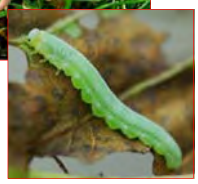
Some Insect Pests of Our Urban Forests

Bob Gara
2014

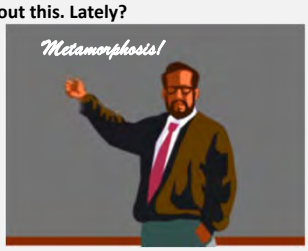
… it's just that there are so many hundreds of insect problems in our urban parks and gardens.

There is no way I can discuss even some of them in any detail .. in 45minutes?



So…

- I feel you already know quite a bit about insects.
- You all know what insect life cycles are about.
- You all were told that insects have metamorphosis.
- But have you all thought about this. Lately?



My plan:

1. **Importance of knowing how insects change their form, *i.e. gradual or complete metamorphosis*;**

2. **Defoliator damage and three examples;**
   - **Spruce aphid**
   - **The tortricids**
   - **Western tent caterpillar**

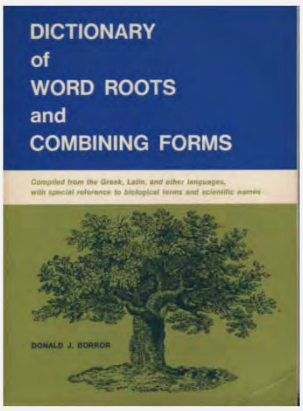
3. **Invaders of trees that are killers (one in particular);**

   - ***Scolytus multistiatus* and the Dutch elm disease**

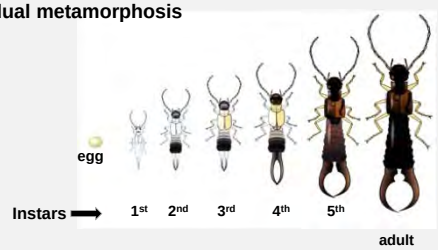
"Metamorphosis"

Meta (L) Change

Morphosis (G) Form



Gradual metamorphosis

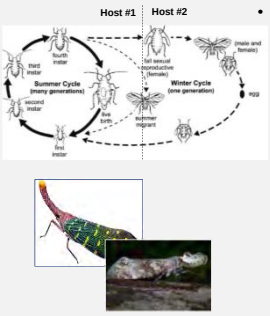


- **all the instars chew (or suck if they are bugs: hemipterans)**
- **all " " compete with one another**
- **all " " (generally) have similar parasitoids and predators**

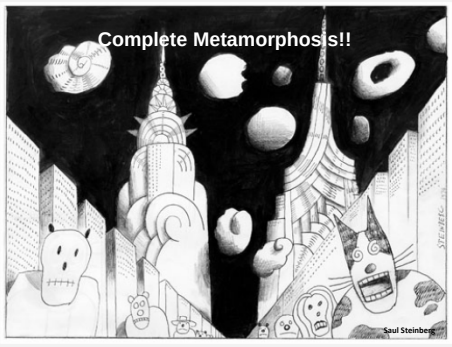
- With gradual metamorphosis there *are no unique ways* for the nymphs to feed, store energy or defend themselves that's different from the adults.
- And the adults are not uniquely specialized for dispersal, finding hosts and reproducing.

- Enemies get the whole mass – nymphs, adults and often eggs!

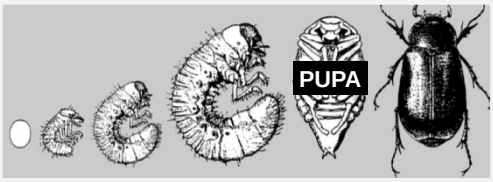
- Applied control is effective because you get them all.
- But timing is still critical as bugs turn into adults and fly off. All at once!
- But, again, natural control is more predictable and more reliable as the pests and enemies have coevolved "face to face" on a two dimensional scale for millions of yrs.



- Those with gradual metamorphosis depend on big-time, but unsophisticated escape methods from their enemies, such as:
  - feed and develop while enemies are not around, *i.e.* winter activity.
  - depend on "razzle-dazzle," alternate hosts, cyclic parthenogenesis, population explosions etc.
  - look weird or scary etc.



Complete metamorphosis



In this case the May beetle:

1. Immatures feed on roots
2. Adults feed on foliage
3. Immatures are specialized for feeding and growing
4. Adults are specialized for reproduction and dispersal
5. You can't treat immatures the same as adults
6. What bridges the gap between these two kinds of insects?

Complete Metamorphosis

Immatures:
- larvae
- grubs
- maggots
- saw flies (larvae)
- caterpillars

Adults:
- moths
- beetles
- etc.. etc.

Evolve

Evolve

You have to be aware of these vast differences in Pest Management

Okay, time to switch gears

Urban trees are impacted by defoliation: some worse than others.

Prof. Herb Kulman's students at the University of Minnesota:

1. **Removed all new foliage on 15 white pines in May.**

2. **Removed, just before budburst, 60% of the buds on 10 maples.**

<u>Results</u>

<u>The white pines</u>: Reduced height growth (80% - 90%) the first yr.; 10% - 40% the second yr. and reduced diameter diameter growth by ≥ 45% over two yrs.

<u>The maple trees</u>: Reduced diameter growth by 47% over two yrs. and one maple died.

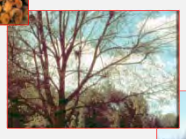
Replanting that maple that died on the U. Minnesota campus

"Now, when defoliation is severe, continuous, or repeated frequently trees *can die across the urban landscape*." Dr. Kulman

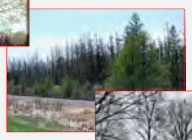
Some explosive examples:

1. **Elm leaf beetle potential;**
2. **Western spruce bud worm;**
3. **Western tent caterpillar;**
4. **Even that insidious spruce aphid.**

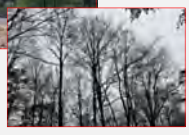
Elm leaf beetle, Syracuse campus



Elm leaf beetle, UW campus



Spruce budworm, park in Yakima



Tent caterpillar, in Victoria, BC

A defoliator of spruce

Spruce aphid (*Elatobium abietinum*) outbreak near Aberdeen WA in 1952.

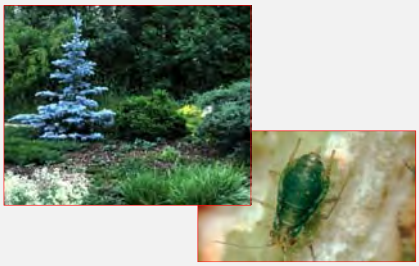
Photo by F.P. Keen from "Insect Enemies of Western Forests."

Sitka spruce along the Washington coast killed by the spruce aphid 1952

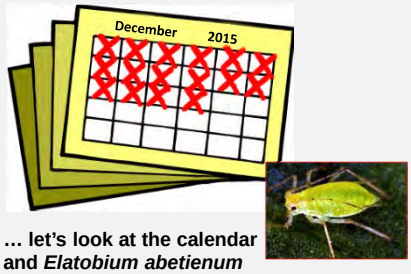
On the other hand, when defoliation is less frequent, or minor, this can happen:

- **Trees look ragged even ugly,**
- **Growth loss occurs,**
- **Trees are weakened and 2^{o} insects attack, also**
- **Conifers suffer more severely than deciduous trees.**

The first defoliator for today: the wily spruce aphid (*Elatobium abetienum*).

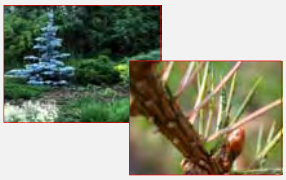


The Spruce Aphid



… let's look at the calendar and *Elatobium abetienum*

It's January 1st.



They are out there feeding on old foliage.
But you don't know it!

It's February 28/29th.

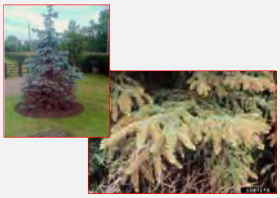
They are still out there feeding on old foliage.
You still don't know it!

It's March 15th

There are lots and lots of them now.

You begin to notice the off-color as old foliage is looking slightly chlorotic.

It's April 15th

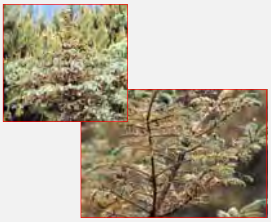


There are Zillions of them now, all sucking away on old foliage.

You begin to notice this as the old foliage is looking really bad.

It's April 16th

They are gone!!
Gone! (¥ & !! Ø ɖ Ψ ♫)



It's May 15th

Only new growth left.
"WAIT UNTIL NEXT YR."!

Remember!

It's late winter – early spring: They are still there!

A well timed spray will get them now!

Let's talk about a moth family that's a huge world wide pest problem: gardens, crops, parks, timber etc.

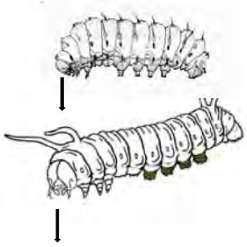
Family: Tortricidae:

"Little Triangles"

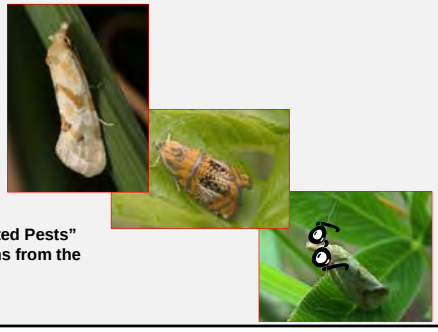
" If larvae are disturbed they 'flip-out, go bananas' etc." Mandibles point forward, instead of downward.

Tortricid (Tortricaedae) mouths point straight along the horizontal axis of the caterpillar.

Other caterpillar mouths point downward



The tortricids are among the most economically important forest, park and garden defoliators in the world, as well as being awful agricultural pests. They are flat-out terrible!



"Most Wanted Pests" photographs from the post office.

Examples of tortricids

Some of their common names based on what they do: leaf tiers, leaf folders, leaf crumplers, leaf rollers, seed and cone feeders, apple worms!, you name it!

Fruit moths such as the plum moth or codling moth (apple worm).

Cone and seed moths

Shoot moths, such as the European pine shoot moth.

Cherry bark tortrix: go into the bark of trees.

Speaking of leaf rollers…..

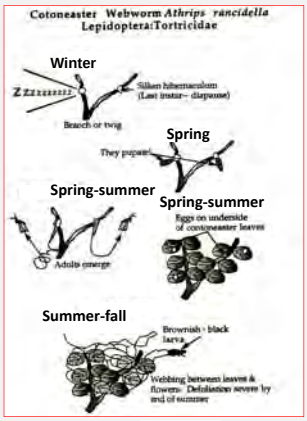
Contoneaster webworm, Athrips rancedella

Characteristics:

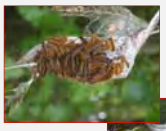
- **triangle shape adult**
- **webbing**
- **nervous larvae**

Cotoneaster webworm

Typical tortricid we have in the PNW: cotoneaster webworm.



Western tent caterpillar, *Malacosoma californicum.*

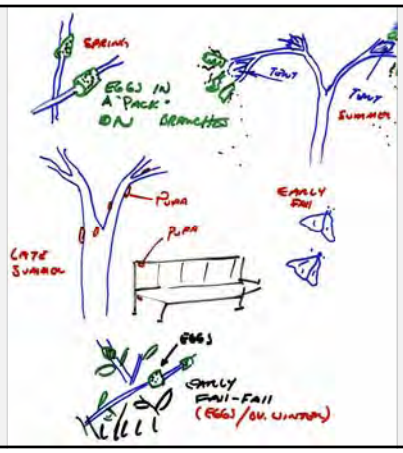


Tent at end of a branch

Tent around branches

An adult

Outbreak in Oregon 2004 - 05



Life cycle of *M. californicum*

COMMON INSECT PROBLEMS — Tent Caterpillars, Skeletonizers, Spider Mites

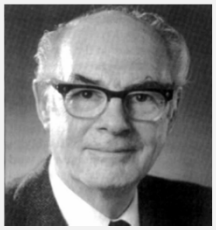
CI-12 TENT CATERPILLARS

The most common tent caterpillar is the western tent caterpillar, *Malacosoma californicum*, which has a checkered yellow appearance and a blue dashed line down the center of the back. There is also a bluish-black species (with keyhole markings down the back) called the forest tent caterpillar, *Malacosoma distria*, but it is not particularly common around the Puget Sound region. The western tent caterpillar is famous for its epidemic cycles on many kinds of trees for two or three years. Then they almost disappear for several years following these epidemic outbreaks. (A.L. Antonelli)

Control: Pick them off, destroy tents, or spray with Bt if necessary. Time sprays to control early instars; the tents still aren't sturdily made and the Bt will get to the larvae. The Bt will also be infested as larvae feed.

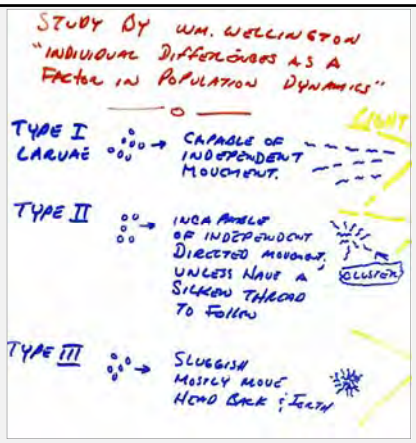
Well all of this is extremely interesting. Right?

The western tent caterpillar: *Malacosoma californicum*

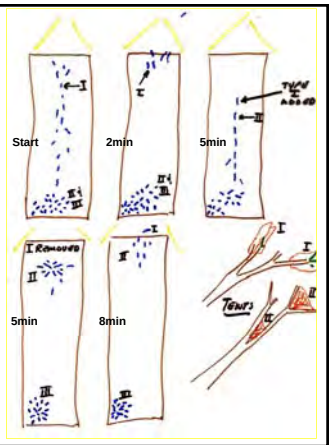


Wellington, W.B. 1957. Individual differences as a factor in population dynamics: the development of a problem. Can. J. Zool. 35:293-323.

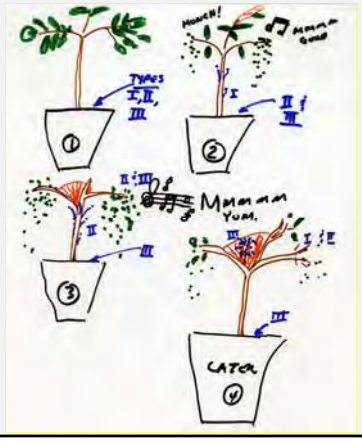
A brief description of Wellington's experiments.



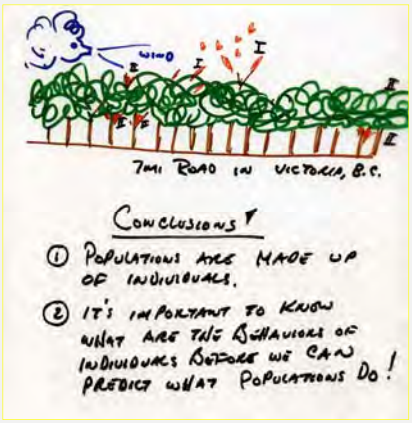
More experiments of shining a light at one end of a table-top runway



Potted red alders



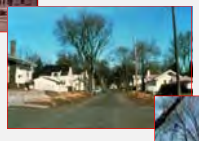
Some food for thought!



Type I and Type II tents

The Dutch elm disease and a barkbeetle

Syracuse University 1938



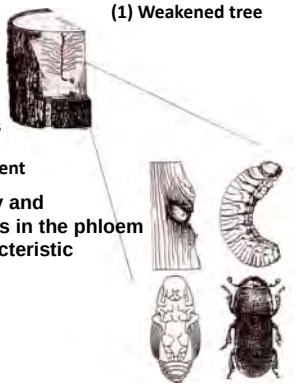
Syracuse 1965

Syracuse 1966

(1) Weakened tree

(2) Host selection
- chem. signal
- host finding
- pheromones

(3) Brood establishment
- Egg gallery and larval mines in the phloem form characteristic patterns



(1) Let's now put together the life of a barkbeetle with that of a terrible fungus, *Ophiostoma ulmi.*

(2) Remember! That the barkbeetle, *Scolytus multistriatus,* spend most of their life cycle under the bark of dead elm trees: in stems and larger branches.

(3) Remember! *S. multistriatus* is a beetle with complete metamorphosis.

Called the Dutch elm disease because it was first reported and studied in Holland in 1919.

In 1930 a huge European elm log that carried both the fungal disease and the bark beetle, which

vectors the fungus, was brought into the U.S.A.: Rahway, N.J.

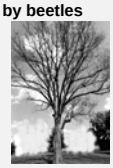
The Dutch elm disease is caused by a fungus called, *Ophiostoma ulmi* and there are several more aggressive strains, one called *O. novo-ulmi.*

The most important bark beetle that vectors the disease is called the European elm bark beetle, *Scolytus multistriatus.*

The fungi and the bark beetle are effectively wiping out the American elm.

The link between the bark beetle and the disease is insidious and self generating: here are the steps in understanding this union.

elm weakened by disease and later killed by beetles



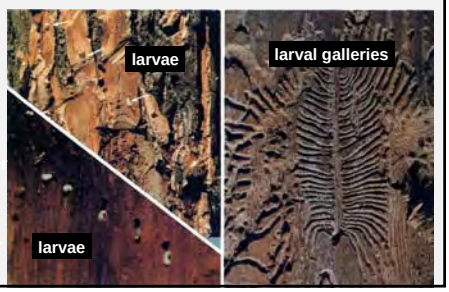
healthy elm

(step #1)

elm weakened by disease and later killed by beetles

(step #2)

bark beetle brood developing



S. multistriatus developing under bark of dead American elm

the bark beetle-killed elm tree

(step #3)

the bark beetle gallery where larvae are developing into adult *S. multistriatus*

coremia that contain sticky spores of the disease, *O. ulmi,* developing in the bark beetle galleries

(step#4)

The newly formed adult *S. multistriatus*, fly off in search of a new host -- but, the females are sexually immature!

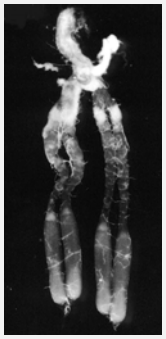
sticky spore **covered with spores**

(step #5)

These sexually immature females *have to fly to the top of a healthy elm*. There they feed in the crotchlets of twigs and branches. In this manner, the females take up amino acids necessary to mature their ovaries.

***Scolytus multistriatus* ovaries**

Before feeding



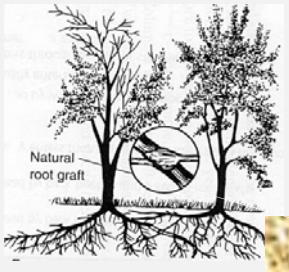
After feeding

(step #6)

As the sexually immature females feed they deposit fungal spores in the feeding wounds.

The spores germinate and the developing vegetative growth of the fungus plugs the water-conducting tissues.

Branch by branch the tree wilts as water can't get to the foliage!!



Dutch elm disease also spreads from infected tree to healthy tree by root grafts.

You know when elms are infected by looking at the vascular tissues.

Management

- ❖**prevent root grafting**
- ❖**sometimes systemic fungicides work**
- ❖**injecting competing fungi shows promise**
- ❖**pruning to remove infected branches early in development of the disease there is promise that resistant elms will become available in the distant future**
- ❖**hybrids between Siberian elms and American elms shows promise too**
- ❖ **… injecting prized elms with competing fungi**