Cornell University
Cooperative Extension

Becoming a Garden Detective

Joyce Tomaselli
CCEDC Community Horticulture Resource Educator
jdt225@cornell.edu

Agenda

- Ask the Master Gardener Hotline
- Integrated Pest Management
- Insect Identification
- Plant Identification
- What is Wrong with this Plant??
- What is Wrong with My Tomatoes?

CCE Diagnostic Hotlines

- Statewide, for many years, CCE staff with Master Gardener Volunteers have traditionally staffed Hotlines to answer resident's questions.
  - Sources of information were books, fact sheets, Cornell research based information and experience.
- The proliferation of websites has not decreased the need for information.
- Callers are young and old, computer savvy and not.

- In 2019 CCEDC received 700 inquiries. By August 2020 received 697.
  - Hotline calls, phone calls, emails, web requests and samples.
  - Sources of information are unchanged.
  - Experience has grown answering them.

Typical MG Hotline questions

- What is it?
- What's wrong with it?
- Should I be afraid of it?
- What do I do about it?
- Why don't you know everything?

The Seven ‘S’s of Plant Diagnostics

- **S**ymptoms: physical changes to plant, e.g. yellowing, wilting, leaf spots, lesions, lack of flowering or fruiting.
- **S**igns: physical clues of causal agent (pest or pathogen) i.e. holes in leaves, frass, mining, fungal spores, egg masses, galls, exit holes, animal tracks, teeth marks, webbing.
- **S**pecies: what plant or plants are affected?
  - There are species-specific diseases and family specific diseases.
  - There are insects that affect specific host plants or many.
  - Damage across many species could be abiotic or large vertebrate herbivore munching.
- **S**ite: e.g. light, soil, wind exposure, drainage, compaction, location near street or sidewalk.
- **S**pread: distribution of signs and symptoms on plant e.g. random or contiguous pattern, top to bottom, inside to outside, older leaves or new growth only, more than one species.
- **S**eason: time of year symptoms or signs first appeared. Do life cycles of pathogens or insects match symptom timing?
- Hi(**S**tory): what has happened on the site? E.g. Construction, soil compaction, homeowner actions (or inactions), recent or long term weather conditions.

Integrated Pest Management (IPM)

- IPM is a common sense approach to Pest Control.

- It is a system for managing pest problems using a range of safe, least-toxic methods.

- IPM is integrated because it uses biological, organic, cultural, mechanical and chemical options for managing pest problems.
  - Goal: manage problems at acceptable levels.
  - Methods: prevent, monitor, diagnose and take action if necessary.
  - Actions: Use least harmful, physical and cultural methods first. Use least-toxic pesticides as a last resort.

➢ Hotline requests for pesticide recommendations are decreasing dramatically.

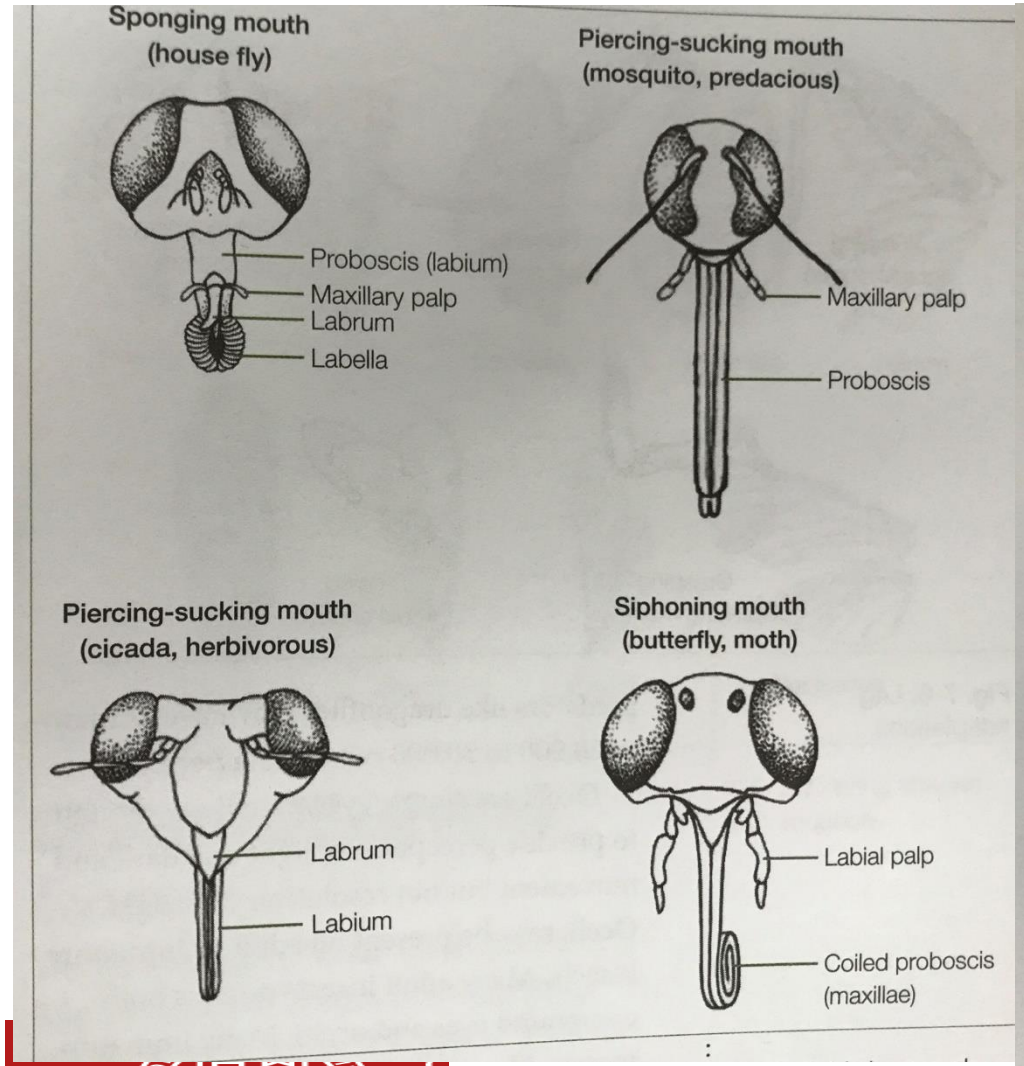
What do I do about this insect?

- **What** is the insect?
  - 99% of our insects are not pests; they are food for other animals
  - Many are also beneficial e.g. pollinators and those that feed on pests
  - Pests are insects that feed on, cause injury to, or transmit disease to humans, animals, plants, food, fiber, and structures
- **Where** was it found?
  - Indoors, outdoors, on a tree, shrub, flower, fruit or vegetable
- **When** was it found?
  - Insects display different stages, behavior and management at different times of the year
- **Who** is affected?
  - The actual target of the insect, the food it depends on, the nesting preference
- **Why**?
  - Determining the insect and its actual or potential damage dictates the recommended action.

Potential Pests

- All Adult Insects
  - Have 3 body regions (head, thorax & abdomen), 3 pairs of legs, 1 pair of antennae, 0-4 wings
  - Are supported by an exoskeleton.
  - True bugs are insects with an incomplete metamorphosis; they hatch as nymphs from their egg then become adults e.g. leafhoppers, aphids, cicadas, stink bugs, water bugs, ticks and bed bugs.
- Spiders, Mites and Ticks
  - Have 2 body regions, 4 pairs of legs
- Centipedes and Millipedes have 2 body regions and lots of legs, either 1 or 2 pairs per body segment.

Insect Identification



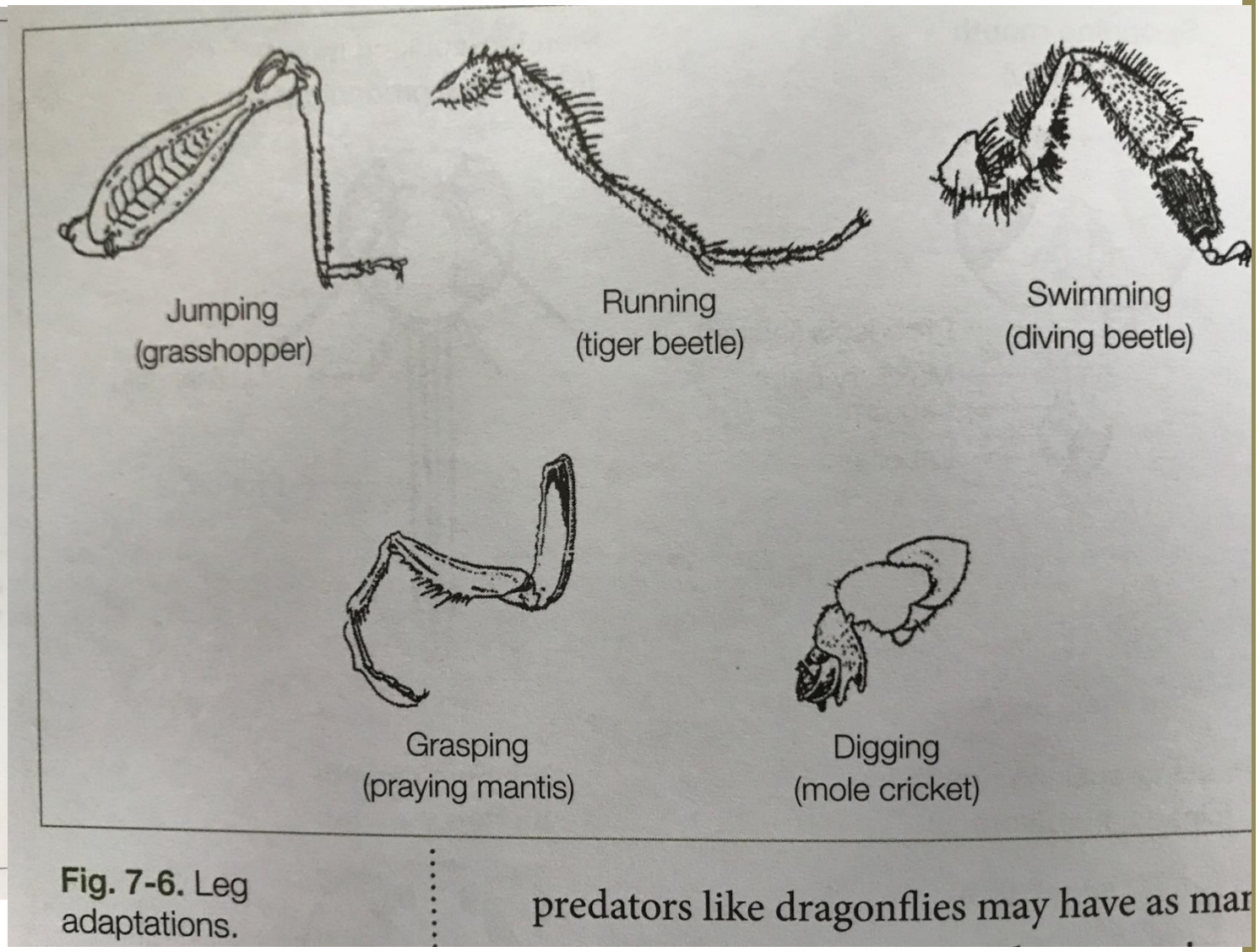
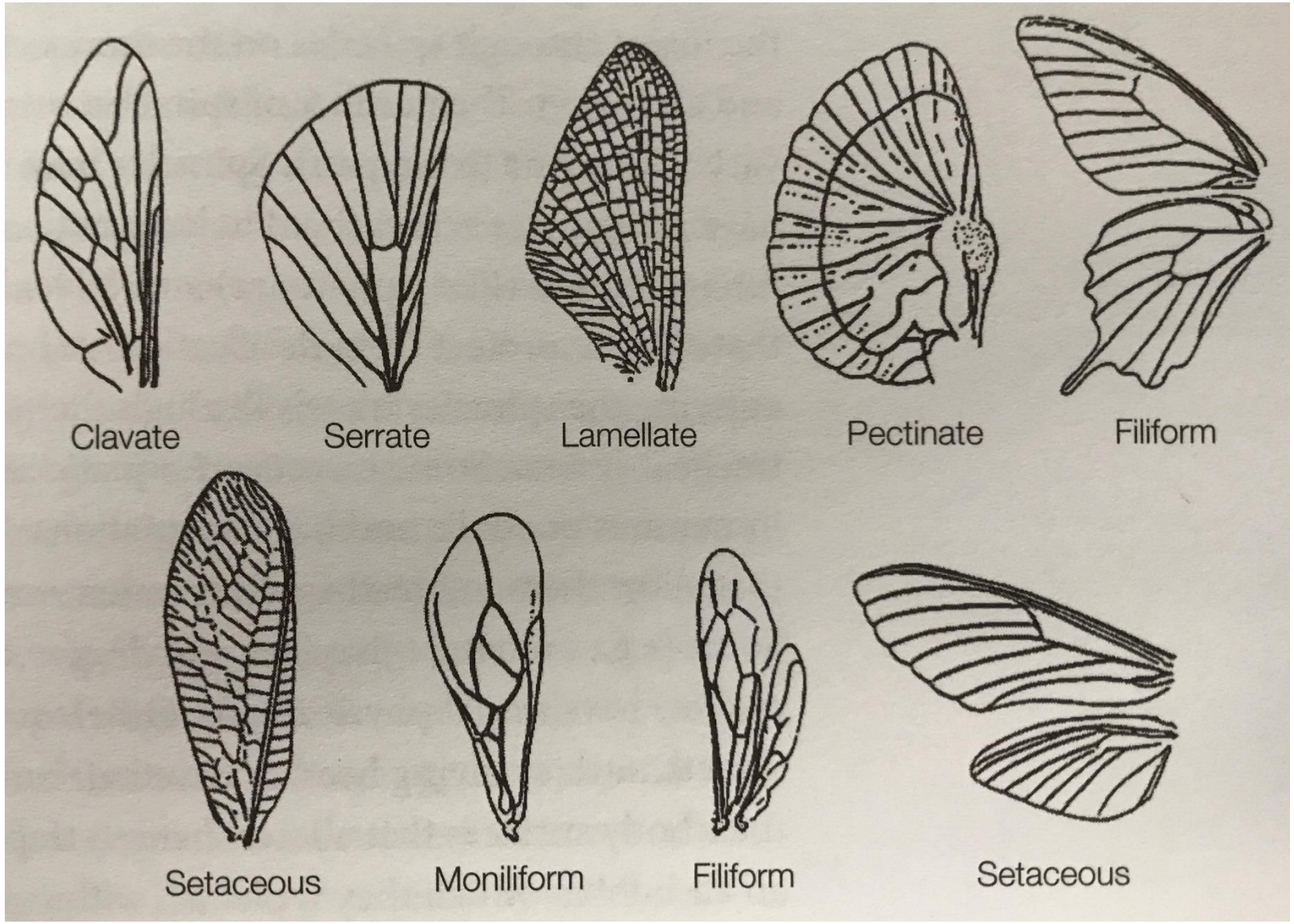


Fig. 7-6. Leg adaptations.

predators like dragonflies may have as mar

Insect Identification

Wing shapes with venation



Insect Identification

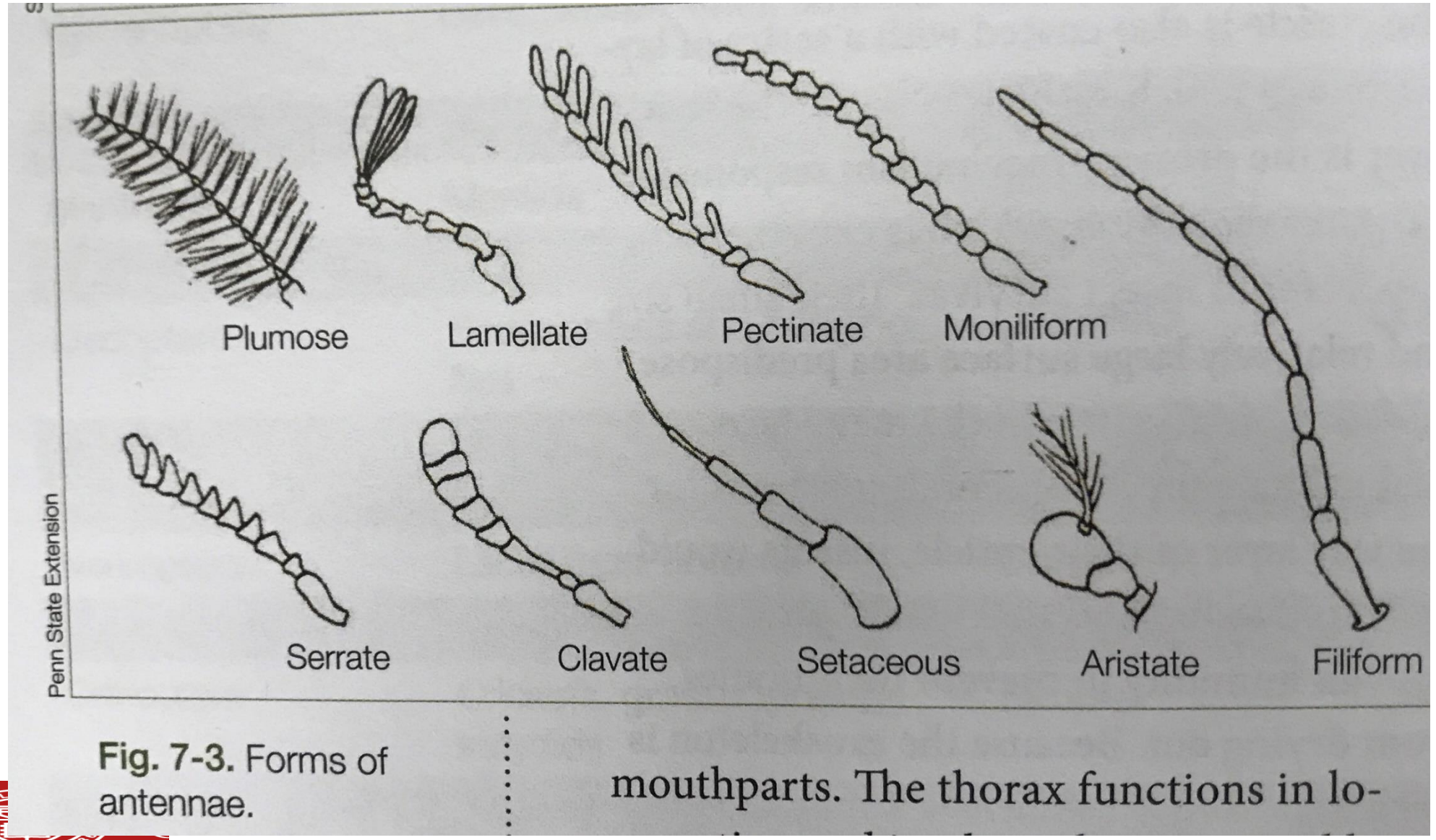
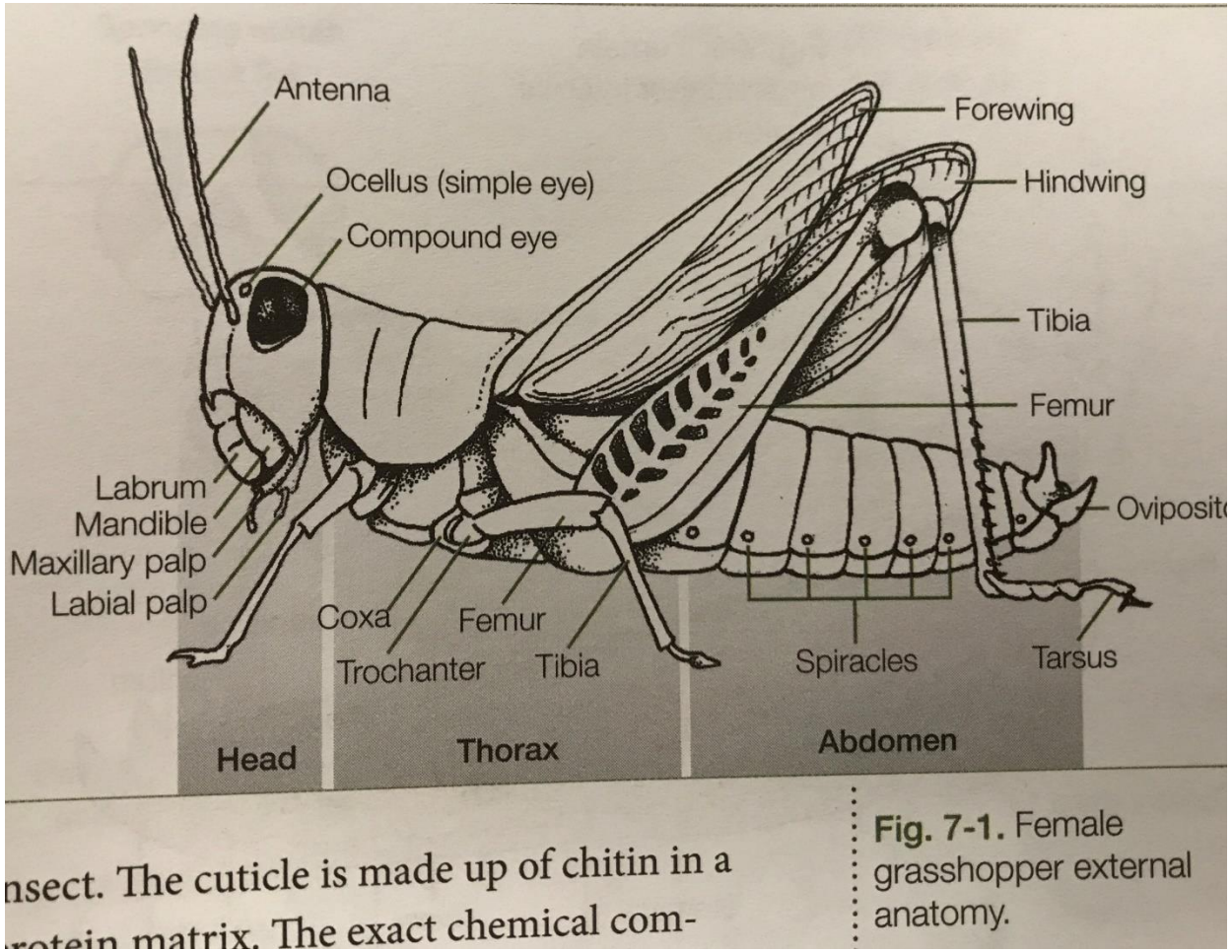


Fig. 7-3. Forms of antennae.

mouthparts. The thorax functions in lo-

Insect Identification



nsect. The cuticle is made up of chitin in a
rotein matrix. The exact chemical com-

Fig. 7-1. Female grasshopper external anatomy.

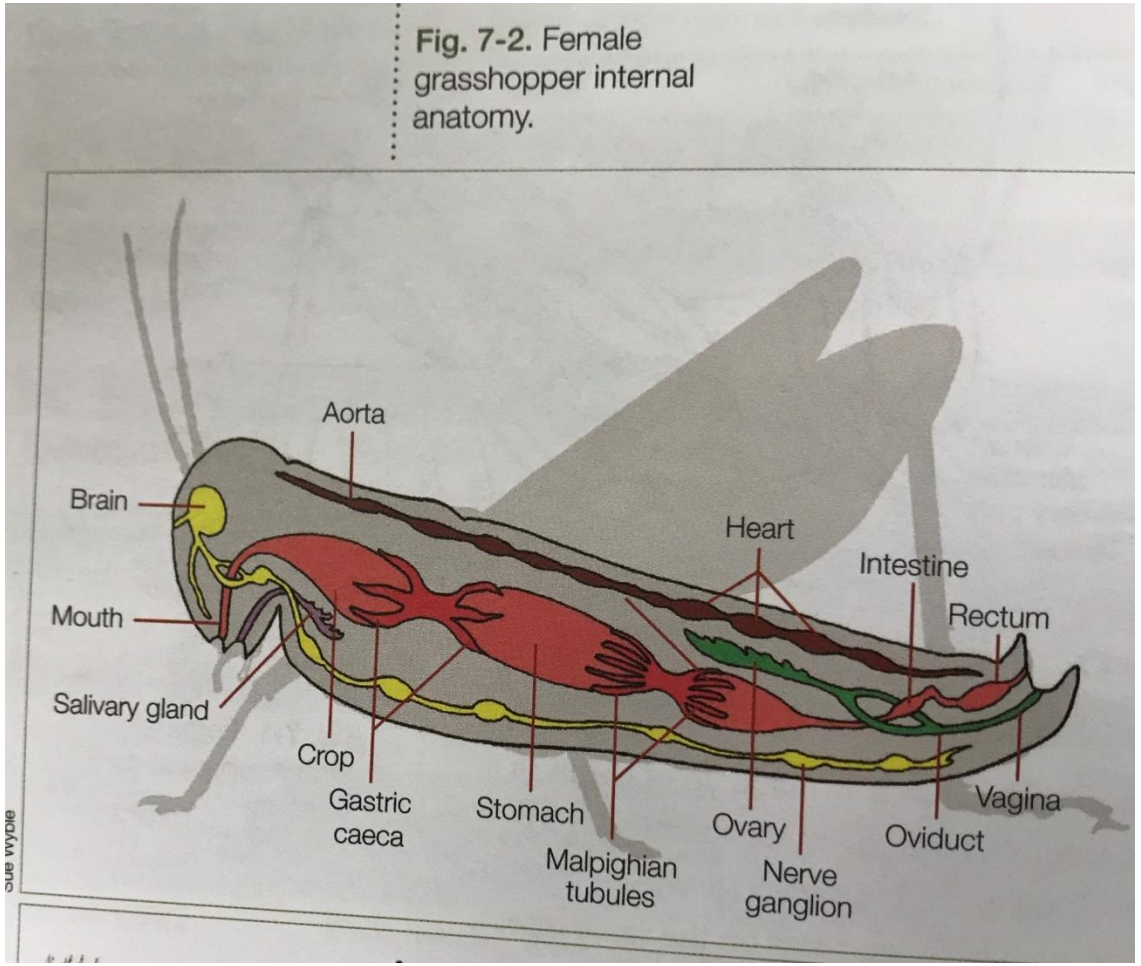
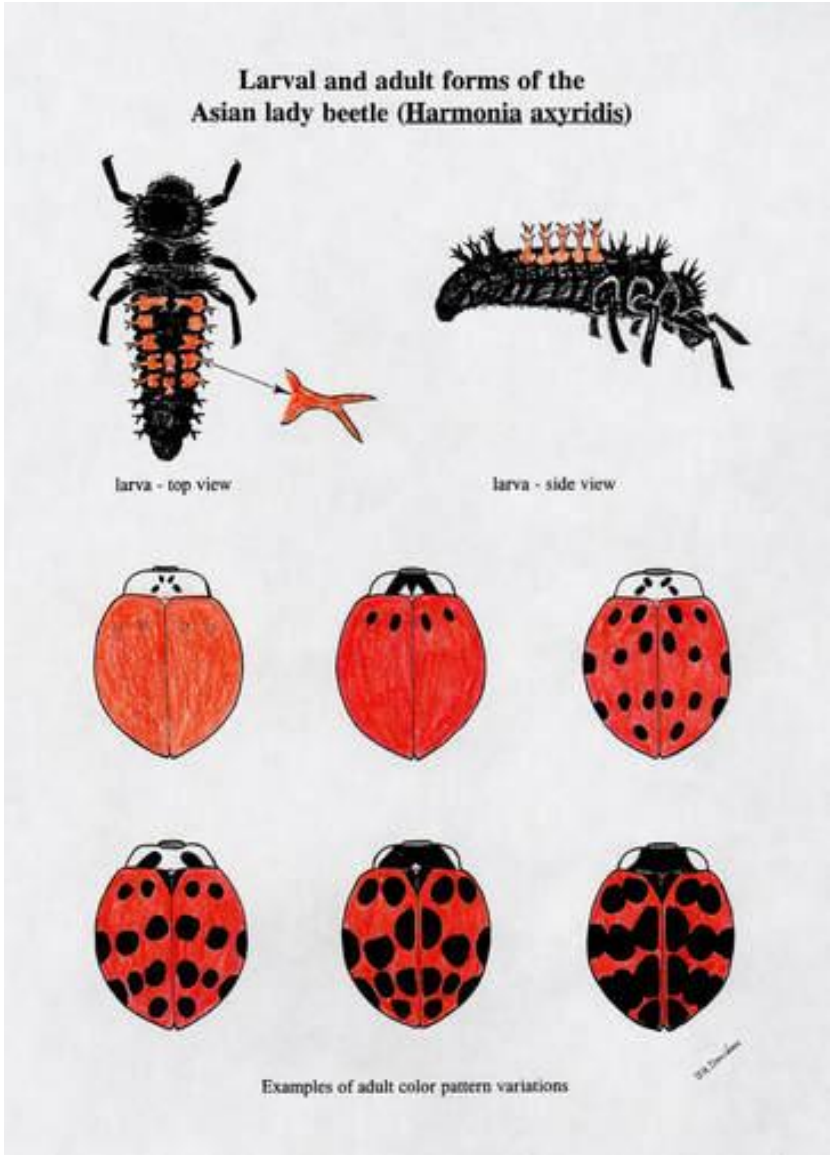


Fig. 7-2. Female grasshopper internal anatomy.

Insect Identification - Beetles

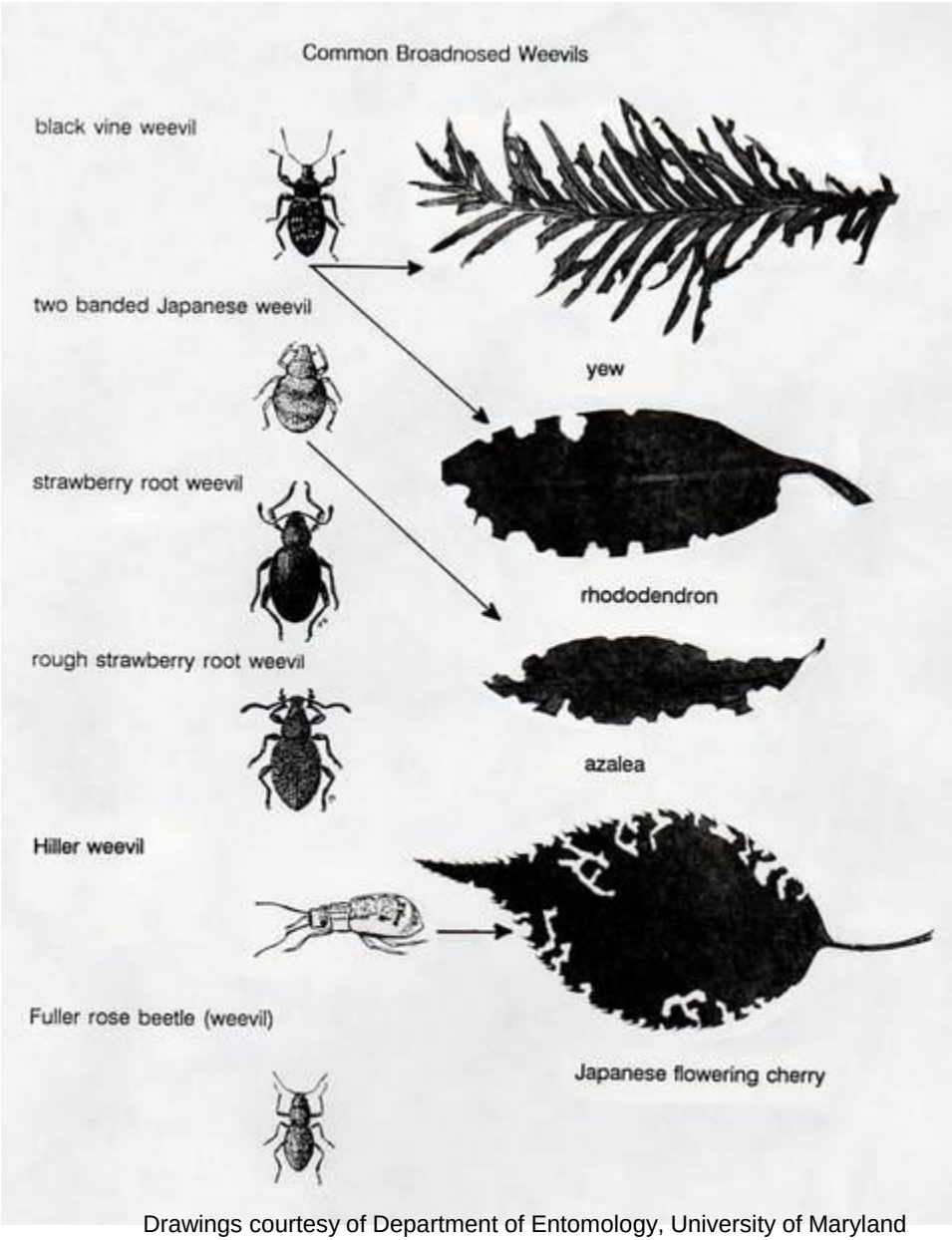


Multicolored Asian Lady Beetle
Harmonia axyridis

Pink Spotted Lady Beetle
Coleomegilla maculata

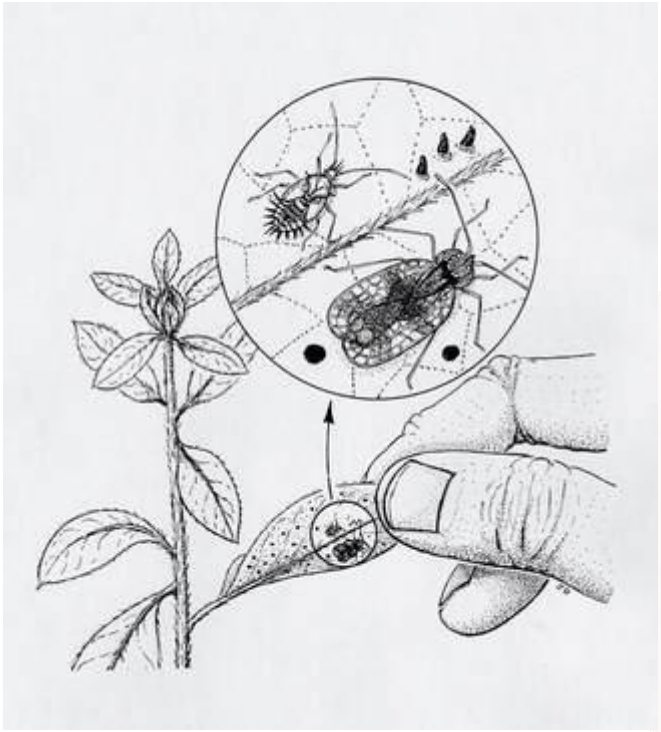
Convergent Lady Beetle
Hippodamia convergens

Weevils

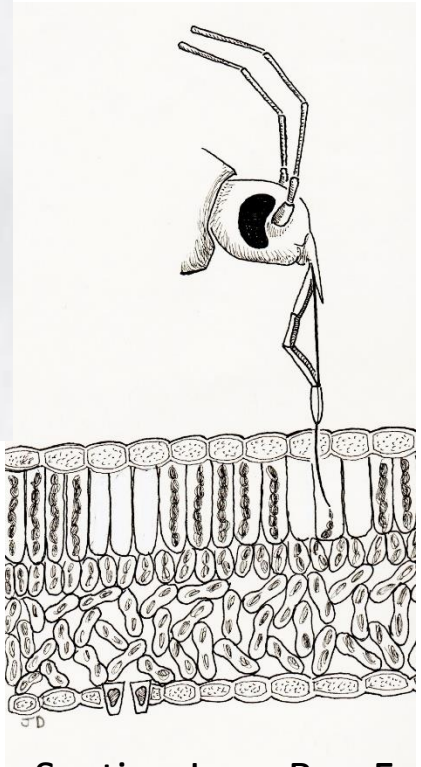


Drawings courtesy of Department of Entomology, University of Maryland

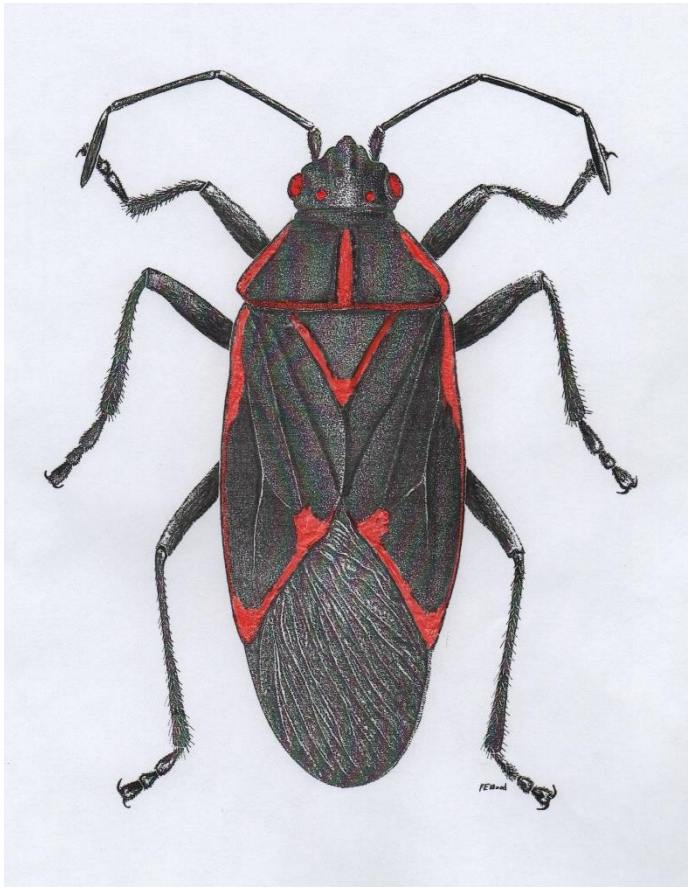
Insect Identification – True Bugs



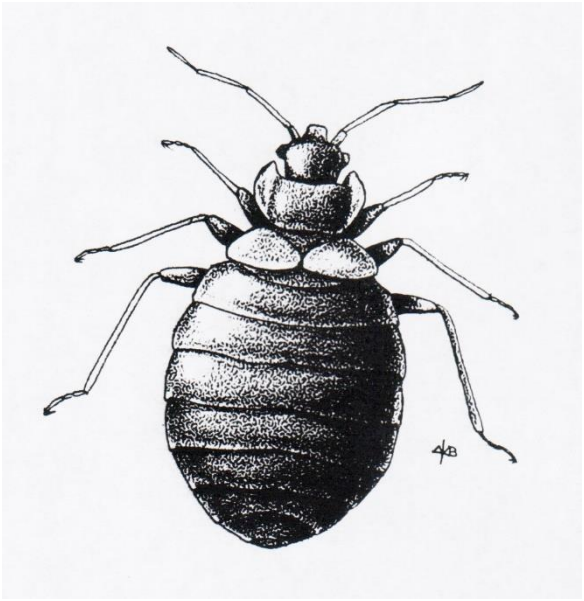
Azalea Lace Bug
Stephanitis pyrioides



Leaf Cross Section Lace Bug Feeding



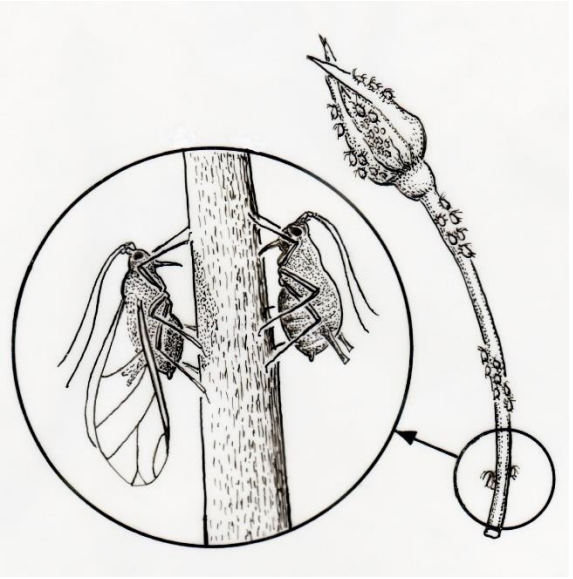
Boxelder Bug
Boisea trivittata



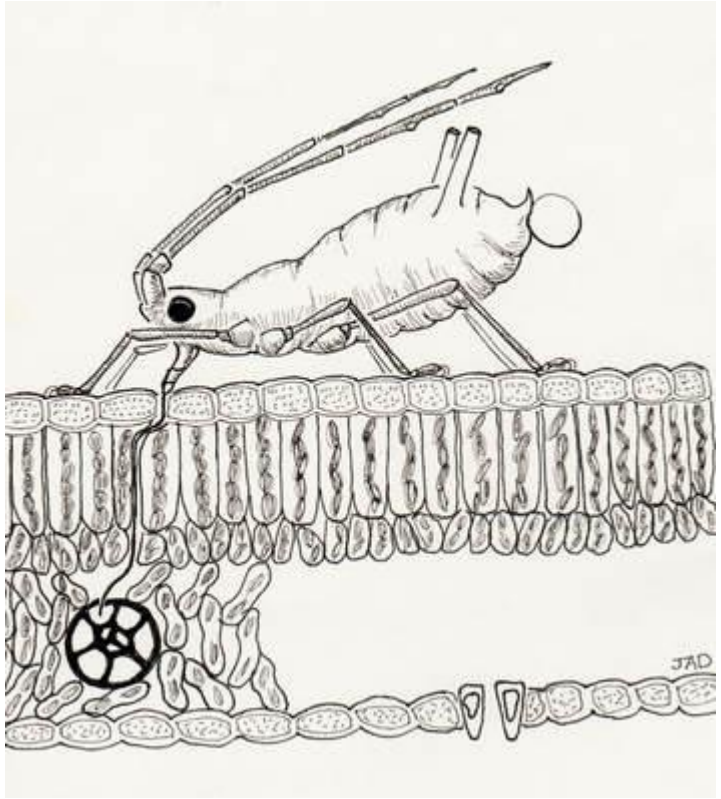
Bed Bug
Cimex lectularius

Drawings courtesy of Department of Entomology, University of Maryland

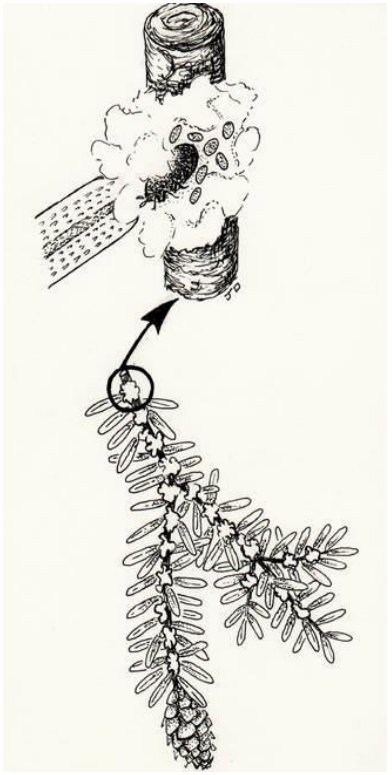
Insect Identification - Aphids and Scale



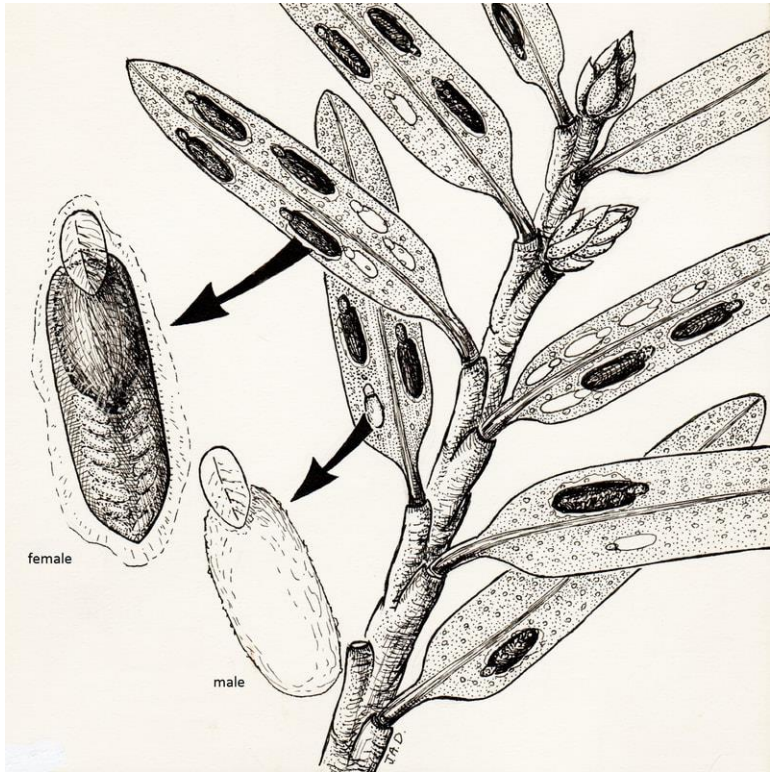
Aphids - Winged and Wingless
(comparison) *Aphididae* family



Aphid Sucking Sap
(Leaf Cross Section)
Aphididae family



Hemlock Woolly Adelgid
Adelges tsugae



Elongate Hemlock Scale
Fiorinia externa

Drawings courtesy of Department of Entomology, University of Maryland

Possible Pests

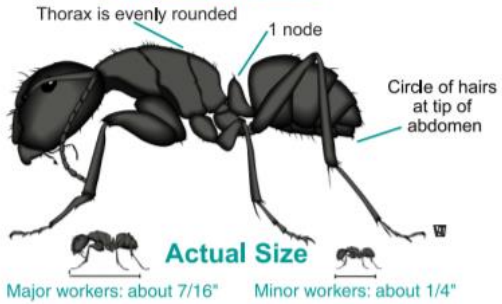
ANT IDENTIFICATION KEY
1-Node Ants

This information is valid for residents of Nebraska.

Black Carpenter Ant

Camponotus pennsylvanicus

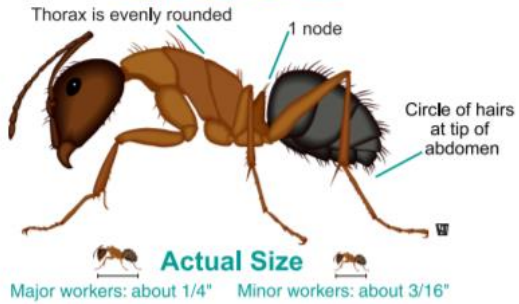
Many sizes of workers.



"Red" Carpenter Ant

Camponotus sayi

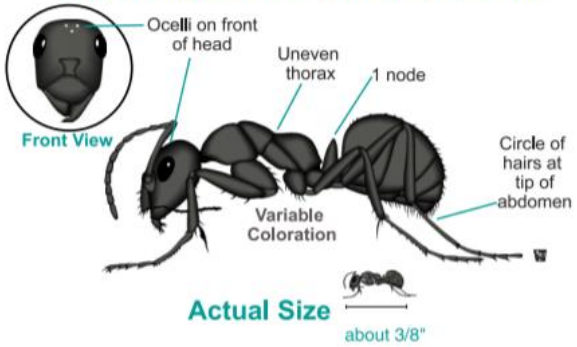
Many sizes of workers.



Field Ant

Formica spp.

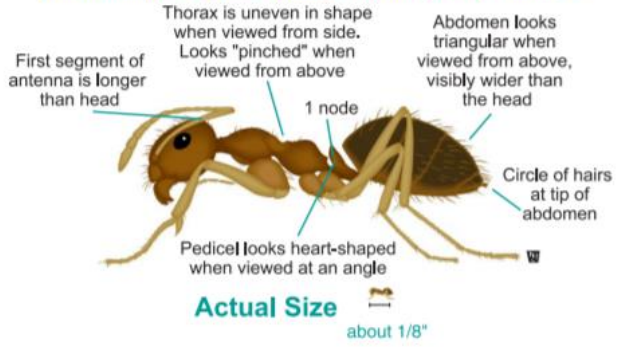
Field ants may be black, brown, tan, reddish, or red and black in color. Often confused with carpenter ants.



Small (False) Honey Ant

Prenolepis imparis

Also called Winter Honey Ant. When these ants are swollen (full of food), the gasters (abdomen) are greatly enlarged.



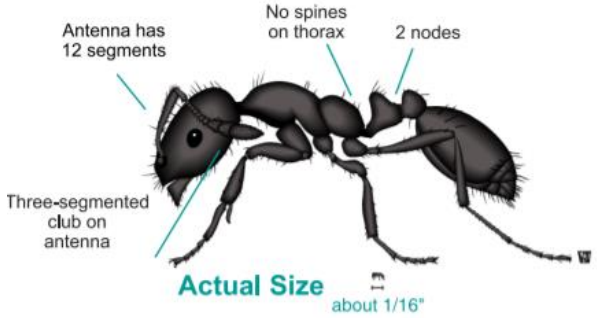
ANT IDENTIFICATION KEY
2-Node Ants

This information is valid for Nebraska.

Little Black Ant

Monomorium minimum

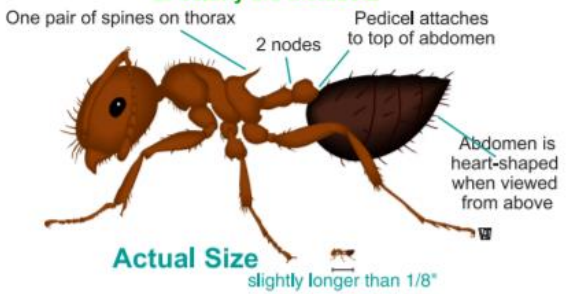
Similar in appearance to Pharaoh Ant except black in color.



Acrobat Ant

Cremastogaster lineolata

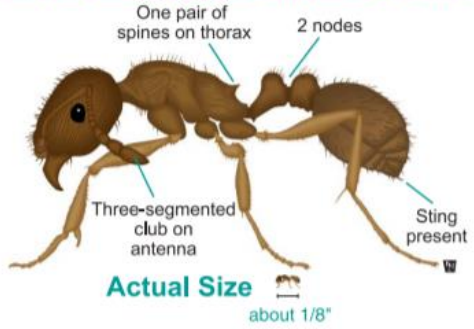
Acrobat ants get their name from the habit of holding their abdomen above their thorax when the workers or colony are distubed.



Pavement Ant

Tetramorium caespitum

Head and thorax is covered with visible grooves.

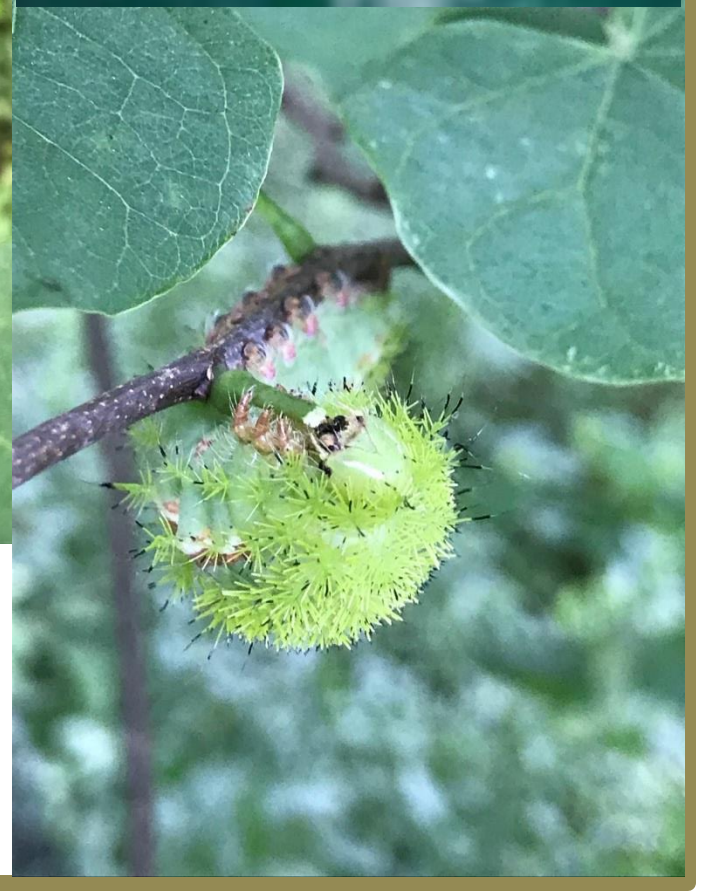


Big-Headed Ant

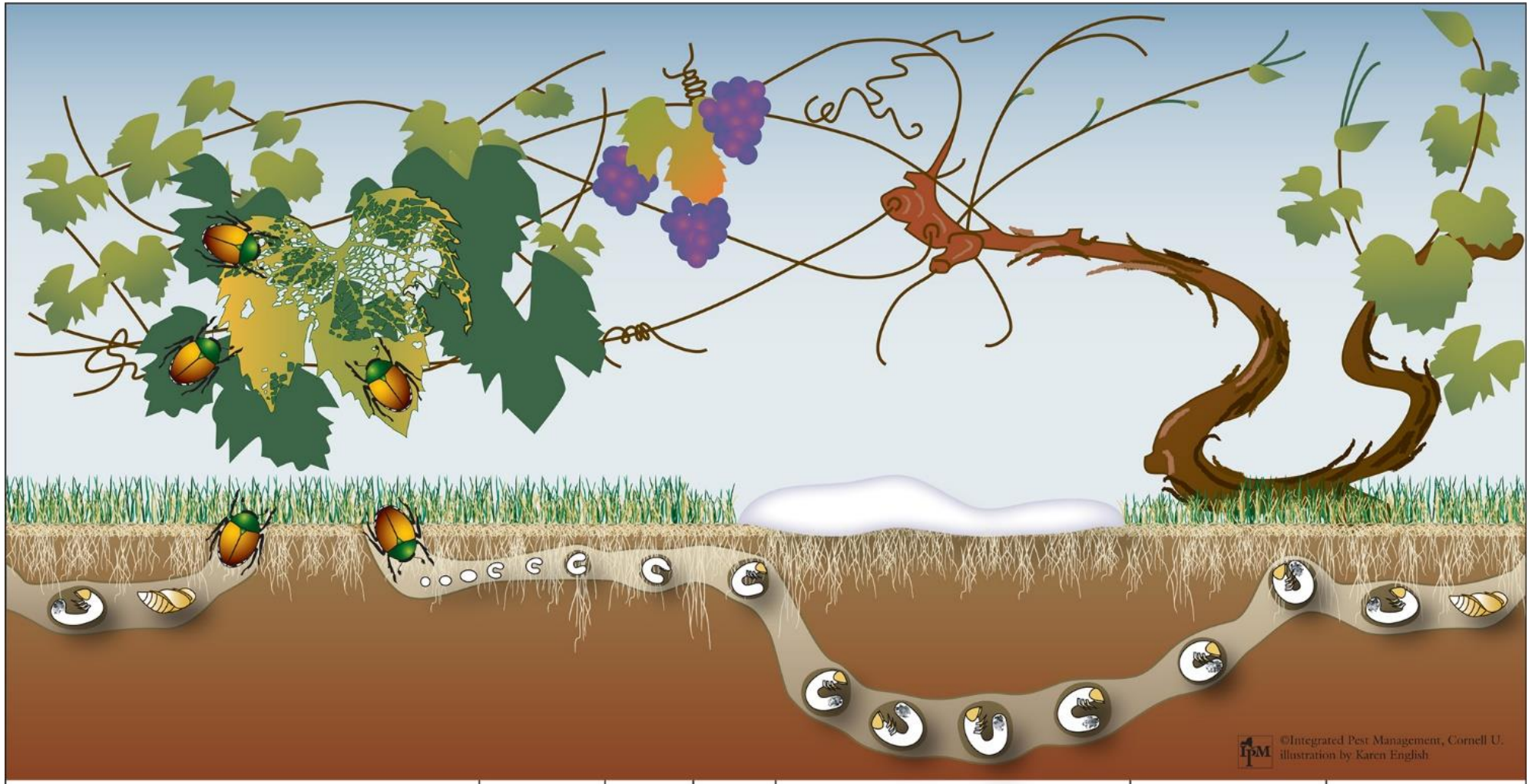
Pheidole spp.

Two sizes of workers. Major workers have a very large head. Minor workers have heads more proportional to their bodies.

Possible Pests



Possible Pests



JUNE — JULY		AUG	SEPT	OCT	NOV — APRIL	MAY	JUNE
Pupation and adult emergence	Egg laying & hatching	Larval growth			Downward migration; hibernation; overwintering grubs	Upward migration; short feeding period; pupation	

Gardening Detective Pest Identification

- Define the problem, Collect clues
  - What's the situation (when and where)
  - What's affected (who)
  - What's the problem (what)
- Determine the harm
  - Chewing, Piercing, Boring
  - Leaf, bark or root damage
  - Vectors of diseases or viruses
  - Structural
  - Nuisance
- Understand why they are there
  - Food sources
  - Shelter needs
  - Life cycle
  - Synthesize the information
  - Look for patterns
- Inform and Advise
  - Control & Management

What's Wrong With This Plant?

- What is the plant?
  - Identifying the plant narrows the possibilities of pests and diseases which could affect it.
- Where is it located?
  - And does that site match the plant's needs?
- When?
  - What is normal for the plant at this point in the season?
- Who?
  - Identifying what is causing the abnormality is critical
- Why?
  - Determining the cause dictates the solution.

A Plant Detective assembles investigates the crime, collects clues, confirms conclusions and then recommends the appropriate action.

Plant Identification

- Written botanical descriptions
- Visual images
- Samples
- Dichotomous Keys
- Books
- Call a friend
- Luck

CONIFEROUS TREE KEY

1. Needles in bundles or groups (2)
1. Needles single or flattened and scaly (3)
   2. Needles in clusters of more than 5 needles ..... **Tamarack*** ***(Larix laricina)***
   2. Needles 2 to 5 per bundle: Pine species (see a-c below)

      a. Five needles per bundle ..... **White Pine** ***(Pinus strobus)***
      b. Needles in pairs, 3 to 4 inches long ..... **Red Pine** ***(Pinus resinosa)***
      c. Needles in pairs, under 2 inches long, bark dark gray ..... **Jack Pine** ***(Pinus banksiana)***

3. Needles scaly and flattened (4)
3. Needles single (5)
   4. Has cones, scales flat, branches fan-like ..... **Northern White Cedar** ***(Thuja occidentalis)***
   4. Has berries, may have scaly and prickly needles on same tree, scales rounded ..... **Eastern Red Cedar** ***(Juniperus virginiana)***
5. Needles flat (6)
5. Needles square, 4-sided, stiff, sharp: Spruce species (see a-b below)

   a. Needles 1/3 to 3/4 inch long, twigs hairless ..... **White Spruce** ***(Picea glauca)***
   b. Needles 1/3 to 3/4 inch long, twigs have hair, grows in wet areas ..... **Black Spruce** ***(Picea mariana)***

6. Needles 1/2 inch long with short petiole ..... **Eastern Hemlock** ***(Tsuga canadensis)***
6. Needles 3/4 inch to 1 1/4 inches long, no petiole, bubbles in bark ..... **Balsam Fir** ***(Abies balsamea)***

Botany Language Basics for Identification of Flowering Plants

To understand the form, function, habitat and essential needs of plants use all your senses (vision, hearing, smell, taste, and touch) to observe plants. A collective understanding of fundamental botanical terms helps us share and discuss our discoveries with each other.

Duration of vegetative parts

Annual: completes life cycle in one year
Biennial: completes life cycle in two years
Perennial: life cycle extends three or more years
Deciduous: plants that shed their leaves at the end of the season and become dormant
Evergreen: plants that are never without leaves attached (**broadleaf evergreens** include all evergreens except conifers which have needle or scale-like leaves)

Plant appearance or habit

Herbs (Herbaceous plant): plants with non-woody stems
Shrub: **woody** perennial with more than one main stem
Tree: **woody** perennial with a single main stem
Vine: herbaceous plants with elongate, flexible, non-self-supporting stems
Liana: a woody vine

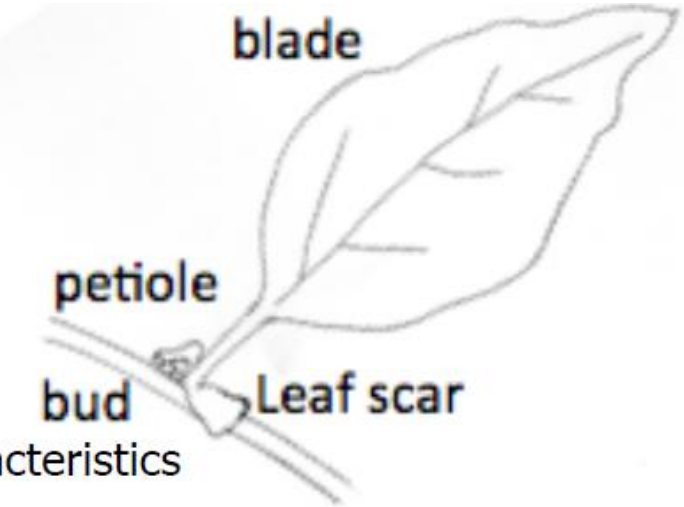
Leaf features

Blade: Flattened part of the leaf

Petiole: stalk supporting the blade

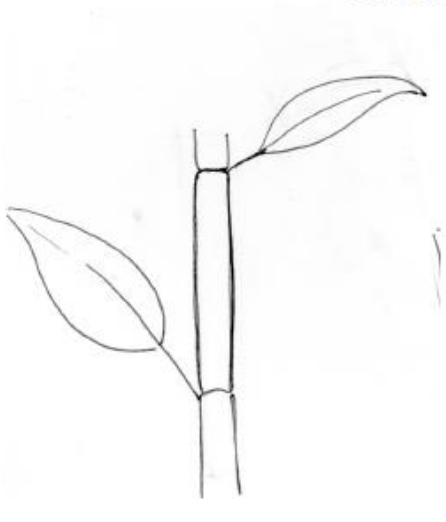
Leaf scar: a heart-shaped scar remains on the stem where the petiole was attached

Bud: forms above leaf scar and contain the beginnings of future growth; size, color, shape and marking of the scales on buds offer ID characteristics

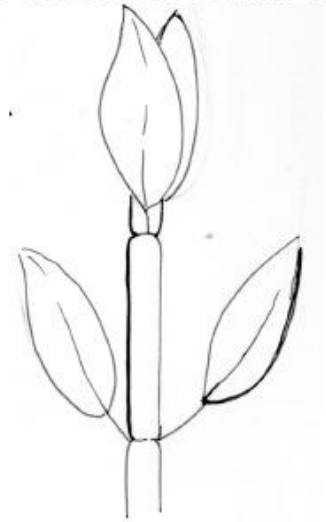


Leaf arrangements on plant stem

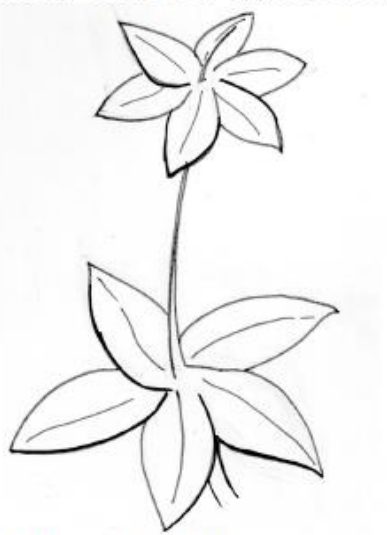
Node: area on stem from which one or more leaves develop



Alternate leaves
1 per node



Opposite leaves
2 per node

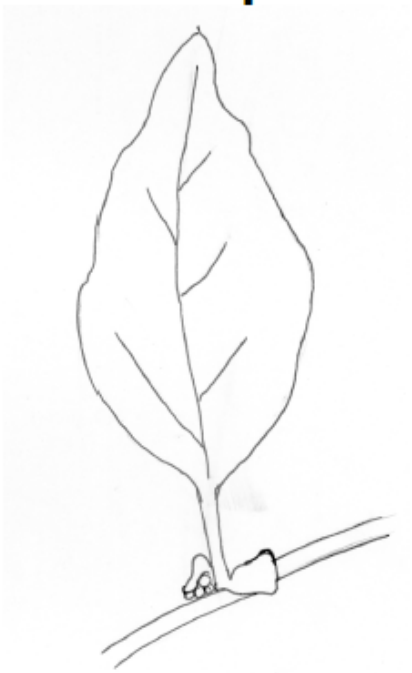


Whorled leaves
More than 2 per node

Rosette leaves
Radiating cluster at base

Arrangement on leaf petiole

Simple



Simple leaf is undivided though can be deeply lobed

Compound

Pinnate compound leaf is feather-like with leaflets attached both sides of central axis

Palmate compound leaf is hand-like with three or more leaflets radiating from one point

***Look** for a **leaf scar** and **bud** in area where the petiole was attached. No leaf scar or bud?*
Leaflet: resembles a leaf but is attaches to the axis of a compound leaf not the stem

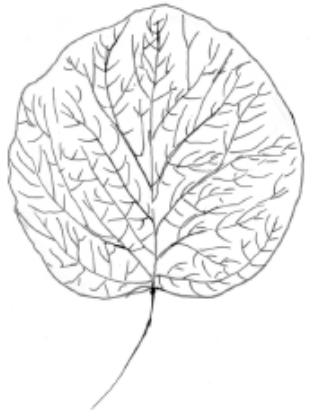
Leaf modifications

Bract: modified leaf often associated with a flower or inflorescence
Sheath: basal portion of leaf that surrounds the stem
Spine: sharp pointed leaf or portion of a leaf
Tendril: twining leaf or portion of a leaf

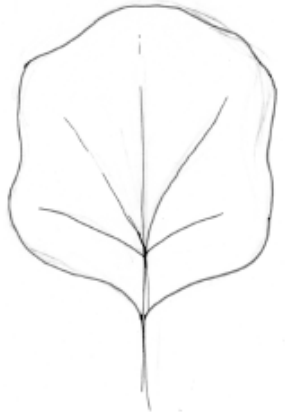
Leaf blade surface

Glabrous: without hairs
Glaucous: waxy coating
Pubescent: hairy surface--there are many kinds of hairiness

Leaf blade venation

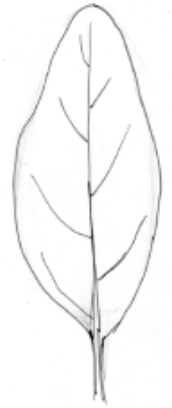


Net (Reticulate) veins form a complex network



Palmate veins radiate from a central point at base

Parallel veins extend in same direction beside each other



Pinnate veins form a major mid-vein with branching side veins

Leaf blade margin

Ciliate
Fine hairs

Crenate
Rounded teeth

Entire
Smooth

Lobate
Indented/lobed

Undulate
Widely wavy

Dentate
Symmetrical
angular teeth

Denticulate
Fine teeth
angular teeth

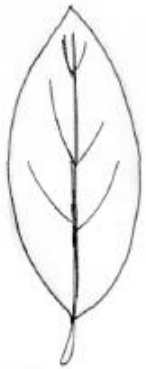
Serrate
Coarse teeth
curved forward

Serrulate
Fine teeth
curved forward

Sinuate
Wave-like
indentations

Leaf blade shape

Cuneate
Wedge shaped

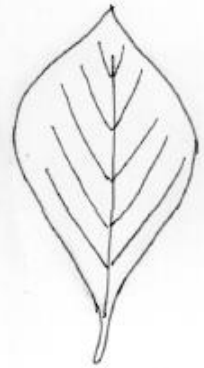


Elliptical
Oval-shaped with small or no tapering

Lanceolate
Pointed at both ends; base widest

Oblanceolate
Widest section towards tip

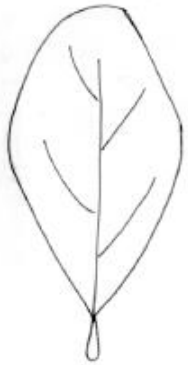
Spatulate
Spoon shaped



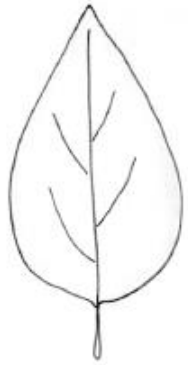
Rhomboid
Diamond shaped

Linear
Thin; sides parallel

Oblong
Wider; parallel sides



Obovate
Egg shape; widest at tip



Ovate
Egg shape; widest at base

Obcordate
Heart shaped

Reniform
Kidney shaped

Leaf blade bases and tips (apex)

Acute
Less than 90° angle

Auriculate
Lobes of a human ear

Cordate
Heart shaped

Hastate
Triangular lobes

Sagittate
Arrowhead shaped

Oblique
Asymmetrical

Truncate
Squared off

Obtuse
Greater than 90° angle

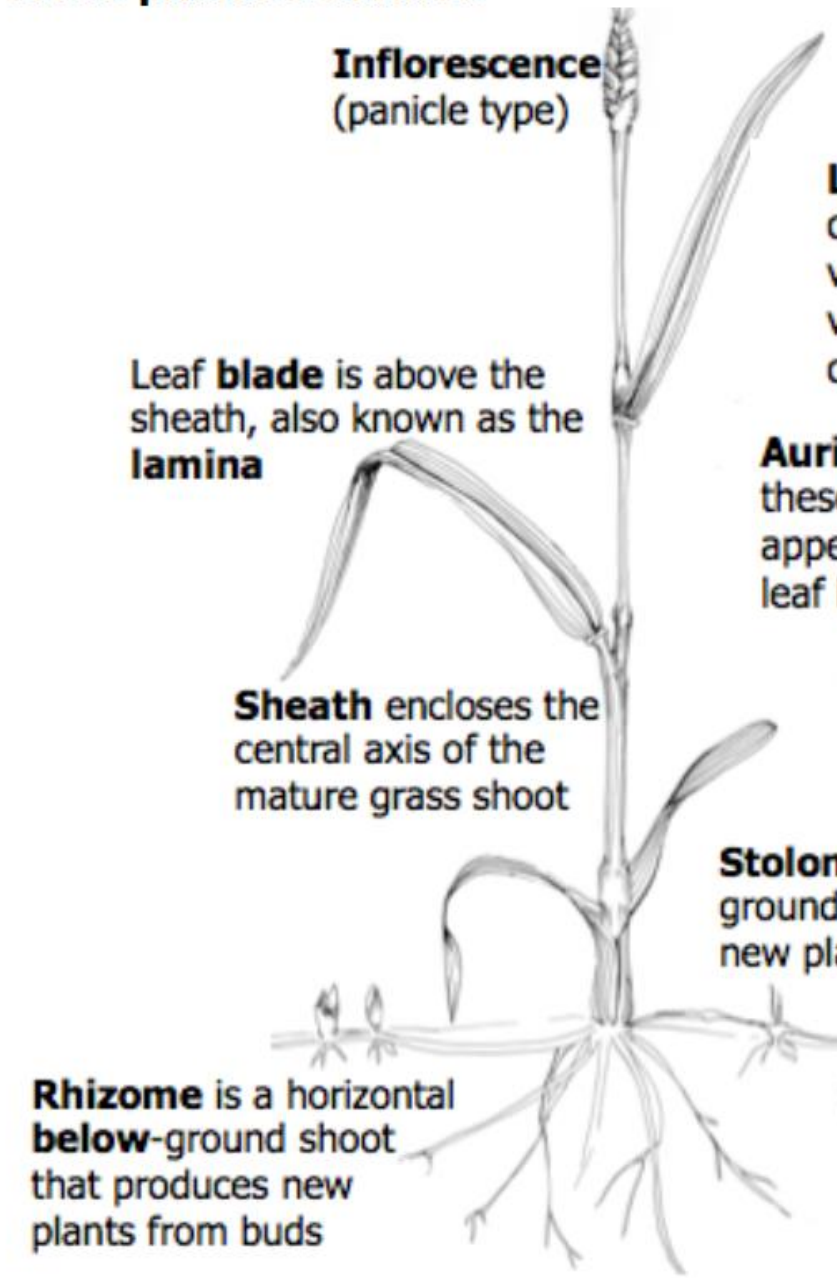
Acuminate
Curving inward; fine point

Cuspidate
Long, thin, sharp tip

Emarginate
Notched towards base

Mucronate
Short abrupt point

Grass plant structures



Inflorescence (panicle type)

Leaf **blade** is above the sheath, also known as the **lamina**

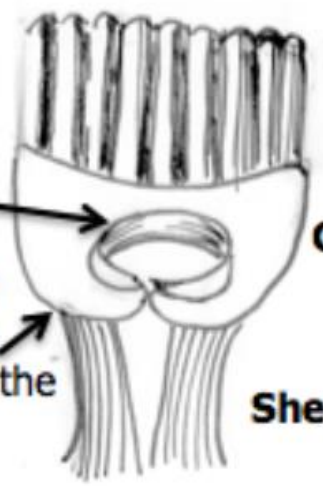
Sheath encloses the central axis of the mature grass shoot

Stolon is a horizontal **above**-ground shoot that produces new plants from buds

Rhizome is a horizontal **below**-ground shoot that produces new plants from buds

Ligule is an extension of the sheath that has various forms; often a vertical membrane or can be bristles

Auricles various shapes of these short, often claw-like appendages at the base of the leaf blade help with ID

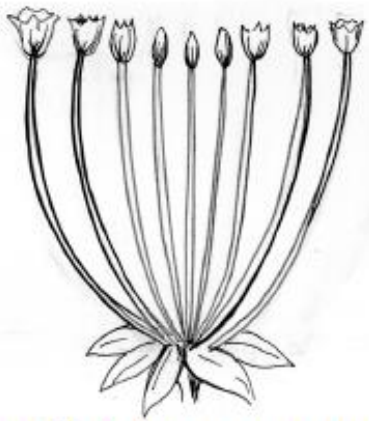


Blade

Collar region

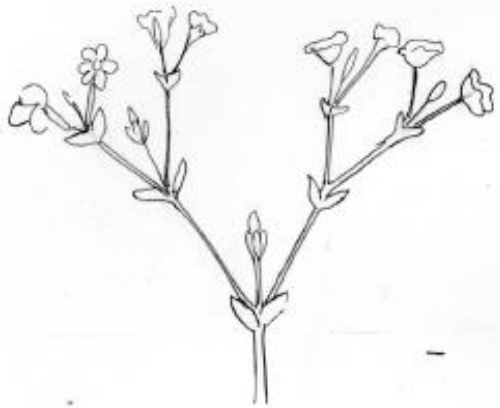
Sheath

Inflorescence type



Umbel flowers originating from a common point with floral stalks of equal length

Corymb flowers along a central axis with floral stalks of unequal length, all ending at the same height



Cyme produce a flat-topped with oldest flowers at the end of main axis

Head produce a short dense arrangement ray and disk flowers

Catkin is a spike-like; often pendent and falling as a unit

Spike has flowers without stalks along a central axis

Raceme has flowers with short floral stalks along a central axis

Panicle is a branched or compound raceme

Solitary is a single flower on a flowering stalk attached to stem

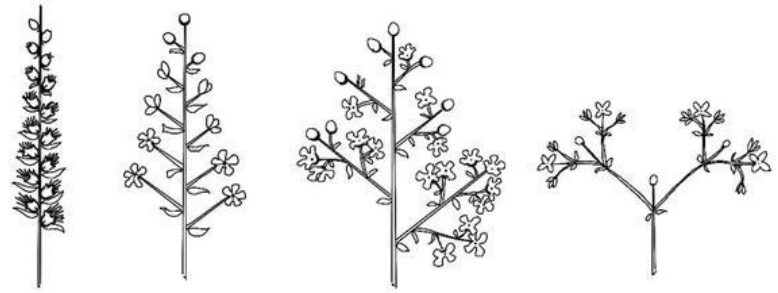
Other Clues

- Bloom Color and Timing
- Fruits and Nuts or lack thereof
- Plant Height, Size
- Site
  - Sun or Shade, Dry or Moist
  - Ornamental Garden or Field
- Verbal description
- (Adequate) Photo
- (Adequate) Sample
- Time of year (what is blooming now)

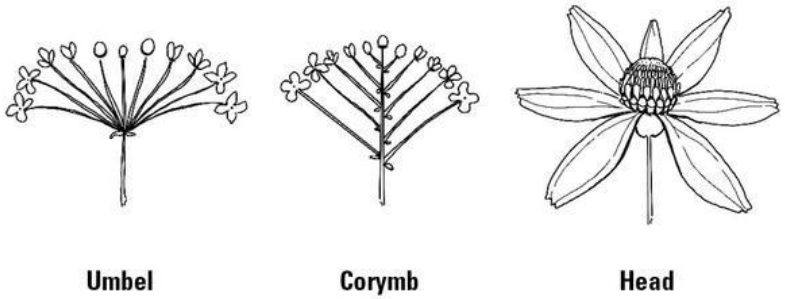
Plant Identification Examples

Twig Arrangement

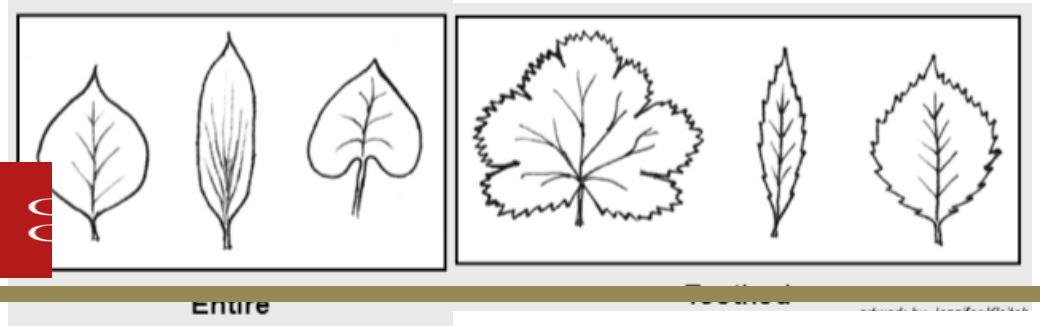
Blossom



Leaf Arrangement



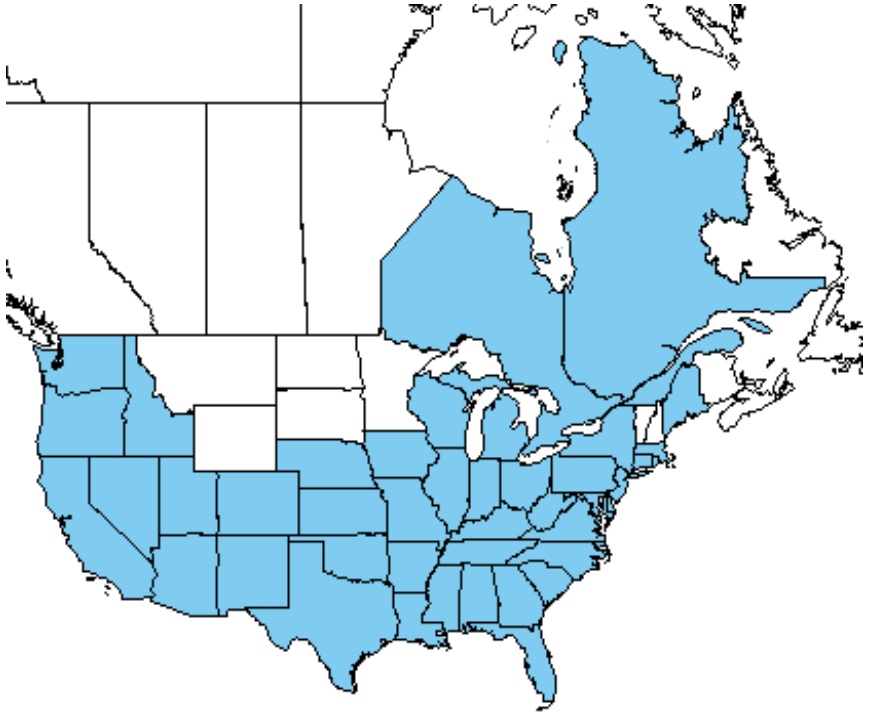
Leaf Margin



Seed

pennsylvania
DEPARTMENT OF AGRICULTURE

Spotted Lanternfly makes use of over 70 different plant species, but strongly prefers the invasive "Tree of Heaven"

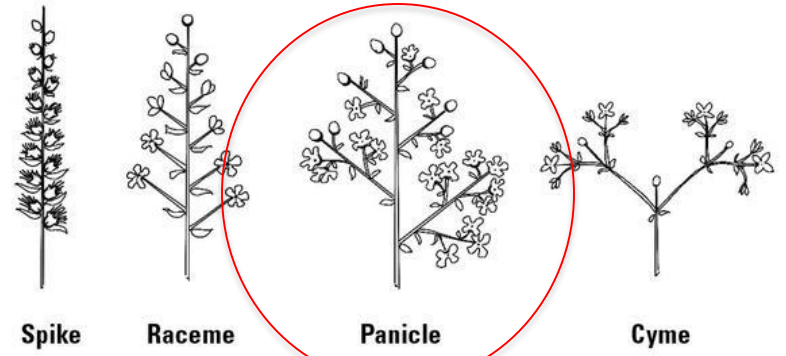


Tree of Heaven Distribution-USDA PLANTS Database

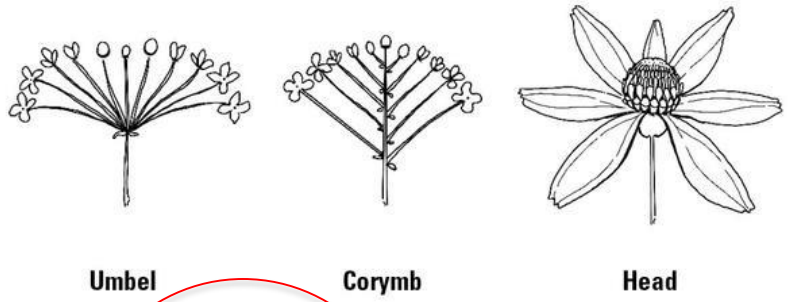
Plant Identification

Twig Arrangement

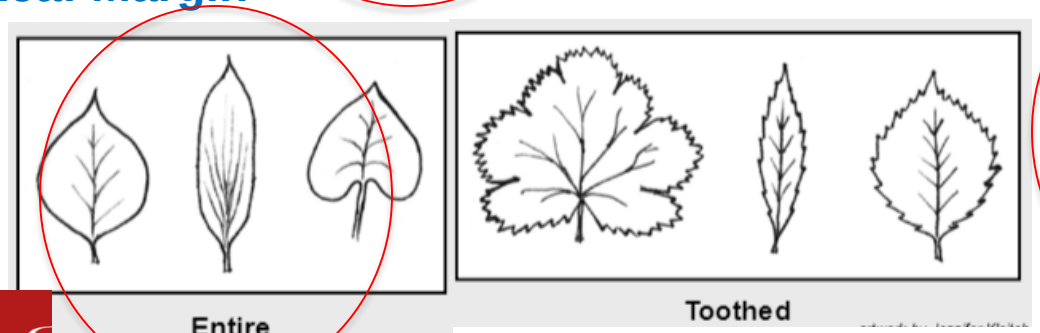
Blossom



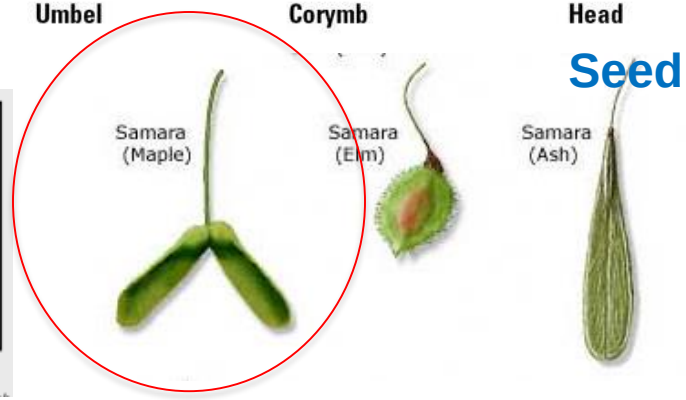
Leaf Arrangement



Leaf Margin

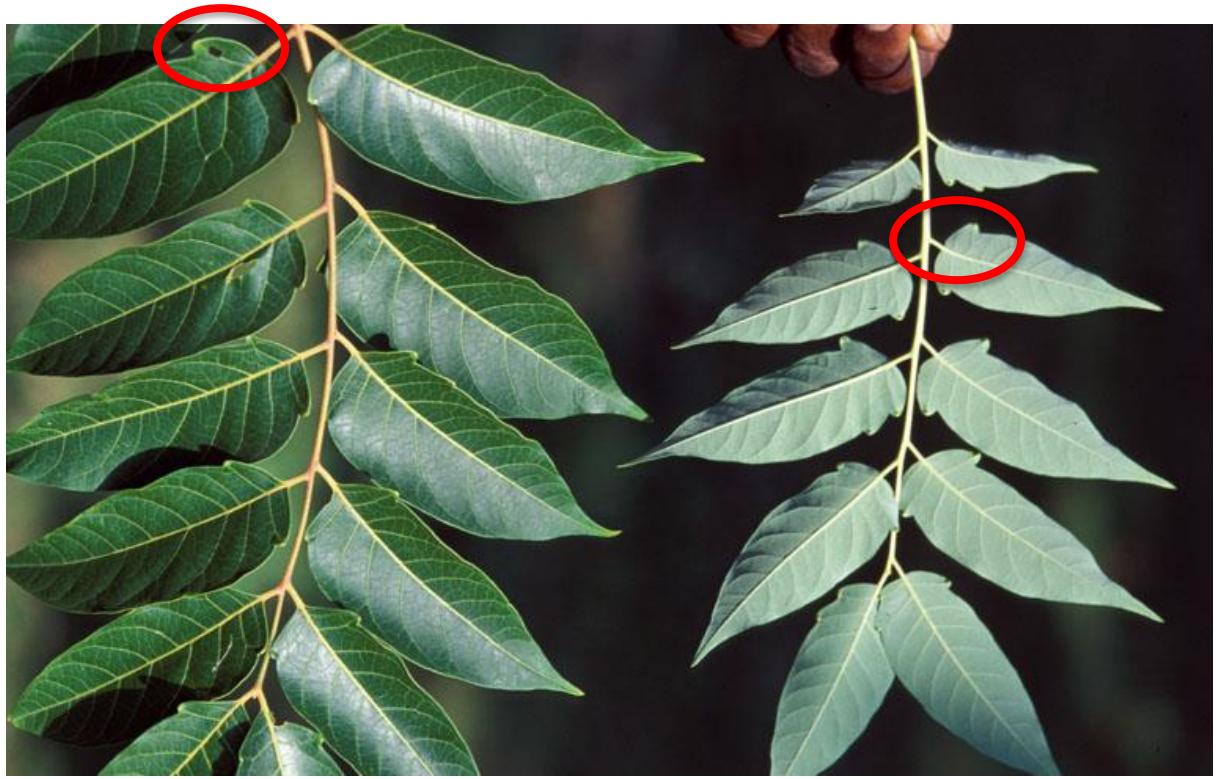


Seed



Tree of heaven, *Ailanthus altissima*

- Large compound leaves w/ many leaflets
- Leaflets have lobe at base
- Alternate branching



James H. Miller, USDA Forest Service, Bugwood.org

Flower characteristics

Tree of Heaven usually has male and female flowers on separate trees. They are arranged in pyramidal clusters. Male flowers have an unpleasant scent.

All photos: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Tree of heaven, *Ailanthus altissima*

Chuck Bargeron, University of Georgia, Bugwood.org

Chuck Bargeron, University of Georgia, Bugwood.org

Fruits in July; has maple/ash-like seeds called ‘samaras’

Bark and twigs

Tree of Heaven has stout olive-brown twigs with large, heart-shaped leaf scars (where the leaves were once attached). The thin bark is pale gray with lighter markings and very smooth.

Look alikes - Sumac

John Cardina, The Ohio State University, Bugwood.org

- Toothed edges to leaflets
- No lobe on leaflet
- Fruit is a pyramidal cluster of berries

e more than 1cm thick and glabrous, per lants of Kentucky and Tennessee.

Leaf scars nearly encircle the buds, per Woody Plants of Kentucky and Tennessee.

Look alikes – Black Walnut

- Rough bark
- No lobe on leaflet

Jason Sharman, Vitalitree, Bugwood.org

- Very distinctive fruits and flowers

Oriental bittersweet, *Celastrus orbiculatus*

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

- They climb and vine up trees
- New vines pop up like snakes
- Inconspicuous flowers in May
- Fruits are red-orange and come out in the fall; fruits and flowers in axils of leaves; ~2-3 per cluster

Look alikes

COMMON HOPS

David Gent, USDA Agricultural Research Service, Bugwood.org

VIRGINIA CREEPER

John Cardina, The Ohio State University, Bugwood.org

- Common hops has u-shaped sinuses and 3-lobes
- Virginia creeper has 5 leaflets, tendrils and no thorns

Avoid Poison Ivy!

Brett Marshall, Sault College, Bugwood.org

Figure X. Ohio State Weed Lab , The Ohio State University, Bugwood.org

What is this Plant? Is it Dangerous? YES

GIANT HOGWEED			
			
HEIGHT 15 to 20 feet	**STEM** 1 to 3 inch diameter Purple blotches, stiff bristles	**LEAF** Compound, lobed, deeply incised; up to 5 feet wide	**FLOWER** White flowers, flat-topped, umbrella, up to 2.5 feet across

What is this Plant? Is it Dangerous?

Wild Carrot, Queen Anne's Lace NO

Wild Parsnip YES

What's Wrong with this Plant?

There are only 3 answers

1. Pests
2. Diseases
3. Abiotic causes

Identifying the plant narrows the possibilities.

Determining the cause dictates the solution.

Pests

- Insects
  - Chewing
  - Sucking
  - Stinging
  - Borers
- Mites, Spiders and Ticks
- Wildlife
- People (neighbors…)

Diseases

Plant disease is any alteration in the physiological processes of a plant, caused by Living organism or non-living agents, which negatively affects the plant.

- A **pathogen** is any organism that can incite a disease. A pathogen is what makes a plant sick.
- A **disease** is the result of a pathogen infecting a plant, which causes abnormal growth or function of a plant.

➢ A pathogen can live in the soil. A disease can't.

Causal Agents of Disease

Living Factors

- Fungi
- Bacteria
- Viruses
- Nematodes

Non-Living Factors

- Nutrient deficiencies
- Mineral toxicities
- Lack or Excess of soil moisture & light
- Too Low or High temperatures
- Air pollution
- Soil pH

Abiotic Damage

Damage is the abnormal growth or function of a plant that is not caused by a pathogen or insect.

- Hail storms
- Grazing by deer or other herbivores
- Damage caused by humans
- Soil abnormalities
- Drainage or lack thereof
- Excessive cold and heat

Cornell University
Cooperative Extension

What's Wrong With My Tomatoes?

Joyce Tomaselli
CCEDC Community Horticulture Educator
jdt225@cornell.edu

Insects

Tomato Hornworm
Hand pick larvae

Aphids
Spray with a
hard stream of water

Whiteflies
Inspect before purchase

Colorado potato beetle
Handpick and destroy beetles, eggs and larvae.

Cutworms
Control weeds
Use Cardboard collars

Flea beetles
Use row covers.
Control weeds.

Physiological Disorders

Fruit Cracking: caused by rapid uptake of water.

Fig. 5 Catface on variety Celebrity | Fig. 6a Concentric crack | Fig. 6b Concentric crack | Fig. 7 Radial cracking

Fig. 11. Yellow shoulders | Fig. 12. Sunscald

Sun damage: lack of good foliage

Blossom end rot: Lack of calcium, inconsistent moisture.

Fig. 1 Blossom-end rot

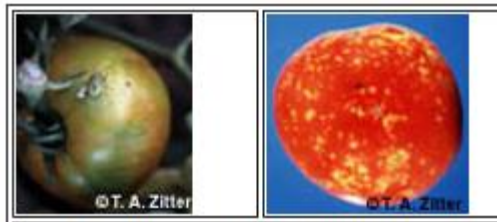


Fig.14. Stink bug leading to Fig. 15. Cloudy spot

Insect damage

Choose resistant varieties, maintain uniform soil moisture by mulching and steady watering and control insects.

Diseases of Tomatoes

Pathogens cause diseases

- Fungi, oomycetes, bacteria, viruses

Know the symptoms vs. the signs

- Usually more than one symptom
- Need physical verification of the pathogen

Know the host and how the pathogen spreads

Must have

1. A pathogen present
2. A favorable environment (usually moisture)
3. Crop susceptibility

The disease, its occurrence and the plant's health determines the severity of damage.

Pathogens and Diseases

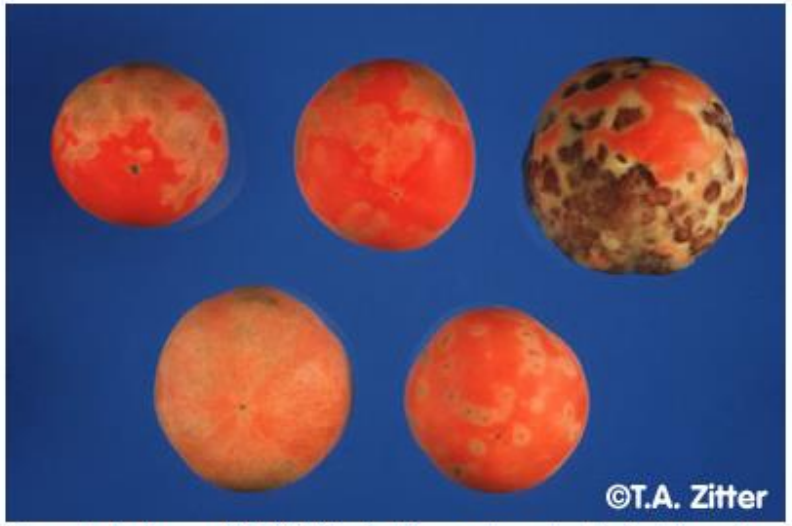
Bacteria

- Cause cankers, spots and specks
- Single celled microorganisms, can overwinter on insects, plant material
- Spread to natural openings (stomates) or wounds by insects, water, equipment

Bacterial spot on immature tomatoes.

Viruses

- Cause mosaics, ring spots, spotted wilts
- Live and replicate in living material
- Spread mostly by insects, also people and tools



Assorted views of TSWV infection on tomato fruit, taken in 1993.

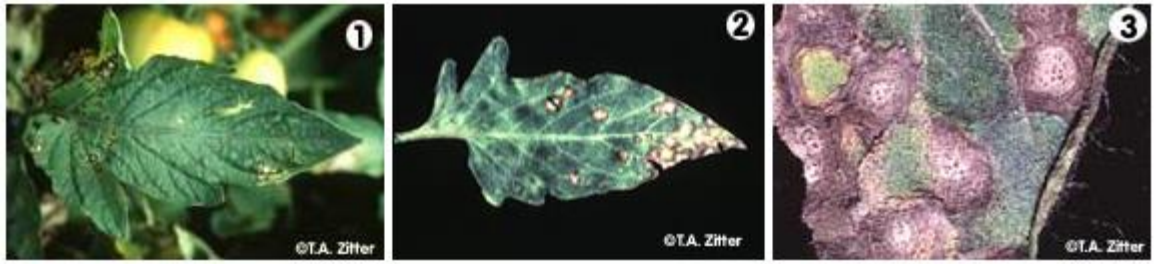
Tomato spotted wilt virus

Pathogens and Diseases

Fungi: Live in soil, spread by splashing water and in water conducting cells

Early Blight

Septoria Leaf Spot



Powdery Mildew

Verticillium & Fusarium wilts

Pathogens and Diseases

Oomycetes

- Cause Late Blight, Downy Mildew, Phytophthora Blight

Phytophthora blight of tomato is also referred to as buckeye rot because of the characteristic lesions on the fruit.

- Called “water molds” but most are terrestrial pathogens
- Spread by spores, swimming and blowing

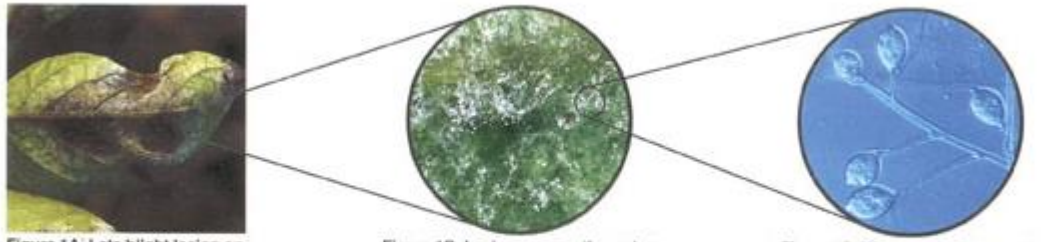


Figure 1A. Late blight lesion on potato foliage. White "fuzz" is *Phytophthora infestans* sporulating from the lesion. (photo: R. V. James)

Figure 1B. Lesion as seen through a hand lens or dissecting microscope. Sporangiophores with sporangia are interspersed among leaf hairs. (photo: K. Loeffler)

Figure 1C. Micrograph of sporangia (lemon-shaped structures) on sporangiophores. Each sporangium is about 0.030 mm in length.

Late Blight

- Late Blight
  - Spreads rapidly
  - Is highly contagious
  - Causes huge amount of damage
- Affects potatoes, tomatoes, other Solanaceae and some annuals (petunia)
- Is an obligate pathogen
  - Needs living host tissue
  - Cannot get into roots
  - Can get into tubers
- Spores spread by wind, up to 30 miles on cloudy days or overnight, and can wash down to soil and tubers

Late Blight on tomato fruit.

Late blight on potato tuber.

Late Blight affects leaves, stems and fruit

Avoiding Late Blight

What can be done to avoid Late Blight?

- Don’t plant table stock potatoes. Seed potatoes are inspected.
- Don’t leave piles of culled potatoes overwinter
- Don’t compost infected plant material or tubers
- Pull up and destroy any potato plants that “volunteer” in spring from old tubers

Managing Late Blight

What can be done to manage Late Blight?

- Plant resistant tomato varieties
- Spray to protect against infection
  - Choose a fungicide that has maneb, mancozeb, chlorothalonil, or fixed copper as an active ingredient AND has tomato and potato late blight on the label
- Monitor crops. Remove and destroy infected material
  - Cutting plants down immediately and bury or bag them
  - Or thoroughly till materials under

➢ Avoid the production of spores that could put nearby farmers and gardeners at risk.

Growing Heathy Vegetables

- Chose a variety of plants with known resistances (i.e. include some which are late blight resistant)
- Follow good garden practices – keep water off of leaves, mulch the soil, gather up and dispose of diseased leaves/fruit
- Always Scout your plants – look for diseases proactively
- Identify diseases properly and understand the potential scope of their damage
- Dispose of diseased material properly (usually not in compost piles, always bagged/”cooked” for late blight).

What's Wrong with My Tomato Plant?

Cornell University Cooperative Extension

PHYSICAL CONDITIONS

Insufficient calcium and moisture in soil cause blossom-end rot.

Rapid uptake of water and temperature fluctuations cause catface/cracking.

High temperatures during ripening and lack of foliage coverage cause yellow shoulders and sunscald.

Photo courtesy UME

INSECTS

Photos courtesy BIVS IPM

Hornworms: Hand pick larvae.

Flea Beetles: Use row covers.

Whiteflies: Inspect before purchase.

Colorado Potato Beetles: Hand pick and destroy.

Aphids: Spray with hard stream of water.

Cutworms: Use plant collars.

DISEASES

Bacteria: spread in openings or wounds; overwinter on plants and insects; cause cankers, spots and specks.

Viruses: spread by insects & people; live and replicate in living materials; cause mosaics, ring spots, & spotted wilts.

Fungi: spread by splashing water; live in soil; cause Powdery Mildew, Verticillium & Fusarium Wilt, Early Blight and Septoria Leaf Spot.

Oomycetes: spread by swimming or blowing spores; cause Downy Mildew, Phytophthora and Late Blight.

Early Blight

Lesions are bounded by leaf veins.

...oms, not ...re brown ...s near stem.

Septoria leaf Spot

Gray round lesion have red-gray borders and tiny black dots in center.

Septoria does not cause lesions on fruit.

Late Blight

Leaf lesions have rounded edges, not bounded by leaf veins.

Lesions are firm and brown.

Lesions on stems are brown with a greasy appearance.

Grow and Manage Tomato Plants

Cornell University Cooperative Extension

Grow Healthy Vegetables

- ✓ Choose plants with known resistances.
- ✓ Follow good garden practices.
  - Water regularly, in the morning.
  - Keep water off leaves.
  - Mulch the soil.
  - Remove diseased plant parts.
- ✓ Dispose of diseased materials properly.
  - Do not put in compost.
  - Bury or bag late blight plants.
- ✓ Proactively monitor plants for problems.
- ✓ Identify and understand scope of problem.

Manage Diseased Tomato Plants

Early Blight and Septoria Leaf Spots

Note: When humidity and temperatures are high, these are common diseases that progress upward from the bottom of the plant .

- ✓ Follow good garden practices as stated above.

Managing Late Blight

Note: Late Blight can occur any time in the season. When humidity exceeds 90%, white spores appear around leaf, stem, & fruit lesions.

- ✓ Follow good garden practices as stated above.
- ✓ Spray to protect against infection before symptoms appear.
  - Use fungicide with active ingredient maneb, mancozeb, chlorothalonil, or fixed copper AND that states late blight on label.
- ✓ Avoid spore production as spores can blow over 30 miles.
  - Cut down plant immediately; bury or bag plant.

https://www.youtube.com/watch?v=j6DaNWHecEE

Becoming a Gardening Detective

- Define the problem, Collect clues
  - What's affected (who)
  - What's the problem (what)
  - What's the situation (when and where)
- Determine the cause
  - Pests
  - Diseases
  - Abiotic causes
- Understand why
  - Synthesize the information
  - Look for patterns
- Inform and Advise
  - Control & Management

Who Done It? **Deer!**