Extension Gardener
Class 8:
Diagnosing Plant Problems
Today’s Class

• Signs and symptoms of plant problems
• Causes of plant problems
• Resources for diagnosing plant problems

Next week:
• Managing plant problems
Bad Things Happen To Good Gardeners!

• Even when you do everything right, problems happen in the garden and landscape.
• Before doing anything, observe the symptoms to determine the cause of the problem.
Plant Problems: Symptoms and Signs

**Symptoms**
- Changes in growth
- Changes in appearance
- Dead plant parts

**Signs**
- Evidence of a pest
- Actual Insect
- Observed mechanical damage
- Secretions from the plant
- Damage pattern
- Recent weather records (severe freeze, late frost, hail storm, etc)
Symptoms: Holes in tissue

- May be large or small, ragged or precise
- **Most Common Cause:**
  - Caterpillars or beetles
  - Also grasshoppers
  - Look for frass (insect poop)
  - Caterpillars may produce webbing

Flea Beetles – small beetles, small holes

Orange striped oakworm
With holes, also look for frass:
Larger insect, larger frass
Holes may also include webbing

- Some caterpillars produce webbing
- May tie leaves together with webbing
  - Frass often collects in webbing
Incomplete Holes

- **Skeletonizers**
- Only eat top surface of leaf (epidermis)
- May eat tissue between veins and leave fine network of veins – skeleton

Rose Sawfly
“Shot hole”

• Center drops out of leaf spot leaving round holes
Symptoms: **Spots**

- May be brown, black, tan, purple, red, yellow . . .
- When caused by disease usually have a **halo**
Spots

- May be caused by insects feeding on back of leaf
- Always check back!
Symptom: Leafmining

- Caused by Leafminers (insects)
- Feed in between top and bottom surface of leaves
- Usually do not cause serious damage
Symptoms: Blight

- Rapid death (necrosis) of leaf tissue
- Large areas of tissue die

Late Blight, Tomato

Fireblight, Pear
Symptom: Distortion

Misshapen – may appear:
• Puckered or blistered
• Crinkled or pinched
• Strapped or twisted

Oak Leaf Blister, fungal disease
Distortion

- Insect feeding
- Many inject toxins in plants to keep phloem flowing – causes distortion
Distortion:

**Strapping**

Usually herbicide related
Some viruses cause distortion
Distortion: Galls

• Entire leaf may become thickened and rubbery
  – Fungal disease
  – Azaleas, camellias in spring

• Galls may form in the leaf tissue
  – Usually insects
  – Gall wasps
Symptom: Discoloration

- Leaves may appear:
  - Darker than normal
  - Lighter than normal
    - Tan, white, gray
    - Yellow = chlorotic
  - Red or purple
  - Bright orange
  - Brown or rust (dead) = necrotic

Bright orange discoloration is almost always a sign of rust (fungal disease)
Symptom: Discoloration

• Pay attention to where discoloration occurs:
  – On the plant:
    • New growth versus old growth
  – Within the leaf:
    • Between veins
    • All over

Yellowing of older leaves only typically a sign of nitrogen deficiency
Discoloration: Interveinal Chlorosis

- Yellow tissue between the veins
- New growth only = Iron deficiency, causes:
  - pH too high
  - Root rot or physical root damage
  - Cold soils

Paper Rice Plant, *Tetrapanax*
Discoloration: Red or Purple

- **Sign of stress**
- May develop in cold weather due to Phosphorous deficiency
- When accompanied by dieback/stunting usually root problem
Discoloration

- **Stippling**
  - Bronzing or yellowing of leaf, made up of hundreds of tiny spots
- **Piercing-sucking insects**
  - Remove chlorophyll from leaf

Stippling caused by azalea lace bug on older leaves – have not spread to new leaves, yet!
Discoloration: Darkening

- Piercing sucking insects which feed on sap in phloem of plants secrete sweet, sticky substance known as honeydew
  - Attracts ants and wasps
- **Black Sooty Mold**
  - Grows on sticky, sweet honeydew
  - Can block sunlight
  - Horticultural Oil helps to break down
Black Sooty Mold can persist long after the insects are gone

Look for insects on back of leaf and on stems/branches
Discoloration: Lighter

- White or gray coating on leaf
- Powdery Mildew
- Fungal disease
- Common on certain perennials, vegetables and trees/shrubs
Symptoms that usually indicate “Problem Lower Down”

• Wilting
• Dieback
• Flagging
• Stunting, often accompanied by chlorosis
  – Lichen may grow on stems
• No leaves/leaves falling off
  – Plant dead or dying
Symptoms: Dieback

- Branches die starting at tips and progressing back toward trunk
- Often due to root damage (construction)
- Severe drought can also cause
- Symptoms may develop years after event!
Symptoms: Flagging

- Leaves/needles on individual stems wilt and/or turn brown and hang on
  - Canker disease
  - Borers in stem
Symptom: Cankers

On Stems

Discolored areas may be sunken or ooze sap (gummossis)
Symptoms: Wilting

• All leaves
  – Root or stem problem
  – Drought

• Leaves on one branch or stem
  – Disease, stem damage, insect borers
Symptoms: Root Rot

White firm roots = Healthy

Brown soft roots = Unhealthy
Causes of Plant Problems

• **Non-living causes** - Known as abiotic problems, these include:
  – Weather
  – Herbicide injury
  – Soil compaction, pH issues

• **Living causes** – Known as biotic problems:
  – Pathogens
  – Insects
  – Other critters
Nonliving Causes of Plant Problems

• Most (~75%) plant problems have nonliving causes!
• Especially true for plants that decline or die within first year of being planted
• The wrong plant for the site or climate!

Sunburn on hosta
Characteristics of Abiotic Problems

- Symptoms appear all at once
- Symptoms do not spread after initial damage
- Many different types of plants may be affected
- May impact a large area
- May have a noticeable pattern
- Defined line from healthy to unhealthy tissue
Common Abiotic Problems

- **Water management** – too much or too little
- Most critical immediately after planting
- Often related to soil conditions

Symptoms: wilting, plant death
Common Abiotic Problems

• **Soil compaction**
  - Plants grow poorly - stunting
  - Lichen on trees and shrubs

• **pH imbalance**
  - Symptom - discoloration; Soil test to determine

![Lichen](image1)

![Interveinal Chlorosis](image2)
Common Abiotic Problems

• **Mechanical Injury**

• Problems in the crown, look near the ground!

• Symptoms: wilting, dieback, plant death
Sapsuckers
Common Abiotic Problems

• **Weather**
  - Drought
  - Cold/Frost
  - Wind
  - Hail
  - Lightening

Cold injury on Indian hawthorn
Common Abiotic Problems

- **Herbicide Injury** – distortion, discoloration

Glyphosate (RoundUp) injury on tomato

2,4-D Injury on Tomato
Living Causes of Plant Problems

• Plant pathogens
• Insect pests
• Critters are living, but do not reside on the plant
  – Deer
  – Rabbits
  – Squirrels
  – Birds
Characteristics of Biotic Problems

- Occurrence is isolated or patchy
- Distribution is random
- Symptoms spread over time
- Nearby plants of the same species or plant family may become infected in time
- Gradual change from healthy to unhealthy tissue
Living Problems

Plant Pathogens Include:

- **Fungi** – vast majority, 80% of plant pathogens
- Bacteria
- Virus
- Nematodes

- Fungi and bacteria cause similar problems
- Problems caused by virus typically unique

Discoloration caused by virus
Common Diseases

Leaf Spots

Blight

Cankers

Mildews

Wilts

Root and Crown Rots
Leaf Spots

- Most are caused by fungi, some by bacteria
- **Least damaging** especially if treated early
- **Host specific**
- Often weather dependent – **worse in wet weather**

- Cercospora Leaf Spot on Hydrangea
- Septoria Leaf Spot on Tomato
- Entomosporium Leaf Spot on Indian Hawthorn
**Fungal Leaf Spots**

Dots within spots

Zonal Leaf Spot: Concentric Circles

Colorful: Red, yellow halos
Bacterial Leaf Spots

Often angular because they are initially limited by the leaf veins

Usually uniform in color (brown-black), may appear water soaked or greasy
Powdery Mildew

• Fungal – white spores on top of leaf cause discoloration and sometimes distortion
• Favored by dry weather
• Most common early summer
• Species specific – different strains infect specific plants
• For most, resistant varieties are available – best defense
• Can be treated with fungicides IF started early
**Downy Mildew**
- Fungal – gray spores on back of leaf, yellow discoloration on top of leaf
- Host specific
- Common in wet weather
- Not easily treated

**Rust**
- Fungal – orange spores
- Host specific
- Common early summer – treatable with fungicides
- Look for resistant varieties
**Blight**

- Cause rapid death of large areas of leaf tissue
- Most are fungal
- Treatable IF detected early
- Fireblight is bacterial – infects apple and pear

*Oak Anthracnose*
Canker Diseases

- Cause flagging and dieback
- Most are fungal
- Usually serious - deadly
- Most cannot be treated
- May be able to prune out
- Host specific
- Often stress related

If you notice flagging or dead stems, look for cankers on the trunk
Wilts

- Most are fungal
- Clog up vascular tissue (circulatory system) – cause wilting, sometimes cause discoloration (yellowing)

- **Soil borne**

- Most common in vegetables – esp. tomato

- Fatal
Root and Crown Rots

- Often associated with poor drainage!
- Can effect seedlings and mature plants
- Roots turn brown, soft and mushy
- Plants may die quickly or slowly
- Persist in the soil
- Not treatable!

Symptoms:
Wilting
Discoloration
Dieback
Nematodes

- Microscopic worms, considered plant disease
- Feed inside plant roots
- Cause stunting, yellowing, slow decline
- No treatment for infected plants
- Host specific – choose resistant species
- Often occur in “hotspots”

Gardenia infected with nematodes
Nematode Types

• **Root knot**
  - Hollies, hibiscus, gardenia, boxwoods, roses, okra, peaches and figs

• **Lesion**
  - Boxwood

• **Stuby root**
  - Azalea

• **Dagger**
  - Rose

• **Sting**
  - Turf

Only root knot nematodes produce visible symptoms.
Virus

• Submicroscopic infectious agent – host specific
• Not usually deadly, often cause **strange patterns or color breaks** on leaves and flowers
• **Need living host**
• Can spread by seed, insects, and nematodes
• NOT treatable
Living Problems: Insects

Common ways insects damage plants:

• **Feed on plant tissue**
  – Eat leaves, buds, flowers, roots
• **Bore into woody stems and trunks**
• **Feed on chlorophyll and plant sap**
• **Transmit diseases**

Eating leaves is only one way insects damage plants.
Insect Development

• **Metamorphosis**
  – Unique to insects

• **Simple metamorphosis**
  – 3 stages, change gradual over time

• **Complete metamorphosis**
  – 4 distinct stages, each unique

• **All insects begin as eggs**
Simple Metamorphosis – 3 stages

- Egg
- Nymphs
- Adult

- How do you know when you have an adult?
- Wings!

- Adults and nymphs usually feed on same food
- Cause damage through whole life cycle

Grasshoppers, termites, thrips, true bugs, aphids, scale
Complete Metamorphosis

- 4 distinct stages
  - Egg
  - Larva
  - Pupa
  - Adult
- Larva and adult usually feed on different foods
- Most are very host specific

Butterflies & moths, beetles & weevils, true flies, wasps, ants, and bees
2 Basic Types of Mouthparts

- **chewing**
  - Caterpillars, beetles, weevils, grasshoppers, termites

- **piercing/sucking**
  - True bugs, aphids, scale, mealybugs
Signs and Symptoms of Insects

**Chewing Insects**
- Holes in leaves
- Skeletonized leaves
- Webbing (caterpillars)
- Frass

**Piercing Sucking Insects**
- Discoloration
- Distortion
- Dieback
- Honeydew and Black Sooty Mold
Beetles

- Relatively large, hard bodies
- **Complete metamorphosis**
- Larvae often referred to as *grubs* – some feed on plant roots
- **Over 600,000 species, 40% of all insects!**
  - Most do not damage plants!
  - Most plant damaging species feed on vegetables
- Most beetle populations peak in June-July

Spotted Cucumber Beetle
Beetles

Generally grubs underground, adults fly around, but not always
Butterflies and Moths

• Complete metamorphosis
• Larvae often referred to as *caterpillars*
• Larvae have **chewing mouthparts**, adults have coiled sucking mouthparts (proboscis) if any at all!
• Moths generally active night, butterflies day
Many types of caterpillars!

Are they pests or butterflies?

Parsley Worm aka Black Swallowtail
Caterpillars

- Some produce webbing
- Prolific frass producers!
- Bird food!!!

Braconid Wasp cocoons – Parasitize caterpillars
Borers

• Bore into stems and trunks
• Some are beetles, others are moth larvae
• Typically fatal, cannot be treated once plant is infested
• Attracted to stressed plants

Asian Ambrosia Beetle
Non Insect Leaf Feeders

• Slugs and snails
  – Active at night
  – Typically ragged holes
  – Often see slime trail

• Deer, rabbits
  – Large volumes of foliage eaten during short time
Insects with Piercing Sucking Mouthparts

**Honeydew Producers:**
- Aphids
- Scale
- Whitefly
- Mealybug

**Others:**
- True Bugs

Black Sooty Mold grows on honeydew secreted by some insects
Aphids

- Tiny, fragile insects suck plant juices from tender growth
- Feeding can cause distortion of tips and leaves
- Can spread virus diseases
- Produce honeydew
- Many species, many colors
- Many natural enemies
- Easily controlled
Scale Insects

- Bumps on stems and leaves
- Actual insect is hiding under the “scale”
- Most but not all produce honeydew
- Many species, host specific
- Can be difficult to control if plants are stressed
- Horticultural oil works for most – spray in May and June when crawlers present
Mealybug
• Closely related to scale and aphids
• More common on houseplants – move outside for summer

Whitefly
• Tiny white insects
• Typically found on back of plant leaves
• Fly off when plant disturbed
True Bugs

- **Gradual metamorphosis**
- Adults and nymphs have **piercing sucking** mouthparts to suck plant juices or other insects!
- Many have glands that release odor when threatened: Stink bugs vs. Scentless plant bugs
True Bugs

- Stinkbugs and Leaf-footed Bugs
- Difficult to control!
Azalea Lace Bug

- The most common pest problem in SE USA!
- Prolific on azaleas in full sun
- Cause stippling, bronzing of leaf
- Generally do not seriously injure plants, damage mainly cosmetic
- Several generations per growing season
Other Lacebugs

- Other lacebugs:
  - **Lantana**
    - Cause plants to stop flowering, leaves discolored, edges turn brown
  - Pyracantha
  - Sycamore

- All difficult to control – cut plants back and spray insecticidal soap
Spider Mites

- Not insects, related to spiders – 8 legs, not 6
- Plant damaging mites have piercing sucking mouthparts but do NOT produce honeydew
- Causes bronzing of leaf, stippling
- Can produce fine webbing close to leaf surface
- Tiny, found on back of leaf
Passionflower – stippling caused by spider mite feeding
Determining What Is Wrong

- **Gather information**
  - What is the plant
  - What are the symptoms
  - Distribution and progression
    - do you think problem is likely biotic or abiotic?
  - Recent weather, activity near the plant (spraying, digging, etc)

- **Research common problems**
Online Resources:
eXtension search engine

https://search.extension.org
Search for problems of specific plant:

- Tomato problems
- Tomato diseases
- Tomato insect pests
Check results from SE states first

- NC = ces.ncsu.edu
- SC = clemson.edu
- GA = caes.uga.edu
- FL =edis.ifas.ufl.edu
- MS = msucares.com
- AL = aces.edu
- LA = lsuagcenter.com
- TX = horticulture.tamu.edu
- VA = pubs.ext.vt.edu
Next Class – Final Class!

• Integrated Pest Management – using multiple methods to prevent and manage insects and diseases
• Will also discuss weeds, deer, ticks
  – **Evening Class** – Tuesday, May 19, 6:00 – 8:00
  – **Morning Class** – Wednesday, May 20, 9:30 - Noon

Pesticides are not the only option!