Quaking Aspen

Insect Defoliation & Aspen Canker

Erin Redding

Photo: Unknown
Ecological Importance
Economical Importance

- Crates
- Pallets
- Matchsticks
- Tongue depressors
- Ice cream spoons
- Furniture
- House trim
- Animal bedding
- Saunas

Photo by Tim Morris

Fergus, 2005
Quaking Aspen

*Populus Tremuloides*

Most widely distributed tree in North America.

Can survive temperatures between -57°C and 41°C (Perala and Carpenter, 1985).
Quaking Aspen

*Populus Tremuloides*

- Pioneer species
- Fast growing
- Shade intolerant
- Short life span
- Found on disturbed sites
- Sandy or gravelly soils
Flowering

- Flowers bloom in mid-spring before leaf-out
- Trees are usually dioecious
- Flowers are wind pollinated

Seedling Establishment

• Seeds are wind dispersed

• Germination can occur between $2^\circ C$ and $30^\circ C$ (McDonough, 1979)

• Germination does not depend on light (Faust, 1936 as cited by Barnes 1966)

• Rootlets cannot break through leaf litter. Seeds will only survive if they fall on bare soil (Fergus, 2005).
Root Sprouts

- More common and more successful than reproduction by seed
- New shoots grow from parent root systems
- Vegetative reproduction creates large clones
- Clones can live for thousands of years
- Individual trees in a clone are equally genetically predisposed to biotic stressors

(Barnes, 1966; Fergus, 2005)
Competitors

• Without frequent disturbance, aspen are replaced by trees with longer lifespan and/or more shade tolerance.
• Forest fire keep aspen from being outcompeted
Insect Defoliation

Photo by S. Katovich
Forest Tent Caterpillar

*Malacosoma disstria*

- Lepidoptera
- Native to North America
- Generalist Herbivore
  - *Quaking aspen*, Oaks (*Quercus* spp.), Gums (*Nyssa* spp. and *Liquidambar styraciflua*) (Meeker, 2008)
- Eat buds, flowers, and foliage

Photo by G. McIlveen, Jr.
Life Cycle

of Forest Tent Caterpillar
**Egg masses**
- 100 to 350 eggs
- Form band up to 2.5cm long
- Overwintering stage
- Hatch mid-February to April
- 5 instars

**Mature Larvae**
- Dark gray to brownish black
- Sparse white hairs
- Pale blue lines
- 5 to 6.4 cm
- Spin cocoons of silk in folded leaves
- Transformation takes 10 days

**Adult moth**
- Tan to brown
- Dark lines through forewings
- 2.5 to 4.5 cm
- Late Spring
- Live 1 day to 2 weeks

Meeker, 2008; Batzer and Morris, 1978
Impact on the Tree

- Re-flush smaller, fewer leaves
- Branch dieback
- Crown thinning
- Less carbohydrate storage
- Loss of vigor
- More susceptible to 2° stress agents
- Death

Photo by godurango.com

Gregory and Wargo, 1986 as cited by Fitzgerald, 1995, 226
Predisposing Factors

- FTC is a native insect
  - Many native parasitoids
- Pest can survive temperatures between -40°C and 38°C (Batzer and Morris, 1978).
- Forest fragmentation and edge effects
  - Faster development of outbreaks
  - Outbreaks last longer

(Roland, 1993)
Inciting Factors

• Outbreaks lasting several years
  - Tree loses too much vigor to respond to environment as adapted
Contributing Factors

- Drought
- Insect borers
- Fungi
  - Hypoxylon (canker)
  - Nectria (canker)
  - Fomes (stem decay)
Control Options

• Preemptive
  - Maintain vigorous growth
  - Do not grow aspen in fragmented stands
  - Minimize other stresses

• Reactive
  - Do nothing
  - Physical Removal
  - Pesticides
    • *Bacillus thuringiensis*
  - Biological Control
    • *Entomophaga*
Aspen Canker

Photo by na.fs.fed.us
Hypoxyylon mammatum

- Ascomycota
- Found throughout the range quaking aspen
- Canker rot fungus
Life Cycle

of *Hypoxyylon mammatum*

(Probably...)
Wind or water borne ascospores enter tree through wounds

5-14 months of infection

Ascospore (sexual spores) are produced in perithecia
Brown to black and very small

Conidia (asexual spores) are produced
Gray and powdery

Infect living tissue underneath bark

Photos from Anderson and Anderson, 1979
Impact on the Tree

- Yellow sunken areas
- Canker
  - made up of dead cells
- Girdling of conductive tissue
- More susceptible to 2° stress agents
- Death

Papery bark covering hyphal pegs
Photo by USDA Forest Service Archive, bugwood.org

Anderson and Anderson, 1979
Predisposing Factors

- Insect tunnels
- Wounds
- Open stand structure
- Soil quality
- Water stress
- Age
  - 15-40 years old
- High humidity and low temperatures
Inciting Factors

- Canker girdles enough of the transport tissue to disrupt total tree functioning
Contributing factors

- Secondary fungal infections
- Wind
Control Options

- Do nothing
- Harvest stand early if 15-25% infected
  - Allow aspen to grow back
- Harvest stand immediately if > 25% infection
  - Grow a different species
- Conservative thinning

Anderson and Anderson, 1976
Health Management Plan
for Quaking Aspen

• **Preemptive Strategies**
  — Grow quaking aspen on sites that it is adapted to
  — Do not grow in open or fragmented stands
  — Avoid thinning stress

• **Monitor and Survey**
  — Monitor population patterns of FTC
  — Egg counts
  — Look for signs of fungal infection

• **Reactive Strategies**
  — Remove individuals infected with *H. mammatum*, possibly whole stands
  — Leave genetically resistant clones whenever possible
  — Pesticides
    • B.T.
References

- USDA Plants Profile http://www.fs.fed.us/wildflowers/communities/aspen/grow.shtml
Questions?