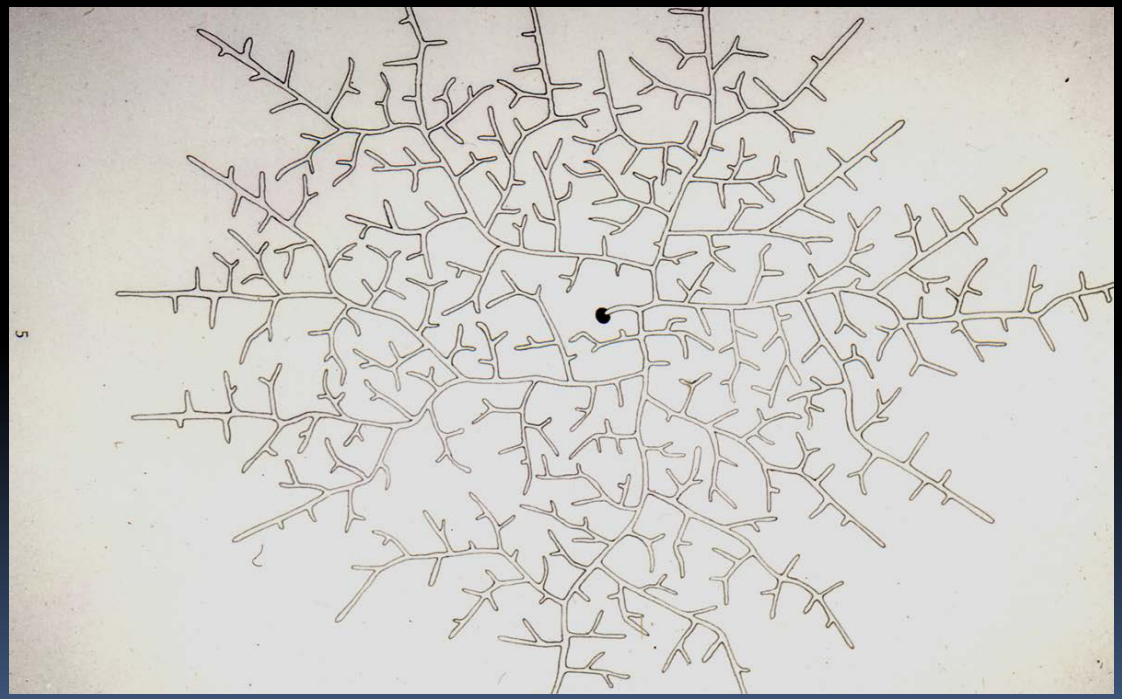
- Oomycetes
  - Not true fungi; *Pythium*
- Ascomycetes
  - Most major turf pathogens
- Basidiomycetes
  - Fairy ring, rusts, smuts, *Typhula* snow mold, red thread, brown patch



Most fungi reproduce by spores. Size, shape, and color of spores can be used to identify fungi.

Fungal Morphology and Growth

Fungi are composed of fine threads called hyphae (mycelium) which repeatedly branch as they grow



Most Fungi are Beneficial

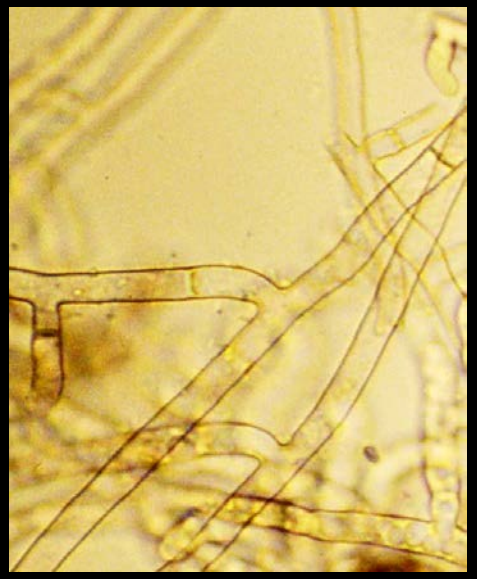
- Fungi break down dead plant material
  - These fungi are called saprophytes
  - Enrich soil with organic matter, release nutrients
- Soil fungi can help reduce activity of plant parasitic fungi
  - Competition
  - Parasitism
  - Production of antimicrobial compounds

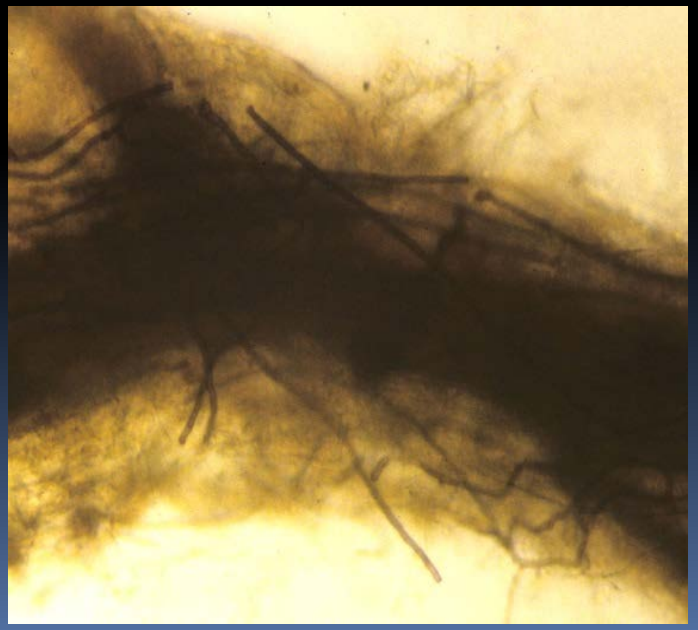
Strobilurus tenacellus

Plant Parasitic Fungi

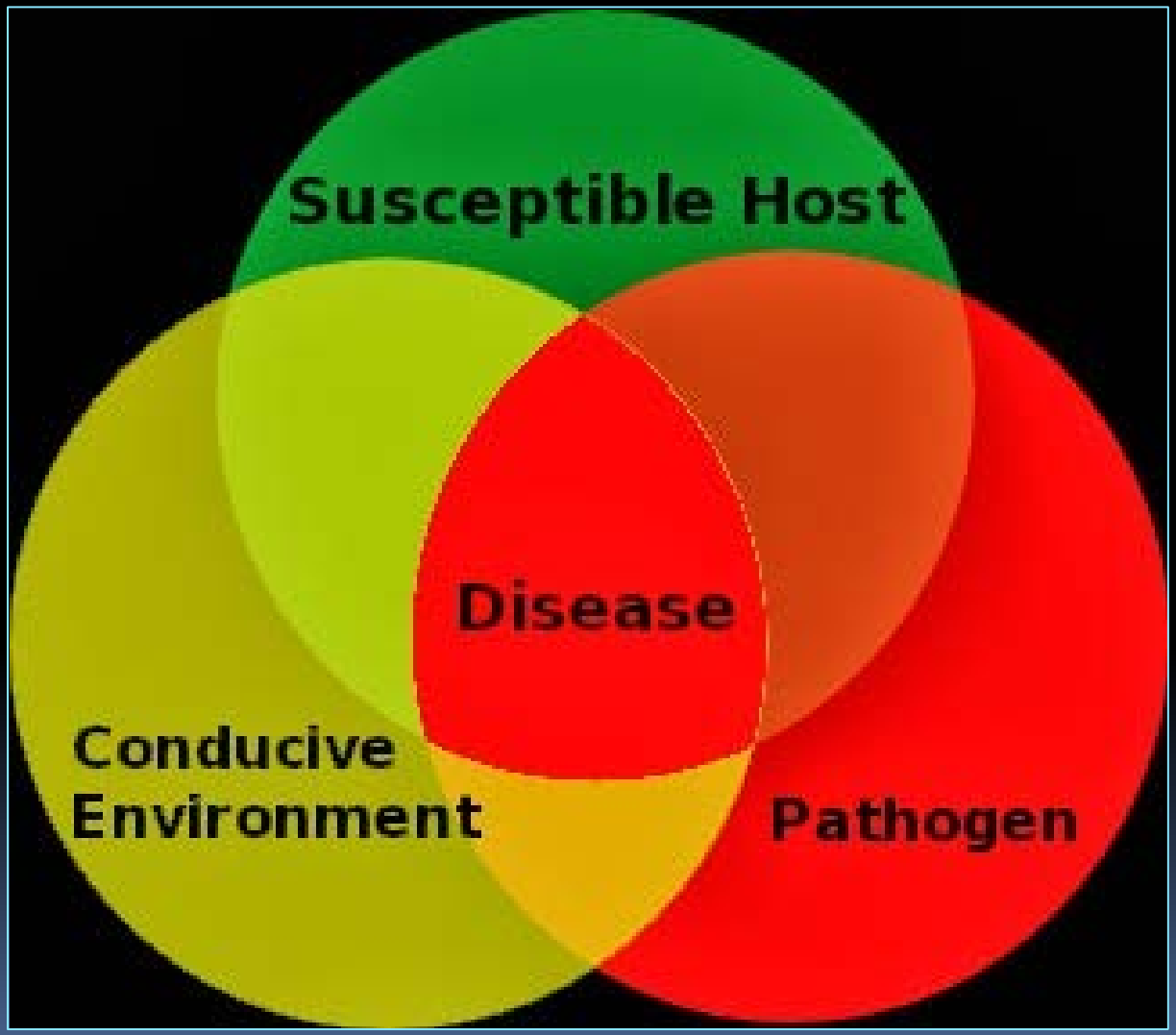
- Able to attack living plants
  - Some are restricted to soil and cause root and crown diseases resulting in patches of dead turf
  - Some only attack leaves, causing leaf spots and blights
  - Spores disperse and infect new plants
  - Fungi survive by producing “resting spores” or structures, or survive in plant tissues as mycelium

Survival of Fungi





The Disease Triangle



Diagnosing Disease

- Diagnosis is based on 3 factors:
  1. Symptoms- reactions of a plant in response to disease (yellowing, wilting)
  2. Signs- the actual pathogen seen on the infected plant (hyphae, fruiting bodies, sclerotia)
  3. Case history- any information relevant to the diagnosis (host species, time of year, environmental conditions, etc.)

Diagnosing Disease- Symptoms

- Symptom= reaction of a plant in response to disease
  - Type of symptoms: leaf spots, wilting, yellowing, browning, rot, etc.
  - Distribution of symptoms:
    - patches, rings, arcs
    - diffuse, irregular
    - patterned or random

Diagnosing Disease- Signs

- Signs- the actual pathogen seen on the infected plant
  - hyphae, fruiting bodies, sclerotia, etc.

Diagnosing Disease- Case History

- Case history- any information relevant to the diagnosis
  - What is the host? Blue, bent, rye, fescue?
  - Is more than one species of grass affected?
  - Prevailing temperature?
  - Rainfall, irrigation, humidity?
  - Fertility level, especially N?
  - Physical conditions: shade, drainage, thatch, traffic?

Abiotic Causes of Diseases

- Heat/ drought stress
- Chemical injury
- Improper fertilization
- Poor soil drainage
- Dog injury
- Mower injury

Integrated Pest Management (IPM) for Turf Care

IPM:

An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological and/or chemical control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

IPM for Turf Care

- Site assessment
- Determine tolerance level
- Regular scouting- determine if treatment is necessary
- Begin with cultural techniques
- Lawns: use pesticides only when cultural controls are insufficient
- Evaluate the results- keep records

Stress is Your Enemy!

Two simple ways to decrease turf stress:

- Increase mowing height
  - 1/10 inch!
  - Green speed can be regained by rolling (up to 3x/week)
- Water deeply and infrequently
  - It can take 2-3 hours to apply 1" of water with the average lawn sprinkler

University of Minnesota

IPM for Turf Care

- #1: Identify the cause of the problem
  - Cultural/Environmental- consider these first
    - Mowing height (3-4" for home lawns)
    - Fertilization
    - Right grass for the right place
    - Soil: compaction, drainage, thatch, pH?
    - Water: too much, too little, wrong time?
    - Light: sun or shade?
  - Disease or insects
    - On lawns, pathogens are often there in small amounts

Understanding Fungicides

Why so many names? The 3 Name System:

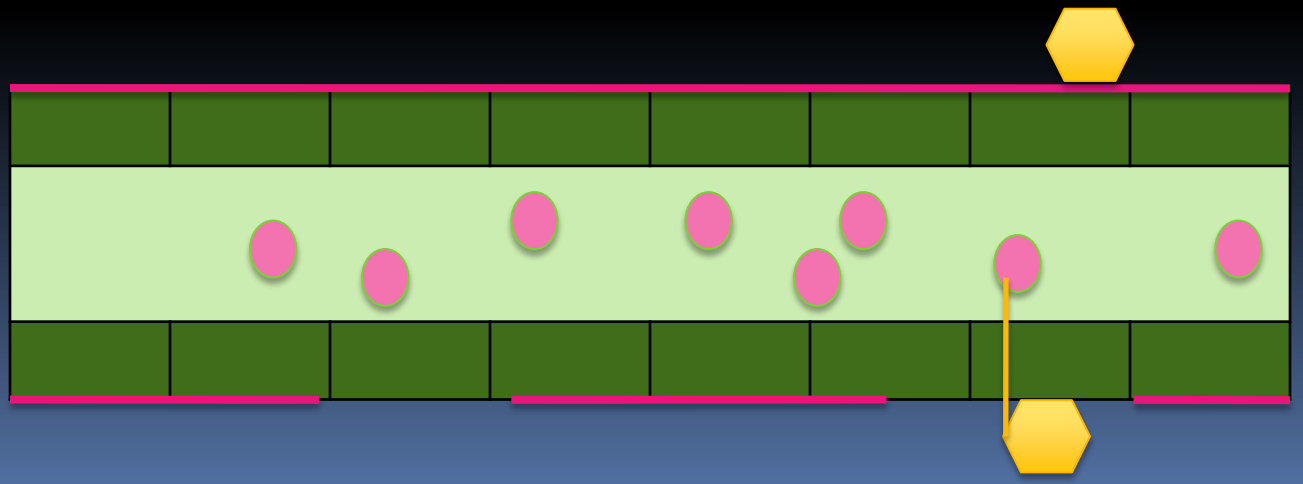
- Chemical name: also known as the active ingredient (a.i.)- describes molecular structure
- Common name: a shortened or "nick name" of the chemical name/ a.i.
- Trade name: the market or brand name of the fungicide

Three name system: example

- Chemical name: 2,4,5,6-tetrachloroisophthalonitrile
- Common name: chlorothalonil
- Trade name(s): Daconil, Echo, Manicure, Chlorostar, Concorde SST, Pegasus L

Protectants vs. Systemics

- Protectant: provides a protective coating on the surface of the plant: also known as a contact
- Systemic: penetrates to various degrees into plant tissues



Protectant Fungicides

- Advantages
  - Resistance development less likely
  - Most have broad- spectrum activity
- Disadvantages
  - Must be applied before infection occurs
  - No redistribution into new tissue as turf grows
  - Thorough coverage is very important
  - Tend to be ineffective against root diseases

  - Examples: chlorothalonil, etridiazole, mancozeb, Thiram, copper

Protectants vs. Systemics

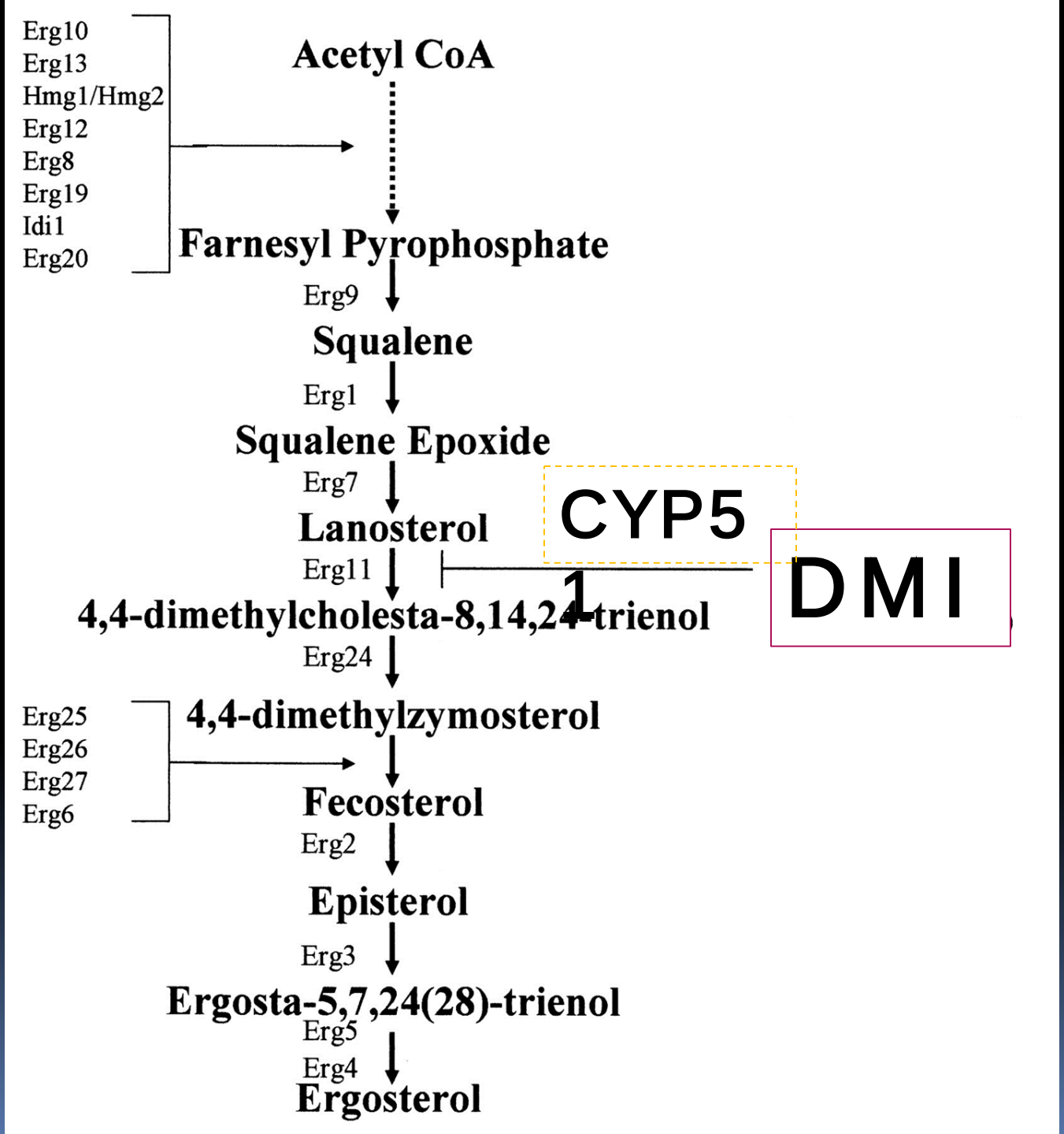
- Movement of systemics within plant tissue
  - Local systemic: penetrates leaves but does not move further
    - boscalid, dimethomorph, iprodione
  - Xylem mobile or acropetal: moves upward in the plant through the xylem
    - propomacarb, flutolanil, tebuconazole
  - Amphimobile or true systemic: moves upward in xylem and downward in phloem
    - fosetyl- Al, phosphorus acid

Systemic Fungicides

- Advantages
  - Redistribute as plant grows (except locals)
  - Coverage less critical than for protectants
  - Will not be removed by rain once they are inside tissues
  - Some also have protectant activity
- Disadvantages
  - Resistance development more common
  - May have a narrow spectrum of activity

Understanding Fungicide Groups

- All fungicides in a group/class have the same mode of action (MOA)
  - for example, DMIs interfere with a specific biochemical pathway (ergosterol synthesis)
- Fungicides in a group will have different names even though they have the same MOA
- Fungicides in a group may behave differently in other ways


Erg10
Erg13
Hmg1/Hmg2
Erg12
Erg8
Erg19
Idi1
Erg20
Acetyl CoA
Farnesyl Pyrophosphate
Erg9
Squalene
Erg1
Squalene Epoxide
Erg7
Lanosterol
Erg11
CYP51
DMI
4,4-dimethylcholesta-8,14,24-trienol
Erg24
Erg25
Erg26
Erg27
Erg6
4,4-dimethylzymosterol
Fecosterol
Erg2
Episterol
Erg3
Ergosta-5,7,24(28)-trienol
Erg5
Erg4
Ergosterol

Understanding Fungicide Groups

- Single site vs. multi-site MOA
- For “high risk” fungicides, rotation with fungicides from a different group is important
- FRAC resistance group number on label indicates similar MOA and risk of cross-resistance

GROUP M5 | 11 FUNGICIDE

PULL HERE TO OPEN

Renown™

Fungicide

syngenta®

Fungicide

For control of turf diseases

Active Ingredient:

Chlorothalonil (tetrachloroisophthalonitrile)*	45.0%
Azoxystrobin: methyl (E)-2-{2-[6-(2-cyanophenoxy) pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate**	3.0%
Other Ingredients:	52.0%
Total:	**100.0%**

Combinations of Fungicides

- Many products available with ≥2 a.i.s
- Active ingredients with different MOAs
- Systemic + protectant helps head off development of resistance to the systemic
- Combinations generally have a wider spectrum of activity
- You can tank mix your own combination of fungicides providing they are compatible

Common Turf Fungicide Groups

- QoI or Strobilurins
  - Inhibit cellular respiration
  - Effective for most true fungi except dollar spot
  - Resistance risk is high
  - Heritage, Disarm, Insignia, Compass
- SDHI (Emerald, Prostar, Velista, Xzemplar)
  - Inhibit cellular respiration
  - Boscalid (Emerald)- specific for dollar spot
  - Flutolanil- mainly for Basidiomycetes
  - Resistance risk is moderate
  - Heritage, Disarm, Insignia, Compass

Some Common Fungicide Groups Used on Turf

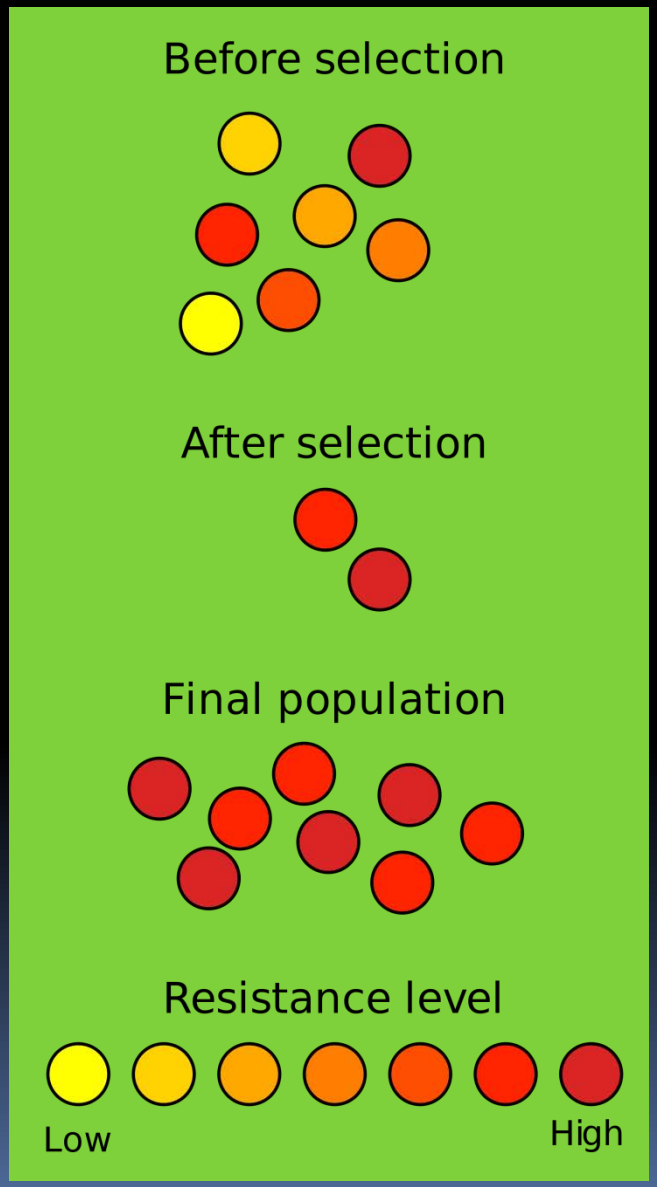
- DMI or SI
  - Inhibit sterol production
  - Effective against most true fungi
  - Resistance risk is high
  - Tourney, Eagle, Trinity, Torque, Bayleton
- Dicarboximides
  - Interfere with signal transduction
  - Effective against some Ascomycetes, also Rhizoctonia
  - Resistance risk is high
  - Chipco, Curalan, Touché, Vorlan

Fungicide Resistance Development

- A problem with systemic fungicides with single-site mode of action
- Protectants usually have a low risk
- Cross-resistance occurs with active ingredients in the same fungicide group
- May develop gradually or suddenly
- Resistance may be persistent or disappear when the fungus is no longer exposed to the chemical

How Resistance Develops

- Single site mode of action= the fungicide targets a specific biochemical pathway
- Some strains may possess alternative pathway
- Sensitive strains are controlled by the fungicide, and the insensitive fungi take over.



Managing Fungicide Resistance

- Know your active ingredients and fungicide groups; rotate with appropriate materials
- Choose fungicides with a low risk
- Do not repeat applications of high risk fungicides
- Mix high risk fungicides with low- risk fungicides, or other chemical groups
- http://ag.umass.edu/turf/professional-turf- ipm- guide

Non-Target Effects of Fungicides

- Earthworms are affected by: Daconil, Koban, Mancozeb, PCNB, and Spotrete
- Increase thatch: 26GT, Fore, Manzate, Dithane, Spotrete
- Aquatic environments, ground water contamination

Why Fungicides Fail

- Incorrect diagnosis
- Inappropriate selection of fungicide
- Fungicide more than 2 years old
- Rate incorrect or sprayer not calibrated
- Foliar application lost to irrigation or rain
- Insufficient coverage (protectants)
- Soil application not watered in sufficiently
- Fungus is resistant to the fungicide

Alternative Practices

- Top dressing with compost
- Over- seeding with a slice seeder
- Control thatch and compaction!
- Prune trees and shrubs to improve air circulation and light penetration
- Planning: improve site conditions, cultivar selection
- Renovation
- Follow label directions

Some New(ish) Products

Biorational and Conventional

Biorationals: Potassium Bicarbonate

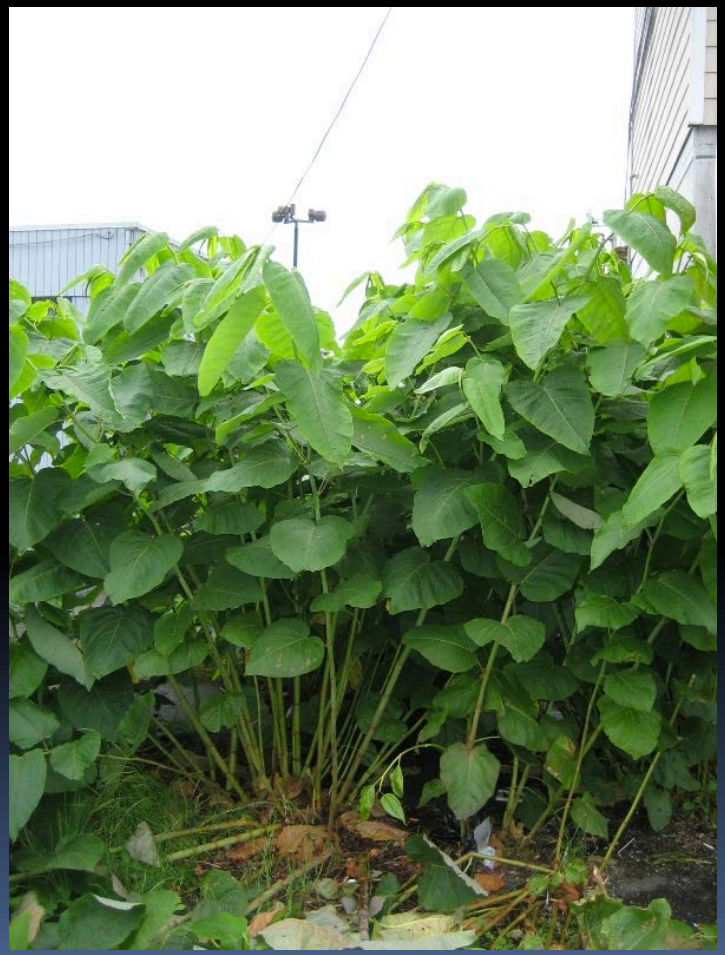
- GreenCure, Kaligreen, Armicarb
- Broad-spectrum activity
- Anthracnose, dollar spot, leaf spots

Biorationals: Phosphonates (Phosphorus Acid)

- Controls Oomycetes diseases such as *Pythium*
- Does not provide phosphorus as a nutrient

Biorationals: Plant Extracts

- Regalia PTO
  - Extract of *Reynoutria* (Giant Knotweed)
  - Stimulates plants' natural defense system
  - Labeled for dollar spot, anthracnose, brown patch, red thread, leaf spots, *Pythium*



Biorationals

- Caveats:
  - Timing critical. If not applied preventively, they offer little or no control
  - Mode of action is primarily protective
  - Must be applied thoroughly and frequently

Conventional Products

- Secure
  - Fluazinam (arylaminopyridine)
  - $ spot, brown patch, anthracnose, snow molds
- Xzemplar (BASF)
  - Fluxapyroxad (SDHI)
  - $ spot, brown patch, summer patch, snow molds
- Velista (Syngenta)
  - Penthiopyrad (SDHI)
  - $ spot, brown patch, anthracnose, etc.
    - FIFRA Section 2(ee) for summer patch, brown ring patch, fairy ring, spring dead spot etc. Valid thru 2019

Nematode Control

- MultiGuard Protect
  - Furfural (2-furancarboxaldehyde)
  - Some success for stunt nematode control in the the northeast
  - Phytotoxic at higher concentrations/ high temps
  - Soil half-life is 1-2 days
- Nimitz
  - Fluensulfone- new chemical class
  - Available by March 2016

Diseases

Gray Snow Mold *Typhula incarnata*

- Develops under snow cover, 30-40°F
- All grasses susceptible; KBG, colonial bentgrass most tolerant
- Patches 1-3' diameter
- 90 days or more of snow cover increases severity
- High fall nitrogen applications increase severity
- Grass will recover quickly as growth resumes in spring
- Signs: gray, lint-like mycelium and sclerotia

Gray snow mold (Typhula blight) on a mixture of lawn grasses


spring-green.com

Sclerotia of *Typhula incarnata*

Pink Snow Mold *Microdochium nivale*

- Also known as Fusarium patch or Microdochium patch
- Patches up to 8” diameter
- Active at 33 - 60℉
- Pinkish tint from mycelium and spores
- Encouraged by cool wet weather and excessive nitrogen
- All grasses susceptible; KBG and fine fescues are more tolerant

Pink snow mold; 3 to 8” patches often wet or “greasy” in appearance, may have a pink cast, especially in spring.

Managing Snow Molds

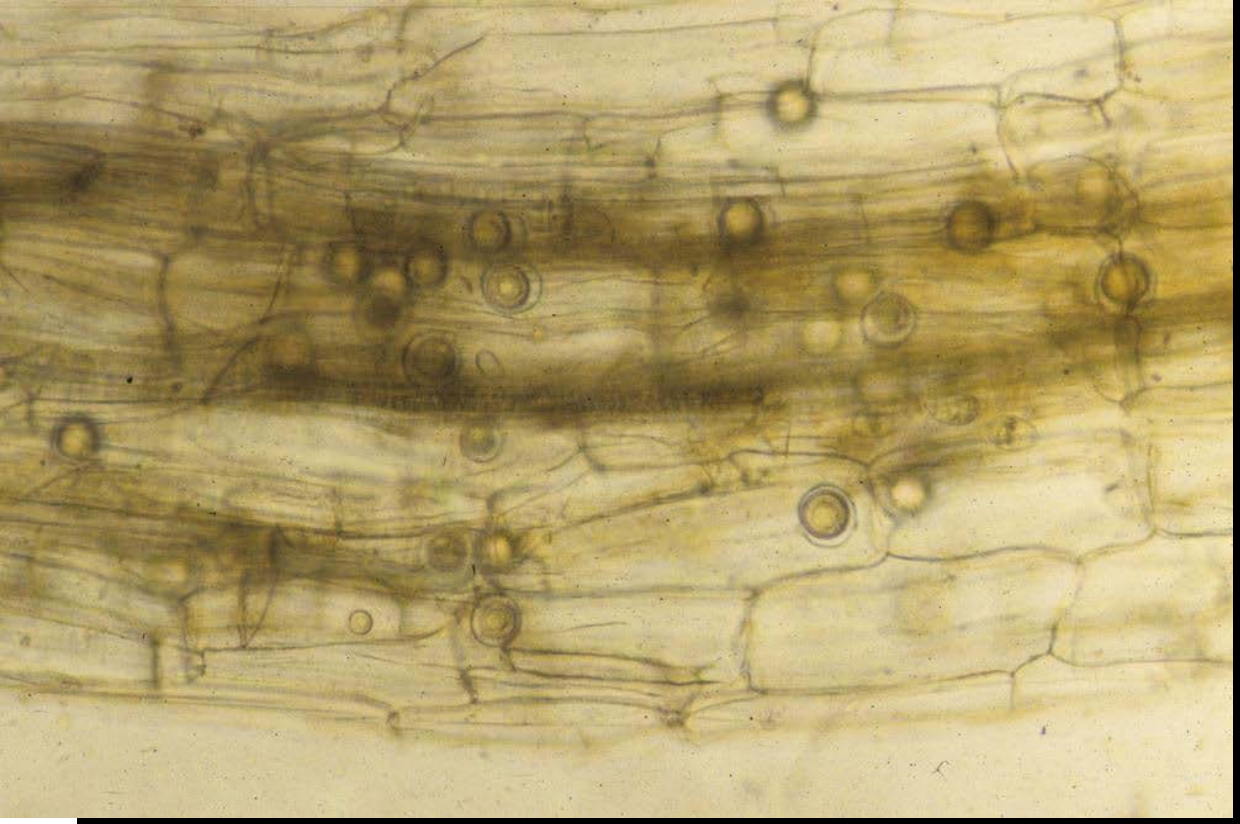
- Do not apply excessive nitrogen in the fall. Make last application six weeks before dormancy and consider slow release forms.
- Continue to mow the grass in the fall until it stops growth
- Avoid excessive thatch and compaction by snowmobiles, skis etc.
- Prevent the formation of large snowdrifts by snow fences or windbreak plantings

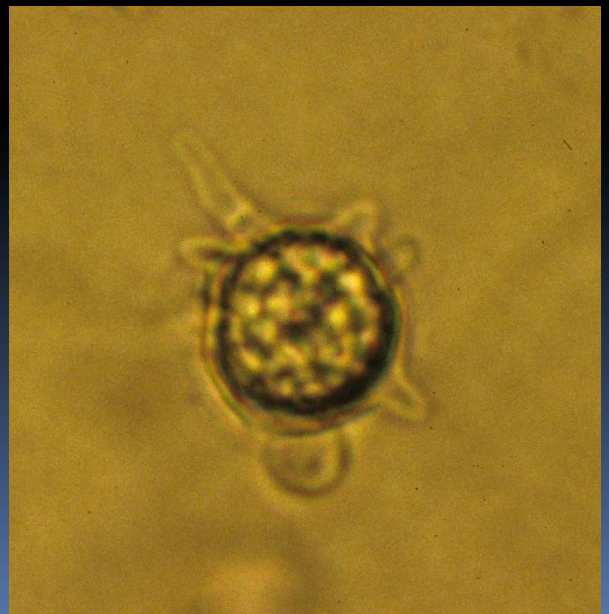
Management of Snow Molds

- Promote rapid drying and warming of disease prone areas in the spring
  - removing snow
  - improve drainage
  - Improve sun exposure and air circulation
- Promote new growth in spring by light fertilization
- Plant new seed if regrowth does not occur
- Fungicides are useful as preventive measures when applied in the autumn, but cannot cure turf when applied in late- winter or spring

Pythium Root Rot

- Several species of *Pythium* infect grass roots
- May occur in cool or warm weather
- Grass will be weak, off color and decline
- Laboratory examination is necessary to confirm
- Control:
  - Drainage, drainage, drainage
  - Unique fungicides are necessary for control





Pythium oospores

Cool Weather Pythium

- Caused by species of *Pythium* that grow well at relatively low temperatures
- Usually affects roots and crown
- Apply fungicides specific for Oomycetes such as propamocarb, ethazole, fosetyl- Al, phosphonates, or mefenoxam
- Recovery will not be quick

Pythium Blight

- Also known as greasy spot, caused by *Pythium* sp. that grow well in hot weather
- Primarily a disease of the foliage; wide host range
- Occurs during hot, humid weather > 90°F
- Begins as discrete patches but quickly coalesces into large areas of blighted turf
- Easily spread by moving water and lawn machinery

Pythium blight on ryegrass

Pythium mycelium visible during wet periods, usually in the morning

Control of Pythium Blight

- Keep nitrogen at a minimum during mid summer
- Improve drainage, reduce thatch
- Avoid mowing turf when wet; never mow wet turf when *Pythium* is present
- Apply fungicides if necessary
  - Root disease: water lightly after application of fungicide sprays
  - Phosphonates will move into plant roots

Dollar Spot
Sclerotinia homeocarpa

- Most common during early and late summer
- Bentgrass, annual bluegrass and fine fescue can be severely affected
- Low nitrogen promotes disease
- Long periods of leaf wetness also promote disease

Apsnet.org

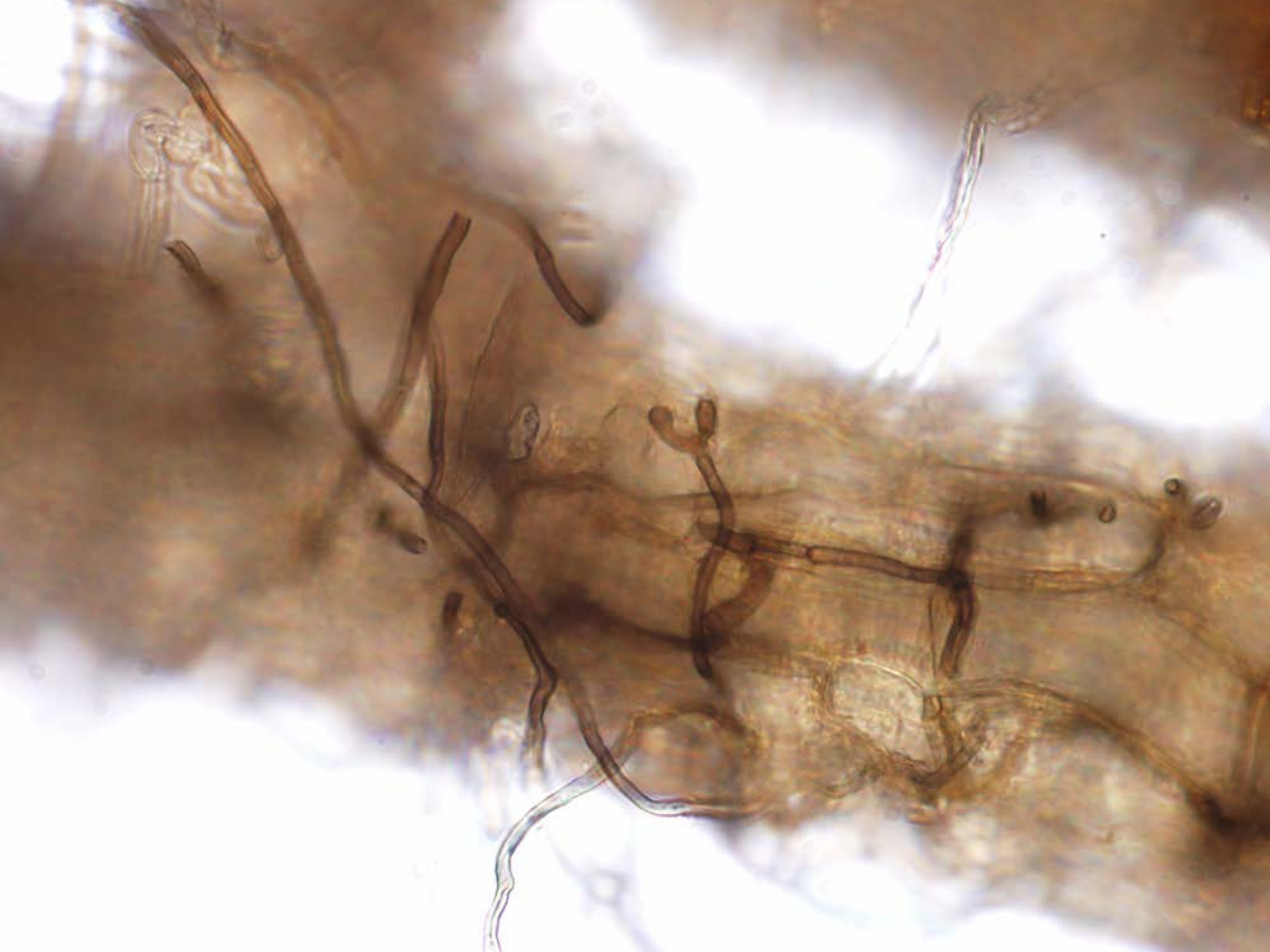
J. Popko

Management of Dollar Spot

- Apply adequate nitrogen
- Avoid water stress
- Time irrigation to avoid prolonged leaf wetness
- Remove dew and guttation fluid from grass
- Some cultivars are more tolerant of dollar spot
- Apply appropriate fungicides if necessary

Summer Patch
Magnaporthe poae

- Primarily a root disease of Kentucky bluegrass; fine fescues and annual bluegrass also hosts
- Infection begins in May; symptoms develop during the heat of summer
- More common on sod 3 to 4 years old, or about 4 years after seeding
- Excess thatch, fertility stress, drought, and compaction favor disease



Managing Summer Patch

- Reduce thatch and compaction
- Raise mowing height
- Apply balanced fertilizer based on soil test; slow release nitrogen is preferred
- Prevent prolonged drought
- Overseed with perennial ryegrass, bentgrass, or resistant bluegrass

Red Thread
Laetisaria fuciformis

- Occurs in cool wet weather of spring and fall
- Wide host range but perennial ryegrass and fine fescues are more severely affected
- Crabgrass and white clover may move into blighted areas
- Encouraged by low nitrogen, water stress and periods of prolonged leaf wetness

Red thread results in a “ratty” uneven growth

Managing Red Thread

- Apply a balanced fertilizer
- Avoid drought, water when grass will dry quickly
- Mow turf, collect clippings
- Maintain pH at 6.5 to 7
- Fungicides are effective but not usually necessary


Rust


Leaf
Smut


Powdery
Mildew

Management of Smut, Rust & Powdery Mildew

- Collect clippings and dispose of them off site
- Low N promotes rust; high N promotes smut and PM
- Reduce shade and leaf wetness duration
- Overseed with resistant cultivars
- Fungicides are generally not needed, but systemics (sterol inhibitors, i.e. propiconazole) would be the best choice

Resources

- Compendium of Turfgrass Diseases
- Practical Guide to Turfgrass Fungicides
  - http://www.apsnet.org/apsstore/shopapspress
  - APS Press 1.800.328.7560
- UMass Turf: http://www.umassturf.org/
  - http://ag.umass.edu/turf/professional-turf-ipm-guide
- Google search engine; look for publications from “edu sites”
- Use the UMass Diagnostic Lab!

How to Take and Send a Sample

- Cut out a slab of turf, 6x6”, include 2-3” of soil
- Include healthy and diseased turf
- Wrap sample to prevent soil from getting on the grass
- http://ag.umass.edu/diagnostics

- Submission form- include relevant case history information
- Send overnight mail; avoid Fridays

Thank you!