**Reading the Tree Leaves:**
Understanding Plant Damage to Identify Insect Pests in the Landscape

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**Diagnostics: “Reading the Leaves”**

- Clues on plant ➔ pest ID
- "Working backwards" is a valuable skill, but can be challenging!
  - Damaging insects may be gone / hard to locate
  - May be 2+ insects present and need to determine pest

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**IPM of Midwest Landscape Plants**

http://cues.cfans.umn.edu/old/ipmbook.htm
Chapter 4: Symptom Categories of Plant Damage

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**Anatomy Dictates Damage**

- Insect anatomy dictates the type of damage caused to plants
  - Mouthparts *usually* the structures involved
  - Rarely other parts or anatomy cause damage (e.g. ovipositor)
- Anatomy varies by type of insect (beetles, true bugs, etc.)
- Anatomy sometimes varies by stage of development
  - Ex. caterpillars vs. adult moths/butterflies
**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:**
1. Beetles
2. Caterpillars
3. Sawflies
4. Ants/bees/wasps
5. Grasshoppers
6. Walking Sticks
7. Earwigs
8. Etc.

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**Sucking Mouthparts**
- Used to drink liquids
- **Can’t chew holes if they wanted to!**
- **Signs**: discoloration, speckling, curling/distortion

**Key Groups:**
1. True bugs
2. Aphids
3. Leafhoppers
4. Plant bugs
5. Lace bugs
6. Treehoppers
7. Mites (spider mites, etc.)
8. Thrips
9. Adult moths/butterflies
10. Some bees/wasps
11. Mosquitoes

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**Host Plant Specificity**
- Most herbivorous insects are **specialists**
  - Only feed on certain plants
- **Generalists** tend to be exceptions
- Knowing the host plant can be an valuable clue

**Host plant lists** available:
- Book appendices, websites, publications

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**Host Plant Lists:**
- UMN: IPM of Midwest Landscapes
- Insects That Feed on Trees and Shrubs
- Ash Pests
- A Guide to Major Insects, Arachnids, and Chemical Injury
- University of Wisconsin: Insect Diagnostic Lab
- Whitney Cradler's book on insects
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:
1. Caterpillars
2. Sawflies
3. Others

- Eastern Tent Caterpillar
- Gypsy Moth Caterpillar
- Elm Sawfly
- Mountain Ash Sawfly
- Post Oak Grasshopper
- Northern Walking Stick
- European Pine Sawfly
- May/June Beetle

Shot Holes: Small holes within foliage

Top Suspects:
1. Small Caterpillars
2. Leaf beetles
3. General defoliators

Also consider:
• Shot hole diseases

- Viburnum Leaf Beetle
- Lily Leaf Beetle
- Oak Rust (Lophodermium Pointae) Adult Damage
Notched Margins: Small notches chewed out of edges of leaves

Top Suspects:
1. Weevils
2. Caterpillars
3. Sawflies

Skeletonization: Lace-like damage; nibble around tough veins

Top Suspects:
1. Beetles
2. Sawflies
3. Caterpillars

2) Discoloration

- Stippling/Speckling
- Leafmining
- Yellowing/Discoloration

- Plant diseases can sometimes cause similar symptoms!

Stippling: Foliage has a speckled appearance; can resemble sandpaper

- Caused by sucking mouthparts

Top Suspects:
1. Lace bugs
2. Plant bugs
3. Leahoppers
4. Aphids
5. Thrips
6. Spider mites
**Thrips**
- Adult Thrips
- Up-close View of Thrips Damage to Foliage
- Thrips Damage to Flower

**Spider Mites**
- Two-Spotted Spider Mites & Eggs
- Spider Mites Damage & Webbing

**Leafmining:** Tunnels, patches, blotches within foliage
- Tiny insects; use chewing mouthparts to tunnel within foliage
- Tend to be very host plant specific

**Top Suspects:**
1. Caterpillars
2. Flies
3. Sawflies
4. Beetles

- Aspen Serpentine Leafminer (caterpillar)
- Locust Leafminer (Beetle)
- Boxwood Leafminer (Fly)

**Yellowing:** Foliage turns yellow / chlorotic

**Top Suspects:**
1. Aphids
2. Plant bugs
3. Scales
4. Leafhoppers
5. Planthoppers
6. Mites

- Also consider:
  • Diseases
  • Fertility
  • Abiotic factors

**3) Distortion**
- Curling/Cupping
- Galls of leaves, twigs, flowers

- Plant diseases can sometimes cause similar symptoms!
**Curling / Cupping:** Foliage becomes distorted; curled/cupped/twisted
- Caused by insects with sucking mouthparts

**Top Suspects:**
1. Aphids
2. Plant bugs
3. Leafhoppers
4. Psyllids

**Also consider:**
- Diseases
- Herbicide injury
- Frost damage

**Galls:** Severe distortion of plant tissue caused by insects, mites, diseases
- Mostly a cosmetic issue; treatment usually not feasible
- Tend to be very host-plant specific!

**Top Suspects:**
1. Wasps (tiny)
2. Aphids & relatives
3. Gall midges (flies)
4. Mites

**Also consider:**
- Diseases

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**Galls caused by Aphids & Related Insects**

- Hackberry Galls (Psyllids)
- Cooley Spruce Gall (Adelgida)
- Hickory Leaf Stem Gall Aphid (Phylloxera)
- Spiny Witch Hazel Gall Aphid (=Phylloxera)

**Midge (Fly) Galls**
- Maple gall midge
- Balsam gall midge

**Eriophyid Mite Galls**
- Maple Bladder Gall (Maple)
- Ash Flower Gall Mite (Ash)
- Spindle Gall (Cherry)
4) Dieback or Dropping

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

Shoot Dieback:

- May involve insect tunnels—check for exit holes, frass, etc.

Top Suspects:
1. Caterpillars
2. Beetles

Also consider:
- Oviposition scars
- Diseases
- Mechanical injury

European Pine Shoot Moth (Pine)

Shoot Dieback:

Top Suspects:
1. Caterpillars
2. Beetles

Also consider:
- Oviposition scars
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White Pine Weevil

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European Pine Shoot Moth (Pine)

White Pine Weevil

Dropped Plant Parts

Top Suspects:
1. Borers
2. Squirrels

Also consider:
- Site conditions
- Weather conditions
- Self-pruning (cladoptosis)

Twig Girdler

Dropped Plant Parts

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1. Borers
2. Squirrels

Also consider:
- Site conditions
- Weather conditions
- Self-pruning (cladoptosis)

Twig Girdler

Dieback due to heavy infestation of oystershell scale

If signs of borers found:
- Host plant
- Location on plant
- Size/shape of exit holes
- Presence of frass
- Time of year

Extensive Twig Drop due to Squirrel Damage

Dieback from Bronze Birch Borer

Also consider:
- Diseases
- Site conditions
- Girdling roots
- Physical injury
5) Other Signs

- Honeydew / sooty mold
- Frass / fecal spots
- Silk / cases / shelters
- Tunnels / exit holes
- Waxy coverings
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"Exuviae (shed exoskeletons)"

Questions?