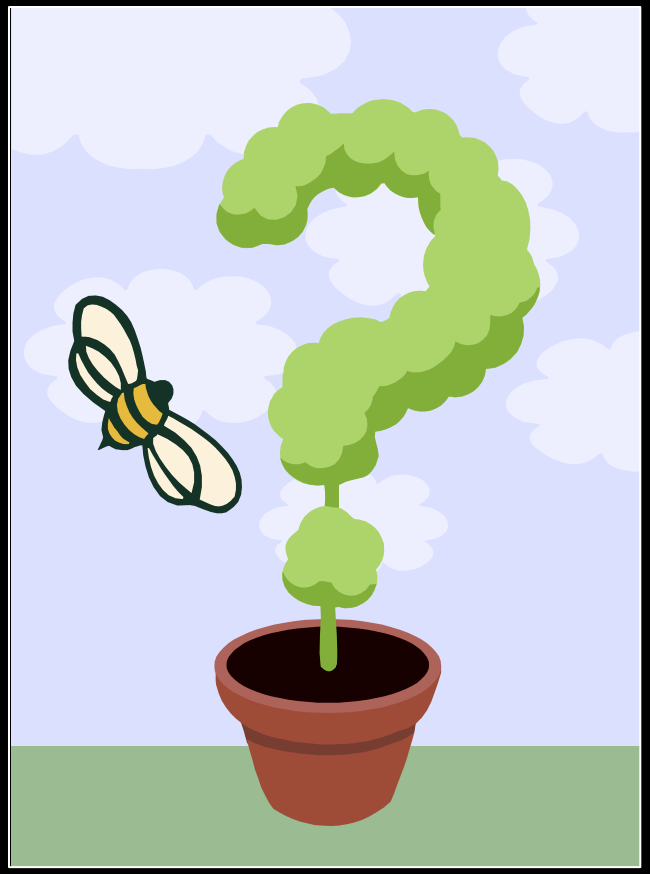
Extension Gardener
Class 8:

Diagnosing Plant Problems

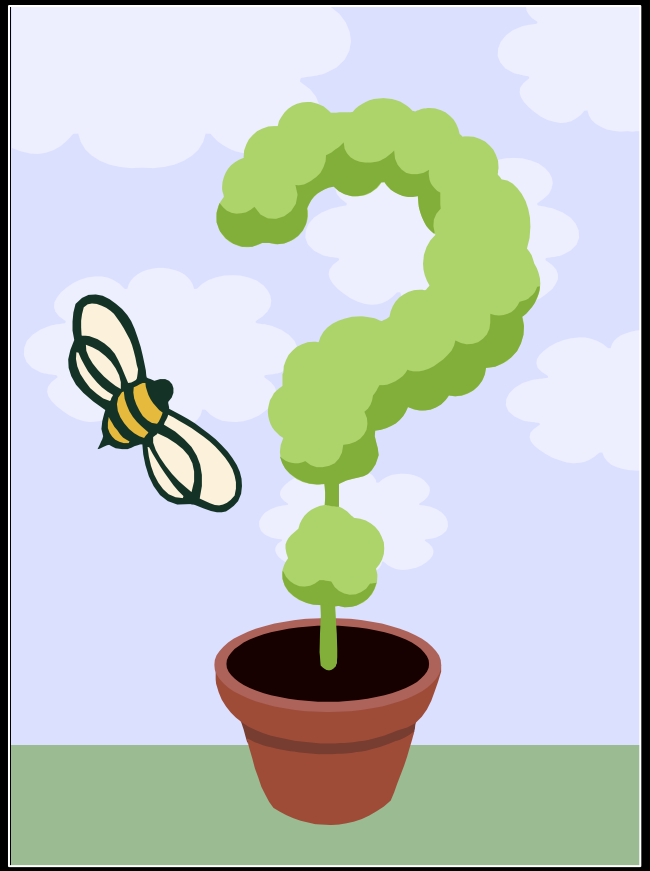


Today's Class

- 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

Fireblight, Pear

Late Blight, Tomato

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

Aphid feeding often 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

Look for insects on back of leaf and on stems/branches

Black Sooty Mold can persist long after the insects are gone

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 (gummosis)

Symptoms: Wilting

- **All leaves**
  - Root or stem problem
  - Drought
- **Leaves on one branch or stem**
  - Disease, stem damage, insect borers

Symptoms: Root Rot

Causes of Plant Problems

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

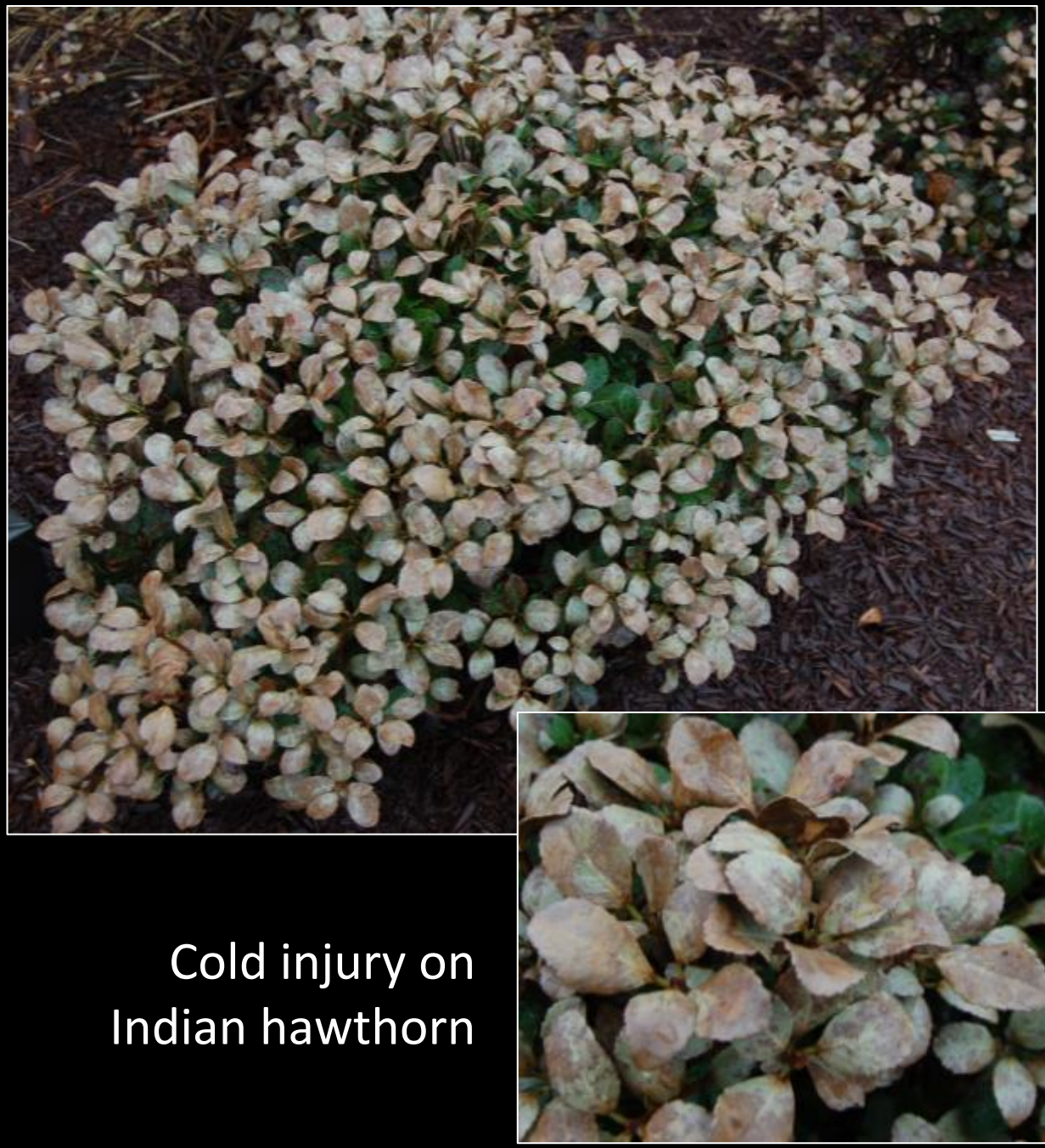
Common Abiotic Problems

- **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
- **N**earby 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

Blights

Cankers

Mildews

Wilts

Root and Crown Rots

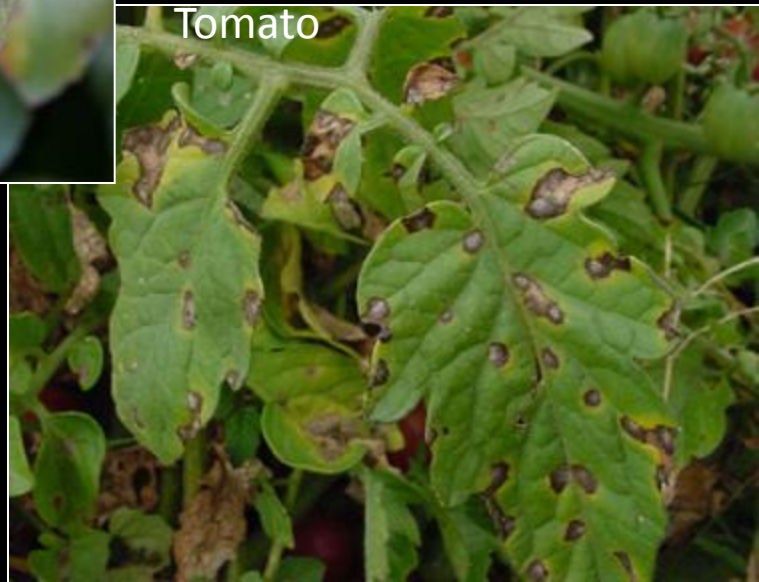
Leaf Spots

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

Entomosporium Leaf Spot on Indian Hawthorn

Cercospora Leaf Spot on Hydrangea

Septoria Leaf Spot on Tomato



Fungal Leaf Spots

Zonal Leaf Spot: Concentric Circles

Dots within spots

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

Blights

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

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

Southern Bacterial Wilt in Tomato

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

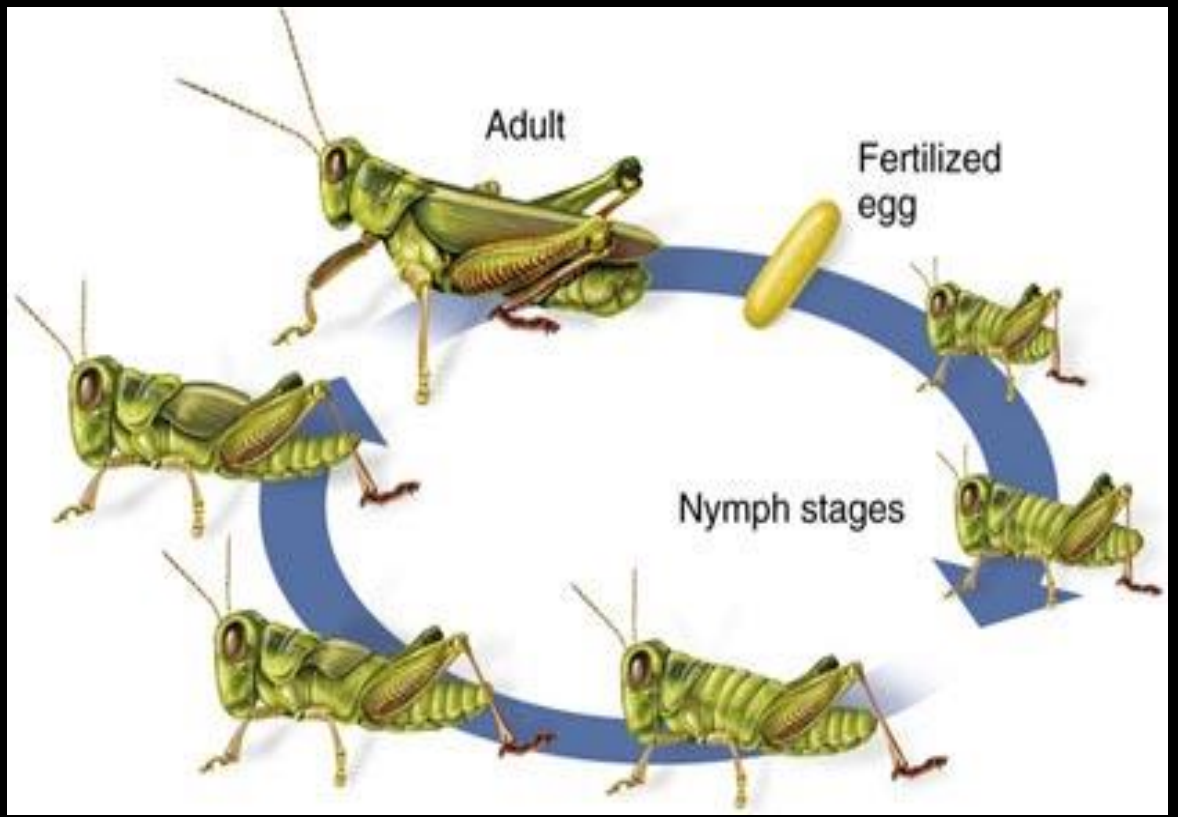
- **Metamorphosis**
  - Unique to insects
- **Simple metamorphosis**
  - 3 stages, change gradual over time
- **Complete metamorphosis**
  - 4 distinct stages, each unique
- All insects begin as eggs

Stink Bug Eggs

Simple Metamorphosis – 3 stages

- **Egg**
- **Nymphs**
- **Adult**

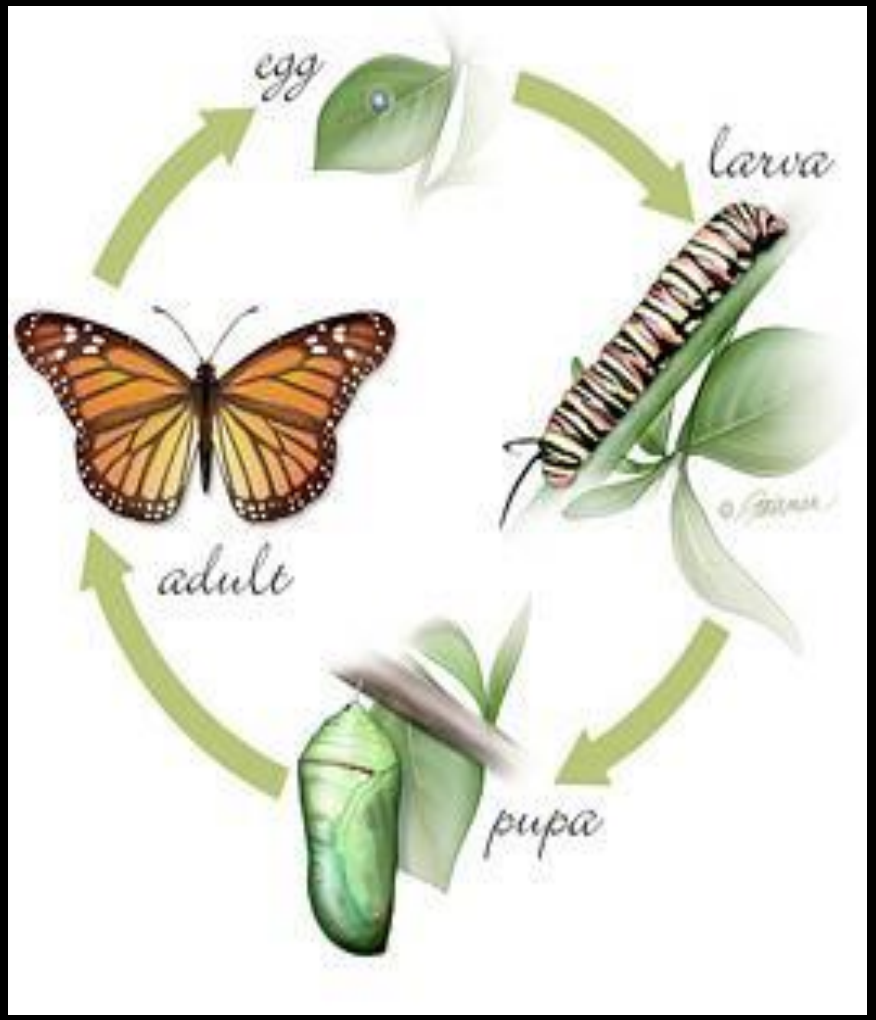
- How do you know when you have an adult?
  - **Wings!**
- Adults and nymphs usually feed on same food
  - Cause damage through whole life cycle



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

Complete Metamorphosis

- 4 distinct stages
  - Egg
  - Larva
  - Pupa
  - Adult
- Larva and adult usually feed on <u>different</u> 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

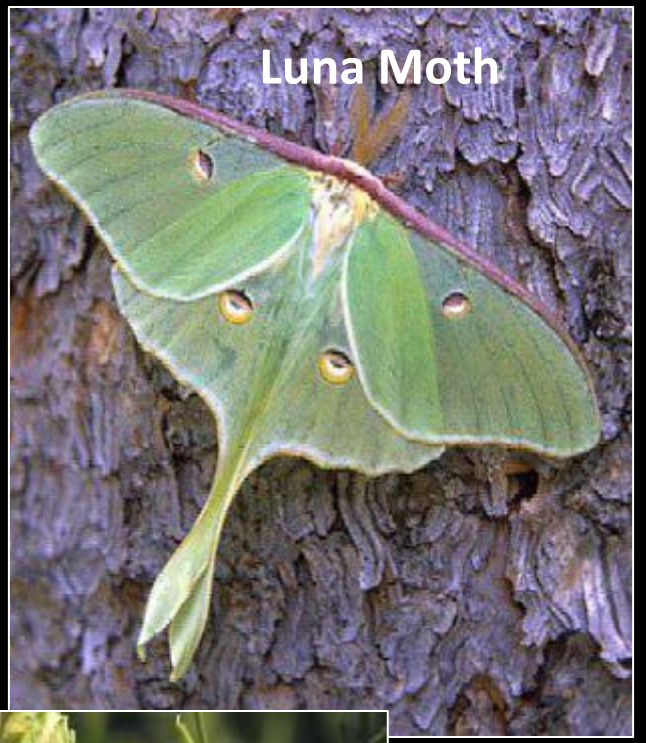
Generally grubs underground, adults fly around, but not always

Colorado Potato Beetles

Japanese Beetles

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



Tiger Swallow-tail

Many types of caterpillars!

Are they pests or butterflies?

Parsley Worm
aka
Black
Swallowtail

Caterpillars

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

Fall Webworm

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

Azalea Lace Bug

Kudzu Bug

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

2-Spotted Spider Mite

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

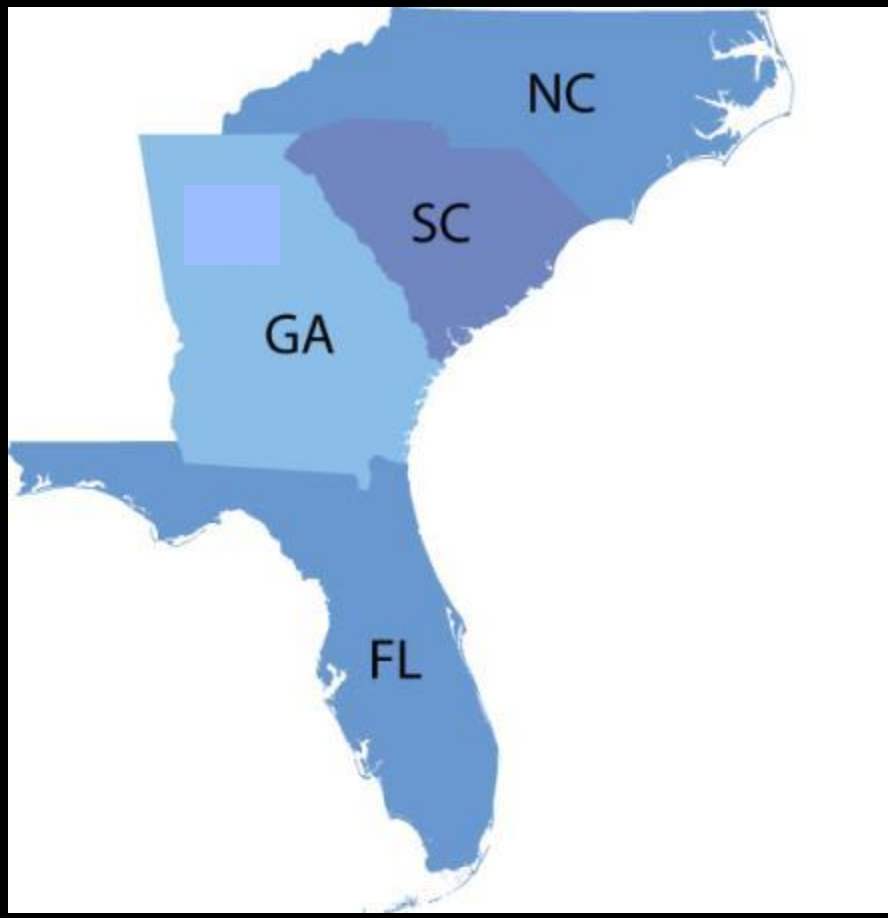
https://search.extension.org

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!