Common Plant Diseases in the Landscape and Garden

Grand Forks Gardening
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Common Plant Diseases and Pests

- What is plant disease?
- Late Blight of tomato and potato
- Other Common Diseases of Vegetables and Ornamentals
- Snow mold on lawns
What is Plant Disease?

- Any disturbance that interferes with normal growth, development, function, economic value, or aesthetic quality of a plant. (slightly modified from Schumann)

- Plant Disease can be caused by two general groups of causal agents
  - Biotic (pathogens)
  - Abiotic
Abiotic vs. Biotic Plant Diseases

**Abiotic**
- Non-living factors
  - Temperature
  - Moisture
  - Nutrition
  - Toxicity
  - Cultural

**Biotic**
- Living factors
  - Fungi
  - Bacteria
  - Viruses, viroids
  - Nematodes
  - Others
The Disease Triangle

- Susceptible Host
- Virulent Pathogen
- Conducive Environment

Disease
Tomato Diseases
Late Blight
Early Blight
Septoria leaf spot
Late Blight

Caused by Phytophthora infestans
Potato field infected with late blight approximately one week after the symptoms were first observed
Late Blight on Tomato Fruit
Survival of the late blight pathogen

0 Only survives in living host tissues
0 When the host dies, the late blight pathogen dies

0 How does it survive from one season to another?
  0 In seed tubers, over-wintering volunteers, cull piles
    0 Seed probably most important
    0 Difficult to see; seed not washed
    0 Late blight spreads during seed cutting
Late Blight Sources

- Infected Potato, Tomato, Petunia, Hairy nightshade
  - Family: Solanaceae

- Home gardens can be source of infective propagules that threaten other small and large plantings

- In some parts of the world, the pathogen can survive outside of the host as oospores – special structures that survive in soil for long periods of time
  - in Europe, Mexico
  - Not in US or Canada (at least, not that we know of!)
Hairy nightshade with late blight (E. Banks, 2009)
How the Pathogen Spreads

- The late blight pathogen produces spores (infective propagules) during cool, wet weather
  - Spores are microscopic and lemon-shaped
- Moved by wind, especially during thunderstorms
- Requires 12 hrs leaf wetness to infect (dew, mist, fog, rain)
- 5-7 days from infection to symptoms and production of new spores
- Fragile, killed by hot dry weather and UV
- Many cycles of spore production
- Spores can fall to soil and produce swimming zoospores that infect tubers
Late blight history in US (and probably Canada)

- Sporadic since 1840s
- 1992 introduction of new strains from Mexico
- In 1995, a more aggressive strain was identified
  - causes more tuber rot, can tolerate higher temperatures
- Even more new strains identified in 2009 and 2010
- The pathogen is extremely variable
What happened in 2009?

- Huge epidemic of late blight in eastern US
- Source was late-blight infested tomatoes that were distributed to big box retail stores
- Weather was conducive
- Late blight spread rapidly in eastern US
  - Both tomatoes and potatoes hit hard
  - Home gardens and organic growers
  - Later spread to the Midwest
What happened in our area in 2009?

- Localized outbreaks of late blight in ND, SD, MB
  - First significant late blight infestations in five years
  - Found in mid August
  - In ND, limited to one or two counties in processing potatoes and garden tomatoes
  - Found in irrigated fields with volunteers (unusual for ND); may have been present in 2008 and not reported
What happened in our area in 2010?

- Late blight was found **EARLY**
  - Found on tomatoes in retail stores in Manitoba in early June; Winnipeg and Brandon
  - Reported in southern MI June 23
  - Detected in ND potato field **June 24; earliest found since 1994**
  - Reported in MB potato fields June 30
  - Reported in WI potato fields mid-July
  - Detected in one potato field in extreme NW MN July 21
  - Became widespread in eastern ND and southern MB

- New strains were identified

- **Why did we have so much late blight in 2010?**
Get Ready Early for Late Blight

- In 2011 late blight will likely be present
  - Infective propagules have built up over the past few years and have probably survived over the winter in living hosts (weeds, tubers, potato cull piles, gardens)
  - Tuber infections were found at harvest and in storage
  - Some of the newer strains appear to be more aggressive
  - The disease was found in potato seed tuber production areas in MT, ND, WI, MB, SK, AB
- So, get ready for late blight in 2011
- Manage late blight before, during, and after the season
Managing Late Blight

- Eliminate initial inoculum
  - No cull piles
  - No volunteers
  - Use certified disease-free tuber seed, but also check the tubers for symptoms before planting
  - Purchase tomato seedlings from reputable local growers; and do not purchase any that appear unhealthy
  - Consider starting your favorite tomato varieties from seed
Managing Late Blight

- Keep foliage as dry as possible
  - Improve air flow by not planting too densely
  - Stake plants
  - Use mulch
Managing Late Blight

- Monitor gardens early and often for late blight
- Remove and destroy infected plants as soon as they are observed during the growing season
  - Seal in plastic bags before discarding in trash, or
  - Burn the debris right away
- Clean up the garden at the end of the season – remove all host plant parts and destroy
- Do not compost late-blight infested plant material
Fungicides for Late Blight

- Protect healthy plants – apply fungicides on a regular basis if late blight is in the area
- Chlorothalonil (such as Bravo or Ortho® Max Garden Disease Control)
- Copper-based fungicides (such as Bordeaux mixture)
  - Some are approved for use in organic production
- Every 5-7 days during cool, wet weather
- Must be applied before symptoms are observed or as soon after as possible (these are not curative)
- Not all fungicides have activity against the late blight pathogen
- Use only fungicides labeled for late blight control on edible crops
What About Using Resistant varieties?

- Some resistant tomato varieties are listed in seed catalogs – these may provide some degree of resistance or tolerance, but may not be reliable (too many strains of the pathogen)
- No commercial potato cultivars with good resistance are available
- We can’t depend solely on resistance for control – the late blight pathogen is too variable
Early Blight

Caused by *Alternia alternata*
Early Blight

- Early blight (*Alternaria*) symptoms on tomato leaf
- Note bullseye pattern of concentric rings – characteristic of early blight
- While early blight is a damaging tomato disease, it is not as devastating as late blight
- Control of early blight on tomatoes is essentially the same as for late blight
Septoria leaf spot
Septoria Leaf Spot

- Typically has small "shot" size necrotic areas
- Not nearly as destructive as late blight
- Controls are the same as for early and late blight
Other Common Ornamental and Vegetable Plant Diseases
• Downy mildew diseases
• Powdery mildew diseases
• Rust diseases
• Grey mold
• White mold
• Root rots
Downy Mildew of Grape

Caused by *Plasmopora viticola*
Downy Mildew – A (little) History

P.M.A. Millardet (a French botanist) first used **Bordeaux mixture** (copper sulfate and lime) to control downy mildew in the vineyards of France.

- He noticed that a copper sulphate-lime powder mixture that was sprinkled on grapevines along highways to prevent stealing of the grapes *also* controlled downy mildew.

- This observation led to the discovery and development of **Bordeaux mixture**.
Downy Mildew – Symptoms

Early symptoms: Initially, leaf spots are pale yellow on upper surface.

Note the white and downy growth mainly on the undersides of leaves.
Downy Mildew – Symptoms

Late symptoms

As lesions age, they become a mosaic of yellow, red, and brown angular spots on the upper leaf surface.
Downy Mildew – Symptoms

Off-color, diseased fruit shrivel and become covered with white or cream-colored, downy fungal growth.

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Downy Mildew Disease Cycle

- A sporangium is produced from the oospore in spring.
- Zoospores are released from the sporangium and disperse by wind or rain splash.
- Zoospores encyst near stomata and the germ tube penetrates.
- Zoospore differentiates in sporangium.
- Oospores are released from decaying leaves on the vineyard floor.
- Cross-section of leaf tissue with oospores.
- Antheridium and oogonia are formed and fertilized in the leaf.
- Sporangia are produced on the berries and the undersides of leaves through stomates.
- "Dilspot" lesion develops on top of leaves.
- Leaf infection
- Fruit infections
- Haustoria
Downy Mildew – Management

- Promote well-drained soils, reduce overwintering infective structures (oospores in fallen leaves, hyphae in buds), prune out infected shoots
- Avoid overhead irrigation or practices that maintain wet foliage for extended periods of time

Fungicides:

- In the same group of ‘water mold’ organisms as the late blight pathogen – so chlorothalonil and copper-based products are effective – apply before disease becomes established
- Applications generally begin before budbreak or at ½-inch shoot length or before bloom (depending on the fungicide)
Downy Mildew of Cucurbits
Caused by *Pseudoperonospora cubensis*
Powdery Mildew Diseases

Caused by a related group of host-specific fungi
Each powdery mildew fungus has a narrow host range.

Main hosts in North Dakota: lilacs, peas, roses, and cucurbits.

Note: lilac powdery mildew doesn’t infect rose, and so on.

Lilac powdery mildew
Nannyberry Powdery Mildew
Rose Powdery Mildew
Powdery Mildew Diseases

Brown to black, nearly spherical survival structures of the fungus (cleistothecia)
Powdery Mildew Diseases

Favorable conditions and symptoms:

- Cool, dry periods after prolonged leaf wetness
- High relative humidity
- Free moisture not required for infection (unlike most other plant pathogens)
- White or grayish powdery growth on leaves, stems, or fruit
- Extreme symptoms = dwarfing, distortion, chlorosis, premature leaf drop, blemishes on fruit
Powdery Mildews – Management

- Increase air circulation – proper plant spacing, pruning
- Plant areas with at least 6 hours full sun
- Plant in well-drained soil
- Avoid water splashing (sprinklers) – water from the bottom, use soaker hoses
- Host resistance is reportedly available
- Purchase plants that look healthy (disease-free)
- At normal pruning time, remove and destroy diseased terminals of woody plants (lilacs, roses)
- Rake up and destroy fallen leaves
Powdery Mildews – Management

- Fungicides are available
  - Chlorothalonil – for garden vegetables like cucurbits
  - Sulfur-based compounds such as Safer® Brand Garden Fungicide – labeled for some ornamentals and edibles
  - Tebuconazole such as Bayer Advanced Disease Control for Roses, Flowers, and Shrubs – DO NOT USE ON EDIBLE CROPS
Rust Diseases

Caused by a related group of host-specific fungi
Rusts on ornamentals

- May require 2 hosts
- Very specialized pathogen
- Typical symptom
  - orange pustules: powdery masses of yellow, orange, purple, black, or brown spores
  - usually on leaf underside.
- Swellings and galls
- Favored by temperate conditions that also favor host
Common Rust Diseases

- Aster
- Achillea
- Chrysanthemum
- Sunflowers
- Liatris
- Snapdragons
- Poplar
- Ash
- Dry Beans
- Apple/Crabapple
- Lilies
- Irises
- Rosaceae
- Grasses
- Others
Some Rust Pathogens Require Two Different Hosts

- Cedar apple rust
  - Main host: apple and crabapple
  - Alternate host: juniper and cedar
Rusts that require 2 hosts

- Cedar apple rust
  - Cedar/junipers and apple/crabapples
- Wheat stem rust
  - Barberry and wheat
- Ash rust
  - Cordgrass and ash
- Oat crown rust
  - Buckthorn and oat
Cedar Apple Rust
Ash Rust

Upperside of leaf

Underside of leaf
Rust on Buckthorn (oat crown rust)
Rusts that require only 1 host

- Some of the rose rusts
- Dry bean rust
- Pea rust
- Sunflower rust
Managing Rust Diseases on Ornamentals

- Protectant fungicides: 1 to several applications before bloom or bud break
  - Usually only if a chronic problem
- Eradication of alternate host
  - Not always practical
- Separate susceptible junipers and rosaceous hosts in nurseries, landscapes
- Prune out rust galls
- Prune out infections
- Use genetic resistance
  - Junipers
  - Other plant species
- Avoid overhead irrigation
Grey Mold

Caused by *Botrytis* sp.
Grey Mold

- Leaf and petal spots - flecks to completely blighted tissue
- Fuzzy, gray lesions
- Possible zonate pattern
- May result in brown, mushy tissue
- Favored by cooler temperatures, moisture, and weakened plant tissue
Gray mold fruit rot on raspberry.
Grey Mold – Management

- Prevent introduction
- Manage leaf wetness, maintain or create adequate air circulation
- Sanitation
  - Prune out and destroy diseased, decaying, or dead plant material
- Remove and destroy plant tops in fall
- Apply fungicides in spring
White Mold
Caused by *Sclerotinia sclerotiorum*
White Mold on Various Hosts

Wide host range
Favored by moist conditions
White Mold on Carrot
White Mold - Management

0 Prevention.
   0 Increase aeration between plants (decrease RH)
   0 Avoid overhead irrigation
   0 Irrigate in morning rather than evening to allow foliage to dry out

0 Prevent build up of sclerotia, which can survive in soil for many years
   0 Remove and destroy infected plants (don’t compost)
   0 Deep plowing
      0 only sclerotia in top 2 - 3 inches of soil germinate

0 Fungicide soil drenches, if perpetual problem

0 Protectant foliar-applied fungicide
Root Rots
Caused by various soilborne pathogens
Root Rot

- Caused by soil-borne pathogens that attack roots
- Roots may be discolored internally or externally
- Symptoms may include wilting, stunting, yellowing
Root Rot on Petunia due to Rhizoctonia

RK Jones NCSU, Bugwood.org
Root rot on bedding plants
0 Symptoms vary, depending on the pathogen
0 Some root rot diseases cause a light brown discoloration on roots
    0 Roots may be mushy or not
0 Others cause distinct, dark reddish-brown lesions on roots
Root Rot Management

0 Prevention:
  0 Select and plant healthy material
  0 Plant in well drained soils
  0 Don’t over water
  0 “Hill up” infected plants to promote adventitious root production above rotted area
Virus Diseases
Geranium Viruses

Yellow net vein virus

Impatiens Necrotic Spot Virus
Ringspot Viruses
Cucumber Mosaic Virus
Virus Diseases

- Movement from plant to plant can occur in different ways, depending on the virus
  - Some are mechanically transmitted – human touch, pruning activity, shovels, and so on
    - Tobacco Mosaic Virus (TMV) – wide host range, carried on cured tobacco and transferred easily to human hands through smoking, chewing, etc
    - Hosta Virus X (HVX) – primarily hosta, transmitted through wounds via contaminated pruning tools
Virus Diseases

Movement from plant to plant can occur in different ways, depending on the virus:

- Some are transmitted by insects, other arthropods, fungi, or nematodes:
  - Impatiens Necrotic Spot Virus (INSV) – wide host range, vectored by thrips
  - Cucumber Mosaic Virus (CMV) – wide host range, vectored mechanically and by aphids
Managing Virus Diseases

- Not curable
- Prevention is key
- Purchase healthy-looking plants
- Remove and destroy infected plants
- Manage potential insect/arthropod vectors
- Sanitize tools
Snow Molds on Lawns
## Snow Molds on Lawns

Two common types:

<table>
<thead>
<tr>
<th>‘Fusarium’ Pink Snow Mold</th>
<th>‘Typhula’ Grey Snow Mold</th>
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<tbody>
<tr>
<td>Yellowish patches; can appear bleached</td>
<td>Circular patches of light yellow, straw, or grayish brown turf</td>
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<tr>
<td>2 to 12 inches diameter</td>
<td>2 to 40 inches or more diameter</td>
</tr>
<tr>
<td>Under certain conditions, cottony, off-white to faint <strong>pink</strong></td>
<td>Matted leaves often covered with white to grayish-white mycelium</td>
</tr>
<tr>
<td>mold growth covers grass</td>
<td></td>
</tr>
<tr>
<td>Pink color and absence of sclerotia distinguish Pink Snow Mold</td>
<td>Small, hard, spherical sclerotia on or in leaf tissue</td>
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<tr>
<td>from Grey Snow Mold</td>
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Snow Molds

Pink Snow Mold

Grey Snow Mold
Snow molds – Management

- Avoid heavy nitrogen fertilizer in late fall
- Mow short for very last mowing of the season before snow
- Avoid excess thatch and compaction
- Lightly fertilize in spring
- Over-seed if no new growth
- Maintain low soil pH
- Maintain balanced fertility
- Gently comb/rake up matted grass when it begins to actively grow
How to submit a sample to local experts if you need help

- Sample from an area just beginning to show symptoms (not dead)
- Include root system, if possible
- Wrap foliage in dry paper towels
- Wrap roots in damp paper towels

- Include information:
  - species and cultivar
  - age of plant(s)
  - description of symptoms and when first noticed
  - prevalence or pattern
  - soil type
  - recent treatments
  - weather
Thank You!

Questions?