Working Backwards:
Understanding Clues from Plant Damage to Identify Insect Pests

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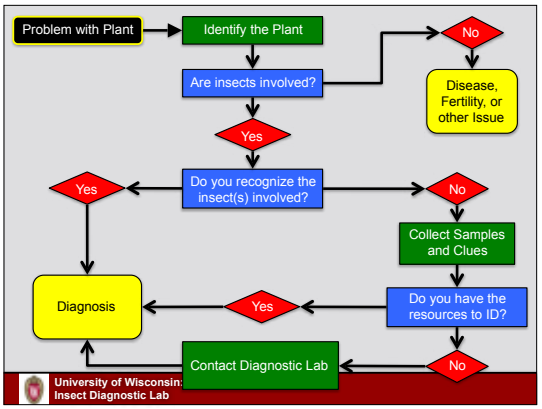

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Garden Insects of North America

- 500+ pages & tons of color photos
- Covers garden & landscape pests
- Low cost (~$30)

- Chapters are based upon type of plant damage:
  - Leaf chewers
  - Sap Suckers
  - Gall Makers
  - Twig/Stem Damagers
  - Trunk & Branch Borers

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What if the Insect is Gone?

- Image RICH
- Focuses on signs of insects
- Variety of images
- Helps with the unusual cases
- Cost ($)

4

IPM of Midwest Landscape Plants

- Chapter 4: Symptom Categories of Plant Damage

http://cues.cfans.umn.edu/old/ipmbook.htm

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Anatomy Dictates Damage

- Insect anatomy dictates the type of damage caused to plants
- Mouthparts usually the structures involved
  - Sometimes other parts as well (*e.g.* ovipositor)
- Anatomy varies by type of insect (beetles, true bugs, etc.)
- Anatomy sometimes varies by stage of development
  - Ex. caterpillars vs moths/butterflies

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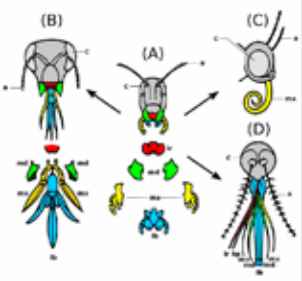
Insect Mouthparts



Insect mouths contain 4 basic parts:
- Labrum
- Mandibles
- Maxillae
- Labium

These 4 basic parts have been modified through evolution for different functions

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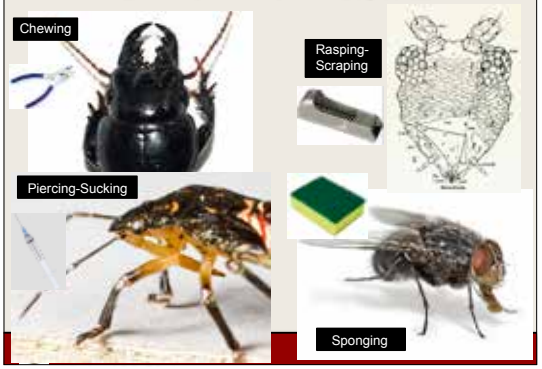
Insect Mouthparts: Types



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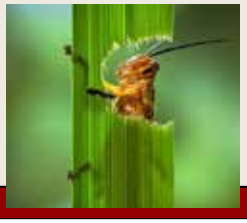
Chewing Mouthparts

- Used to physically chew/cut off pieces of plant material
  - Signs: holes, notches, leaves gone entirely, etc.
  - Also used by borers and leafminers
- Key groups with chewing mouthparts:
  - Beetles
  - Caterpillars
  - Sawflies
  - Ants/bees/wasps
  - Grasshoppers
  - Walking Sticks
  - Earwigs
  - Etc.



Piercing/Sucking Mouthparts

- Used to drink liquids
  - Can't chew holes if they wanted to!
  - Signs: discoloration, speckling, curling/distortion
- Key groups with chewing mouthparts:
  - True bugs: aphids, leafhoppers, plant bugs, scales, etc.
  - Adult moths/butterflies
  - Some bees/wasps
  - Mosquitoes
  - Mites such as spider mites

Rasping Sucking Mouthparts

- Asymmetrical mouthparts
  - Initially scrape plant materials, then slurp up liquids
  - Signs: pale streaks/spots
- Key groups with chewing mouthparts:
  - Thrips

Working Backwards:

- Sometimes, damaging insects may be gone or hard to find, so looking at the signs/symptoms and working backwards is a critical skill
- In other cases, there may be multiple types of insects present and we need to figure out which one is the culprit

Host Plant Specificity

- While some insects are broad generalists (ex. Japanese beetle), there are many insects specialize on certain types of plants
- Knowing the host plant can be an invaluable clue

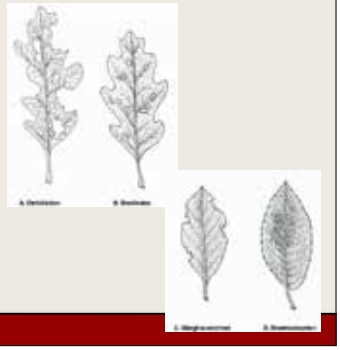
To be a good entomologist, be a good botanist first!

Main Insect Symptoms on Plants

1. Chewing on foliage, petioles, or twigs
2. Discoloration
3. Distortion of plant tissues
4. Dieback or dropping of plant parts
5. Other signs: droppings, cast skins, etc.

1) Chewing on Leaves, Needles, Petioles

- Defoliation
- Shot Holes
- Notched Margins
- Skeletonization



Defoliation

- Large portions of leaves or entire leaves eaten away
- **Top Suspects**:
  - Caterpillars: gypsy moth, eastern tent caterpillar, forest tent caterpillar, euonymus caterpillar, fall webworm, and *many* others!
  - Sawflies: elm sawfly, European pine sawfly, dogwood sawfly, dusky birch sawfly, etc.
  - Others: beetles (such as May/June beetles), grasshoppers, walkingsticks, earwigs, slugs

Defoliating Caterpillars

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Defoliating Caterpillars

- Many other caterpillar species can be found in the landscape
- To narrow down: appearance, host plants, time of year

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Defoliating Sawflies

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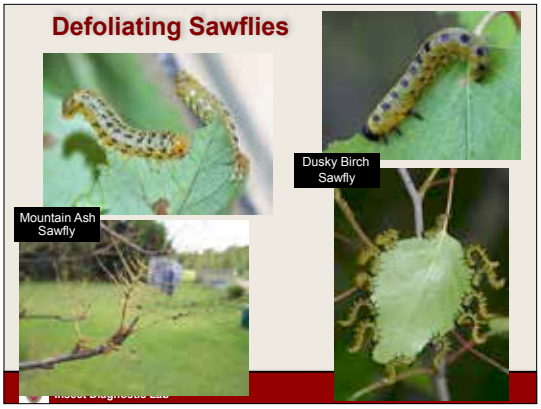
Defoliating Sawflies



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European Pine Sawfly

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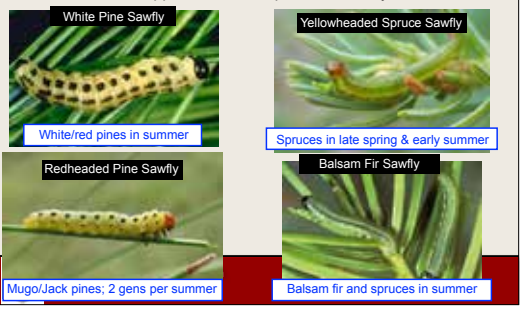
Other Conifer Sawflies

- Many other sawfly species are associated with conifers
- To narrow down: appearance, host plants, time of year



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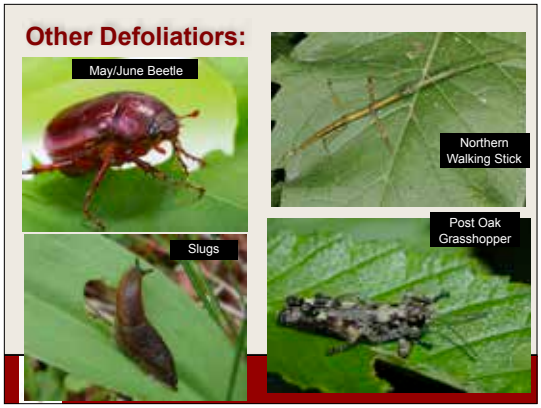
Other Defoliators:



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Shot Holes

- Small holes within foliage
- **Top suspects**:
  - Small caterpillars
  - Leaf beetles
  - General defoliators
  - Shot hole diseases

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Shot Holes:

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Special Case: Hail Damage

- Hail can also cause shot hole injury or tearing of foliage
- Also check for damage / bruising on upper side of twigs/branches

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Notched Margins

- Small notches chewed out of edges of leaves
- **Top suspects**: weevils, small caterpillars, small sawflies

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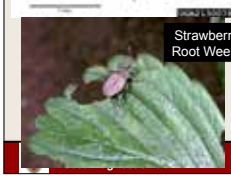
Notched Margins Examples



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Notched Margins Examples

Many species exist; many different hardwood plants attacked

Many species exist; many different hardwood plants attacked

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Special Case: Notched Margins

Can cause minor notching.
They are beneficial pollinators!

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Skeletonization

- Leaves have a lace-like appearance; damage may go partially or entirely through the leaf tissues
- **Top suspects**: some beetles, sawflies, and small caterpillars

Many hardwood plants in summer

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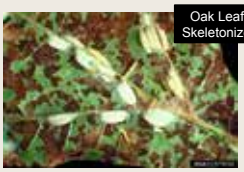
Examples of Skeletonization



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Examples of Skeletonization

On roses in spring & early summer

On oaks in summer

On rosaceous plants in late summer

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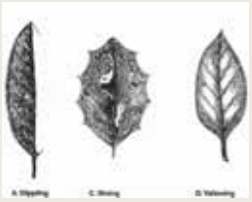
2) Discoloration

- Stippling/Speckling
- Leafmining
- Yellowing/Discoloration



- Plant diseases can sometimes cause similar symptoms!

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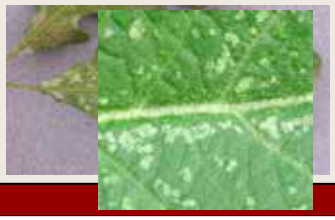
Stippling / Speckling

- Foliage has a speckled appearance
  - Can sometimes resemble sand paper
- Caused by insects/mites with sucking mouthparts
- **Top suspects**:
  - Lacebugs
  - Plant Bugs
  - Leafhoppers
  - Thrips
  - Spider mites



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Stippling:

Lace Bugs

Rose Leafhopper

Ash Plant Bug

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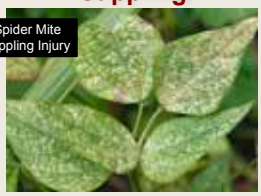
Stippling:

Spider Mite Stippling Injury

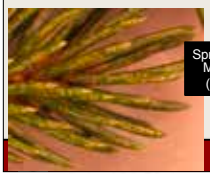


Two-Spotted Spider Mites

Thrive under hot/dry conditions

Produce webbing when populations high

Spruce Spider Mite Injury (Conifers)



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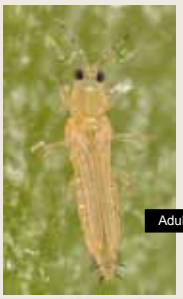
Thrips

Up-close View of Thrips Damage to Foliage



Adult Thrips

Thrips Damage to Flower

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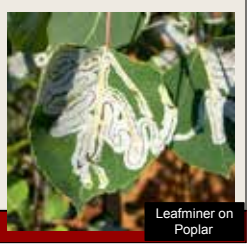
Leafmining

- Brownish patches within foliage
  - May be linear, circular blotches, meandering
- Responsible insects are tiny; use chewing mouthparts to tunnel within the foliage
- Tend to be *very* host plant specific
- **Top suspects**:
  - Caterpillars
  - Flies
  - Sawflies
  - Beetles



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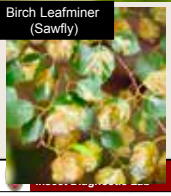
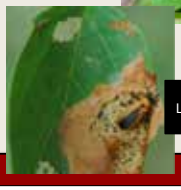
Leafminers





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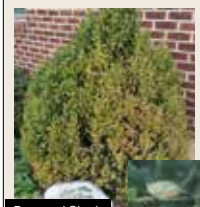
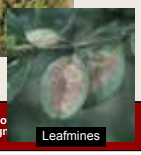
Boxwood Leafminer (Gall Midge)

- Tiny (~1/8" long) yellow larvae live and feed within leaves of boxwood
- Adults active and laying eggs in June


Boxwood Shrub


Dissected leaf w/ larvae and pupae


Leafmines


Emerging Adults

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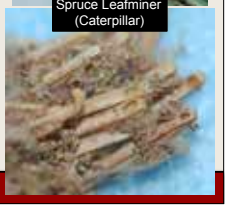
Needleminers


Arborvitae Leafminer (Caterpillar)


Spruce Leafminer (Caterpillar)



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Yellowing / Discoloration

- General discoloration of plant tissues
- Can be a vague symptom; can resemble diseases, fertility issue, etc.
- Top suspects:
  - Aphids
  - Plant bugs
  - Mealybugs
  - Whiteflies
  - Leafhoppers
  - Certain Mites


Yellowing on Grapes due to leafhopper feeding

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Yellowing/Discoloration:


Aphids


Potato Leafhopper & Plant Injury

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Special Case: Four-Lined Plant Bug


Four-Lined Plant Bug (Adult)


Four-Lined Plant Bug (Nymph)

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Erineum Galls


Gall patches on Maple


Up-Close View of Erineum Gall


Eriophyid Mite

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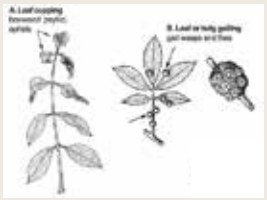
3) Distortion

- Curling/Cupping
- Galls of leaves, twigs, flowers
- Plant diseases can sometimes cause similar symptoms!



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Curling / Cupping

- Foliage distorted and curled
- Caused by insects with sucking mouthparts
- Diseases & herbicide injury can cause similar symptoms
- **Top suspects**:
  - Aphids
  - Plant Bugs
  - Leafhoppers
  - Psyllids


Curled Viburnum Leaves due to Aphids

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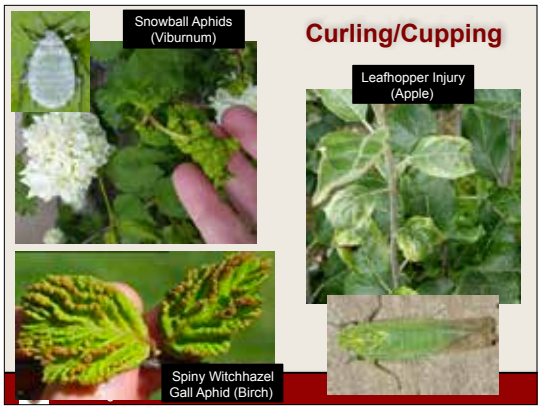

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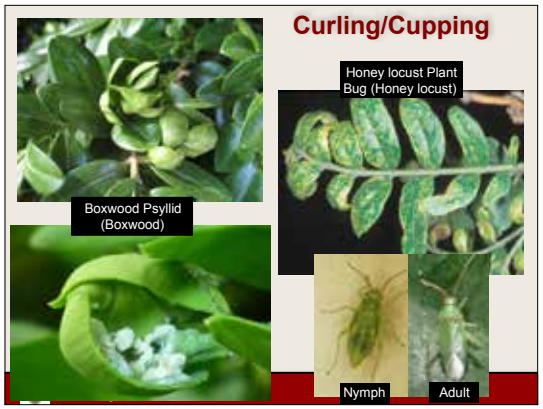

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Galls

- Sever distortions of plant tissues in response to insects, mites, or certain diseases
- Can be caused by a wide range of insects/mites
- Mostly a cosmetic issue; treatment usually not feasible
- Tend to be very host-plant specific!

- **Top suspects**:
  - Wasps (tiny!)
  - Aphids & relatives
  - Gall midges
  - Mites
  - Others: Beetles, flies, etc.

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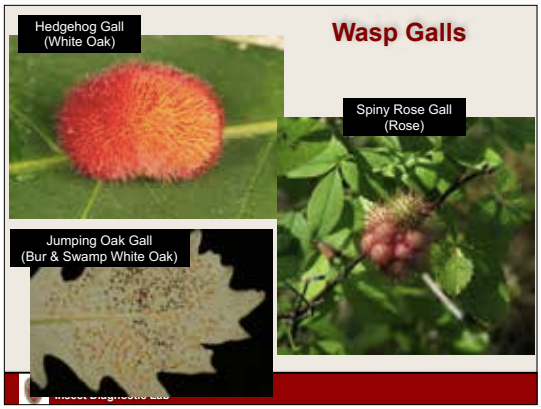

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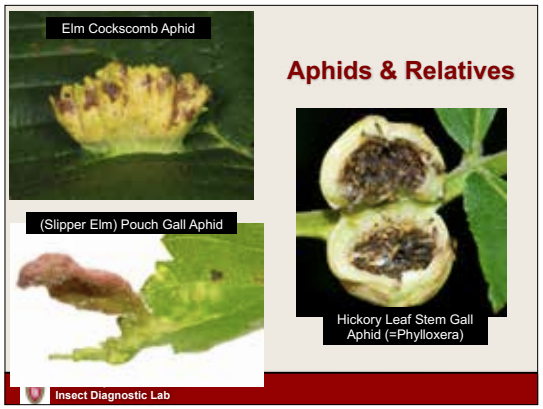

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Eriophyid Mite Galls

Maple Bladder Gall (Maple)

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Eriophyid Mite Galls

Erineum Gall (Maple)

Ash Flower Gall Mite (Ash)

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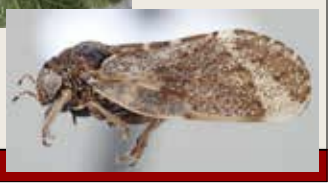
Psyllids

Hackberry Psyllids



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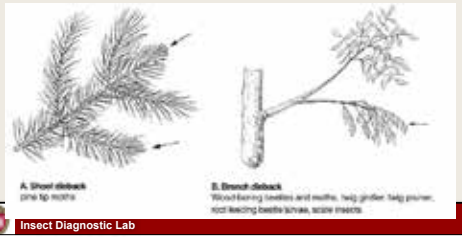
4) Dieback or Dropping

- Shoot dieback
- Branch/Trunk Dieback
- Dropped plant parts



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Shoot Dieback

- Tip of shoot dying
- May involve insect tunneling
  - Check for exit holes, frass, etc.
- **Top suspects**:
  - Caterpillars
  - Beetles

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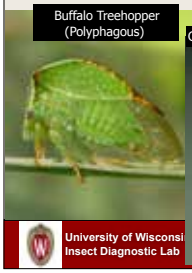
Special Case: Damage Due to Oviposition

- Occasional egg Laing (oviposition) injury can occur from insects such as treehoppers and tree crickets
- Oviposition scars can kill/stunt shoots, twigs & small branches



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Dieback of Branches or Trunk

- Often indicates serious issues
  - Check for signs of disease, technical injury, etc.
- **Top suspects**:
  - Borers
  - Scale insects

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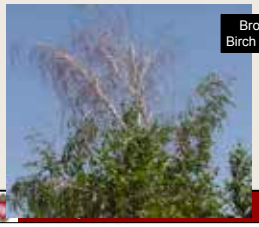
Borers

- Can either be primary or secondary borers
- Important clues: host plant, size of holes, presence of frass, part of plant (twigs, branches, trunk, etc.)



Bronze Birch Borer

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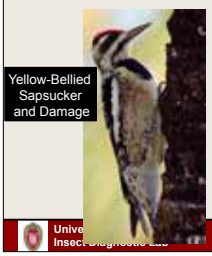
Special Case: Sapsucker Injury

- Can resemble borer activity
- Holes regular in size, often in linear or grid-like pattern
- Typically tolerated by trees; occasionally problematic

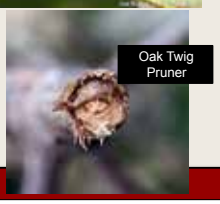

Yellow-Bellied Sapsucker and Damage

Dropped Plant Parts

- Dropped plant parts
- **Top suspects**:
  - Boring insects
  - Squirrels

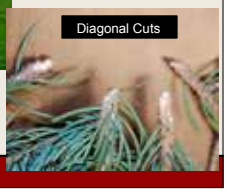

Maple Petiole Borer


Twig Girdler


Oak Twig Pruner

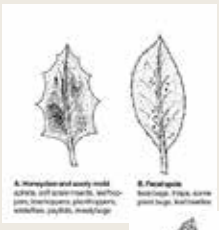
Special Case: Squirrels


Extensive Trig Drop


Diagonal Cuts

5) Other Signs

- Honeydew / sooty mold
- Frass / fecal spots
- Silk
- Protective cases / shelters
- Waxy coverings
- Exuviae (shed exoskeletons)

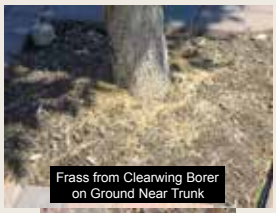


Other Signs:


Up-close view of Magnolia Scale


Magnolia Scale, Honeydew, Sooty Mold and Scavenging Insects

Other Signs:

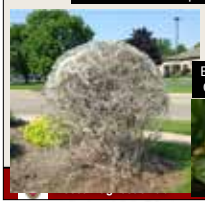

Frass from Clearwing Borer on Ground Near Trunk


Clearwing Pupal Case and Exit Hole


Zimmerman Pine Moth: Oozing Pitch

Other Signs: Silk


Eastern Tent Caterpillar


Euonymus Caterpillar


Fall Webworm

Questions?

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