

PSEP: Pesticide Safety Education Program

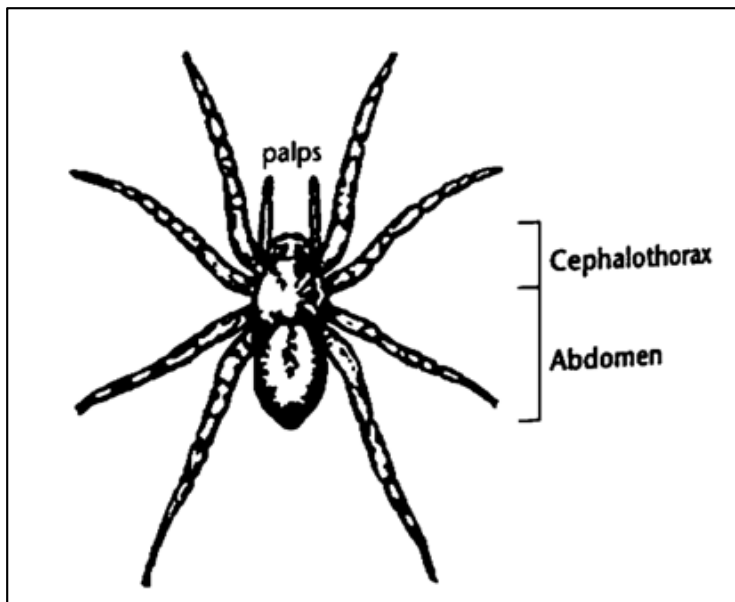
INSECTS & DISEASES

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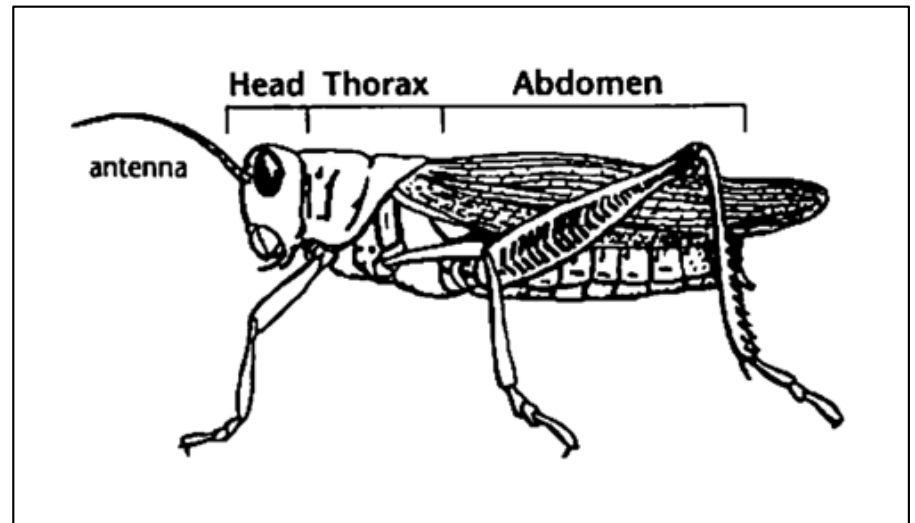
Jan 30, 2019

Insects & their

Relatives*



* Mites, spiders,
daddy-long-legs



INSECT PESTS:

competes with interests

Beneficial INSECTS:

- pollinators
- decomposers
- predators
- parasites



Integrated Pest Management (IPM)

Use of effective **MULTIPLE** strategies to attain an economically **acceptable** yield or **plant quality** while causing the least disruption to the environment

Integrated Pest

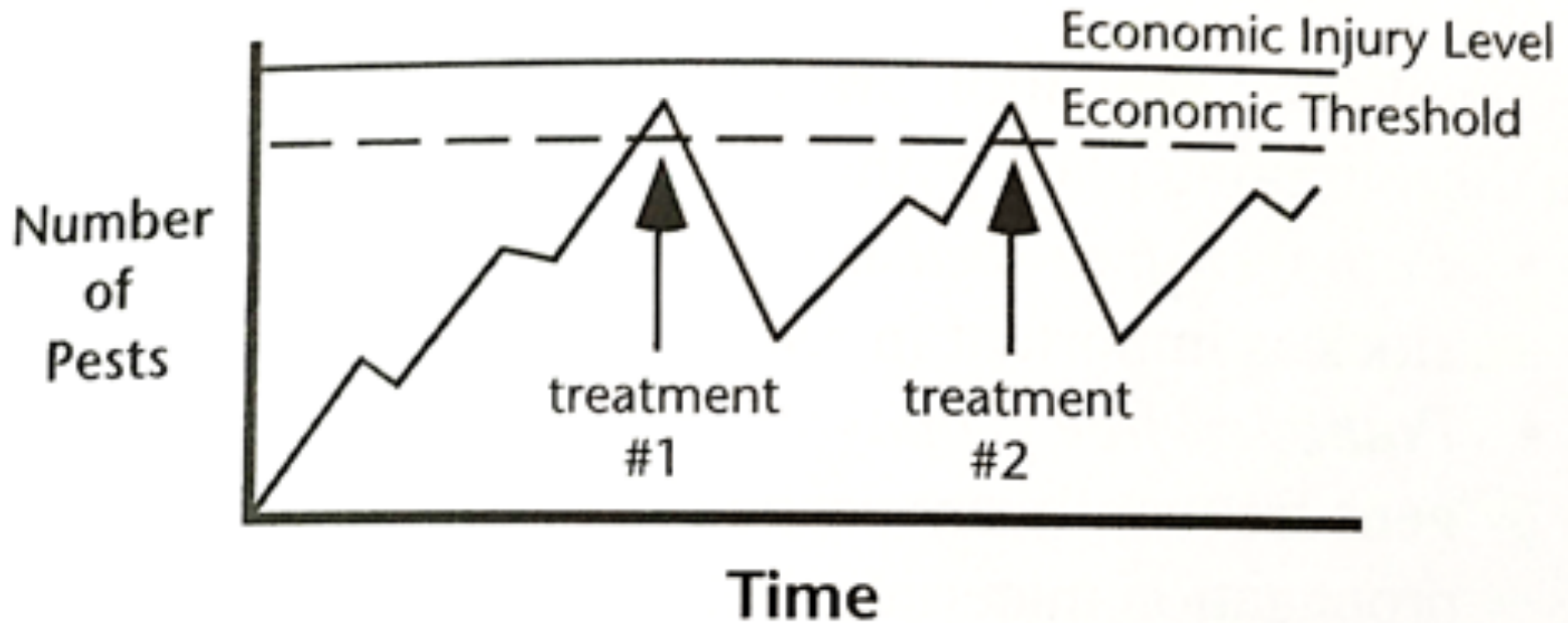
Management (IPM):

Usually means suppression,

NOT mean eradication*

or elimination*.

* Rarely advised unless pest is new to area, damages high-value crops or serves as a disease vector.



Economic Threshold (ET)

Act to Prevent Reaching Economic Injury Level

Economic Injury Level (EIL)

Damage Greater than Control Costs

IPM Principles



- Identify the insect
- Learn about its life cycle and the life cycle of its host

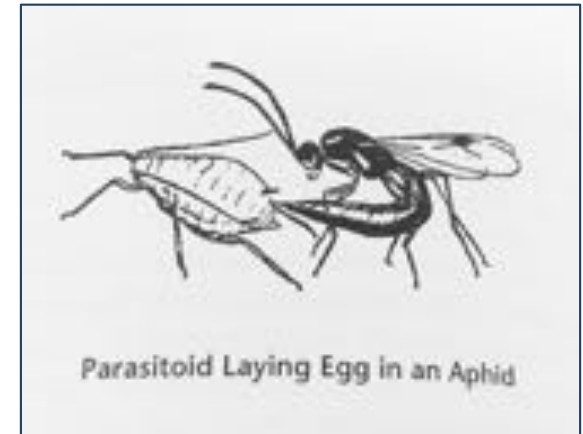
Important when determining the best time to implement management techniques. Most pests are susceptible to pesticides only at specific times in their life cycle.

IPM Methods

- Resistant varieties (Cat 4: apple scab)
- Crop rotation (Cat 3: root maggot)
- Cultural control (Cat 4: water & fertilize birch to help withstand bronze birch borer)
- Mechanical & physical control
(Cat 7, Cat 10: heat, traps, barriers, electrocution)

more IPM Methods

- Regulatory control
(Cat 1: root knot nematode)
- Biological control
- Sanitation (Cat 3, Cat 4 examples)
- Chemical control

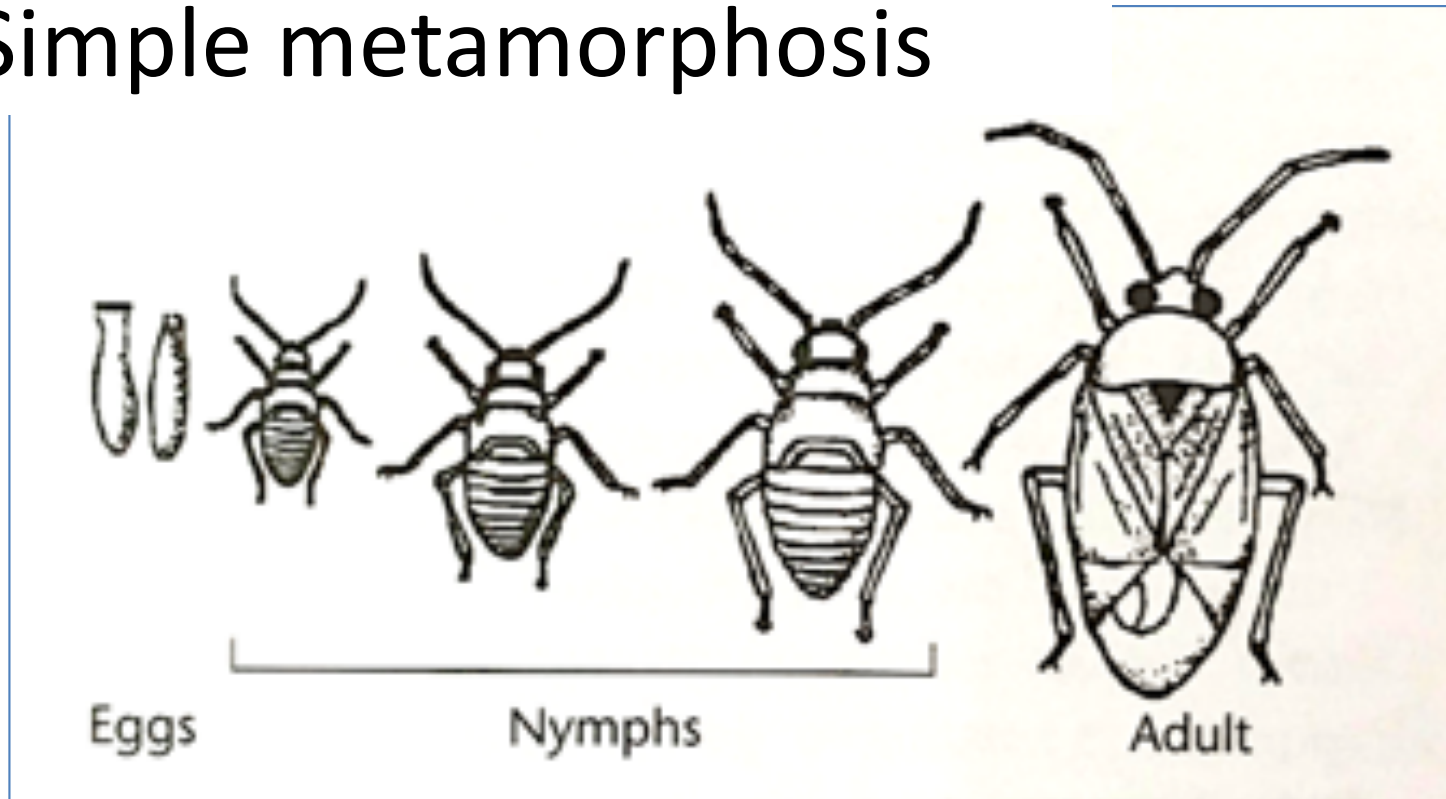


CHEMICAL CONTROL

- Best used with cultural controls
- Economic threshold
- Insect life cycle
- Disease management, fungicides usually more effective than bactericide
- Alternate or tank-mix products with different modes of action

Insect Growth & Development

Simple metamorphosis



Complex (complete) metamorphosis

1) egg 2) larva 3) pupa 4) adult

Adults	Larvae
Moths and Butterflies	caterpillars, inchworms, loopers, leafminers, cutworms, borers, webworms, leafrollers
Beetles	grubs, wireworms, borers, billbugs
Flies	maggots, grubs, leafminers



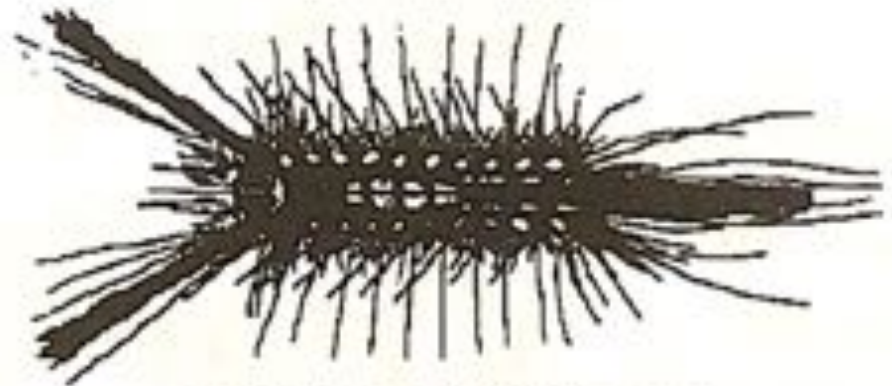
Wireworm



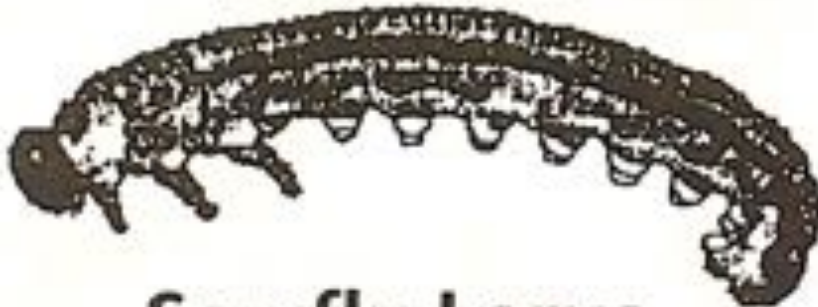
Fireweed Hornworm



Root Maggot



Tussock Moth



Sawfly Larva

Larvae

No army worm in Alaska (2018)

Insect classification

Insects

- Grasshoppers
- Earwigs
- Thrips
- True bugs (Lygus bug)
- Aphids & psyllids
- Leafhoppers
- Spittlebugs



Photo by Sherry Lee Bottoms

- Scales & mealybugs
- Whiteflies
- Moths & butterflies
- Beetles
- Flies, gnats, mosquitoes
- Ants
- Bees
- Sawflies
- Parasitic wasps



Photo by Julie Riley



Photo by Sherry Lee Bottoms

MOSQUITOES

- Alaska has about 35 species
- Two groups:



*Culiseta
alaskaensis*

Floodwater (temp. standing water), *Aedes*

- Eggs can be laid on damp soil and can even dry out before hatching*

Permanent (standing) water, *Culiseta*

- Eggs cannot dry out
- Can overwinter as adults

* *Hatch when conditions are wet after a rain.*

Historical photos of mosquito control



PN-682

FIGURE 25.—Spraying near Fairbanks with one-half pint of 20-percent DDT per acre. Picture taken at midnight.



PN-826

FIGURE 19.—Applying DDT dust as a prehatching treatment on snow at Anchorage.

USDA Agriculture Handbook No. 182,
The Mosquitoes of Alaska, 1961

Insect classification

Insect relatives

- Spiders
- Spider mites
- Eriophyid mites
- Smyphylans



Photo by Sherry Lee Bottoms

Spiders hatching

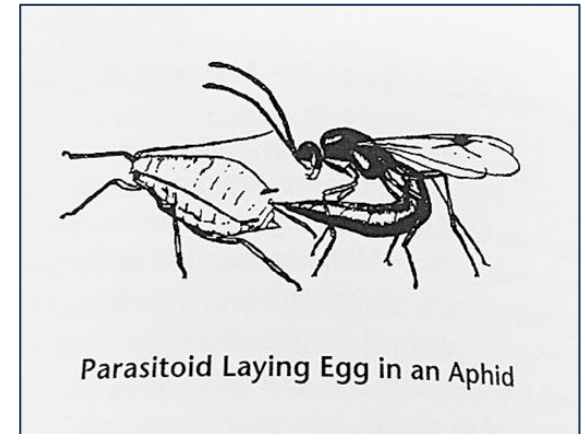
Damage caused

- Chewing insects
- Piercing-sucking insects

Leafhoppers and aphids vector diseases

Natural enemies

- Predators
- Parasites & parasitoids



CHEMICAL CONTROL

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Insecticides

Modes of Action

Contact insecticides

Systemic insecticides

Control can be:

- Selective (narrow-spectrum)
- Broad-spectrum

Persistence

- Nonresidual
- Residual



Insecticide Classifications

Traditional



Inorganic (non-carbon based)

- Derived from minerals (B, S, Zn)
- Act as stomach toxins
- Highly toxic to mammals & nontarget organisms

Traditional

Botanical organic insecticides

- Derived from plants
- Includes nicotine, rotenone, pyrethrums



Photo by Julie Riley

Traditional

- **Synthetic** ORGANIC insecticides
 - Chlorinated hydrocarbons
 - Organophosphates
 - Often **more acutely toxic** to people & mammals than chlorinated hydrocarbons
 - **Cause greatest # of pesticide-related illnesses**
 - Carbamates -- Pyrethroids
 - Spray oils

- **MICROBIAL Insecticides**
 - Bacteria, *Bacillus thurengiensis* (BT)
- **Insect growth regulators**
- **Insect attractants**
- **Insect pheromones**

Emerald ash
borer trap



Photo by Sherry Lee Bottoms

Plant Disease



What is PLANT DISEASE?

Plant varies from healthy condition



- **Infectious agents**
 - living, transmittable
- **Non-infectious agents**
 - non-living, not transmittable



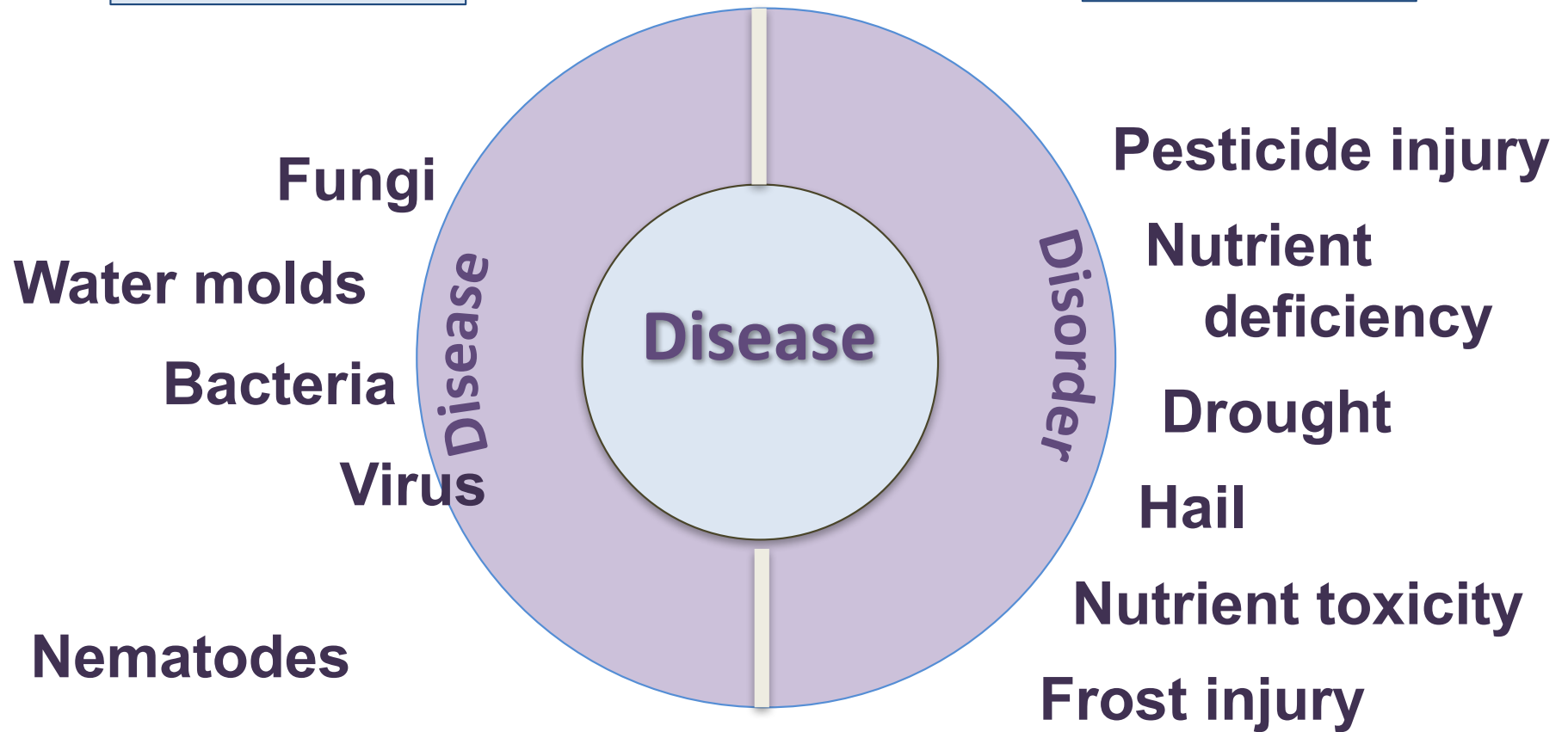
Non-living, abiotic



Living, biotic

BIOTIC
(living)

ABIOTIC
(non-living)



PATHOGENS

PATHOGENS

* Organisms capable of causing disease

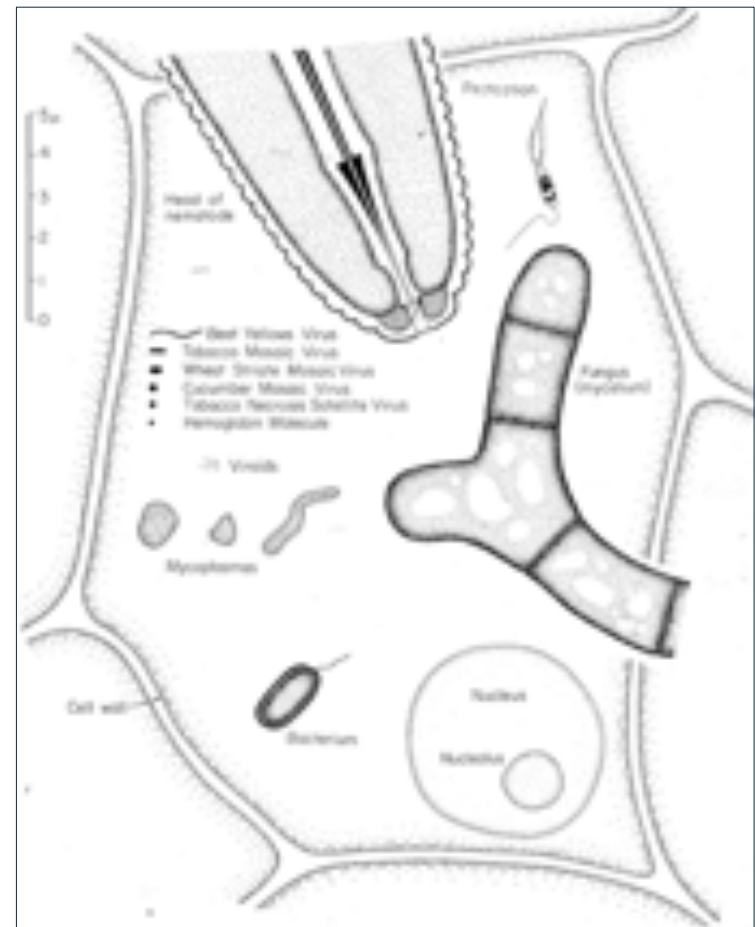
Fungi

Bacteria

Viruses

Mycoplasmas

Nematodes



Fungi

- Cause nearly all of the economically important diseases.
- Characterized by filamentous mycelium.
- Non-photosynthesizing, exudes enzymes to absorb food.
- Reproduces by spores and fragmentation.

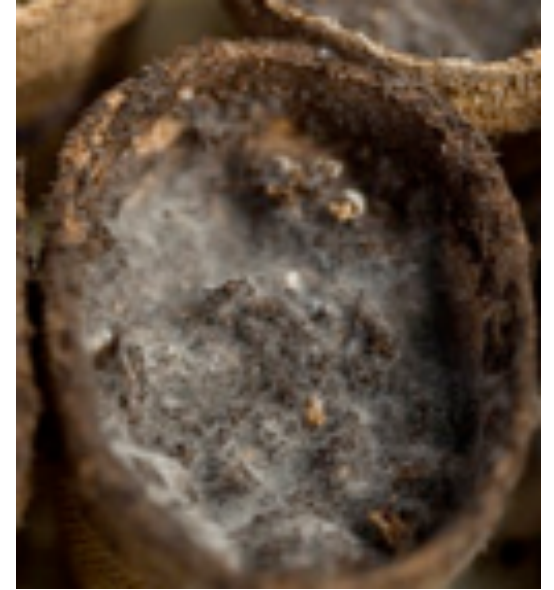


Photo by G. Gordon Pyle

Fungal diseases

- Powdery mildew
- Black knot
- Dry rot

Wood Decays and Stains.....

Pini Conk or Red Ring Rot.....

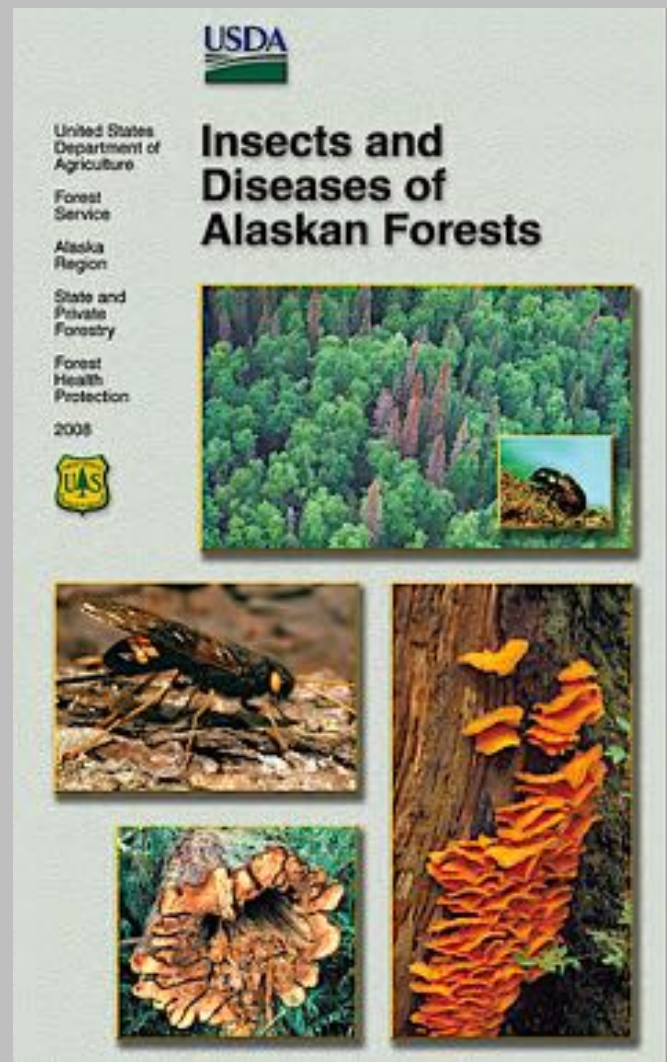
Pinicola Conk or Red Belt Fungus

Chicken of the Woods or Sulfur Fungus

Velvet Top Fungus

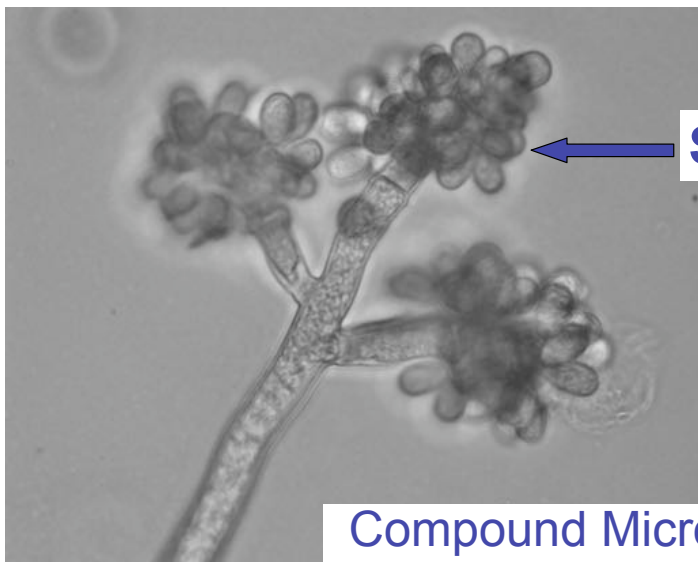
Artist's Conk

Lacquer Conk or Varnish Conk



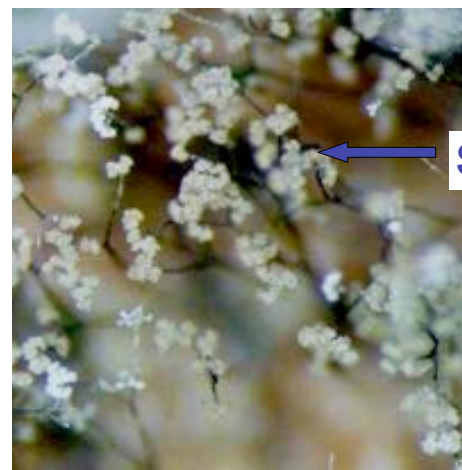
Signs versus symptoms

Botrytis spores & mycelium are signs



Spores

Compound Microscope



Spores

Dissecting Microscope



Mycelium



Symptom

Photo by Julie Riley



Fireblight on apple

Erwinia amylovora

Bacterial Diseases

One celled organisms

Wikipedia

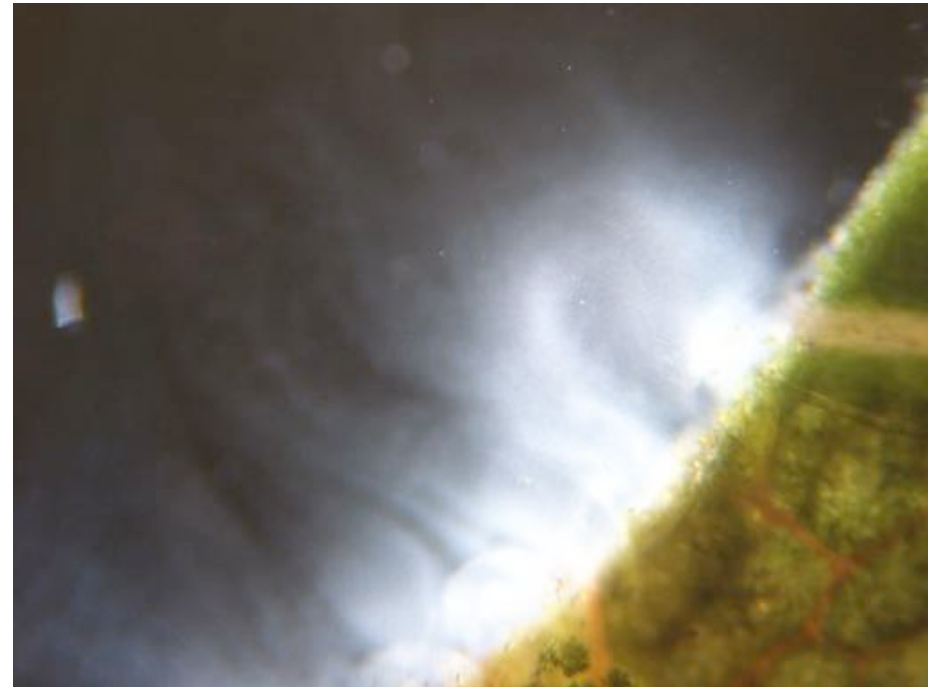


North Carolina State University

Bacterial leaf spot on begonia

Xanthomonas begoniae

Identification of bacterial diseases



Streaming from leaves

Viral Diseases



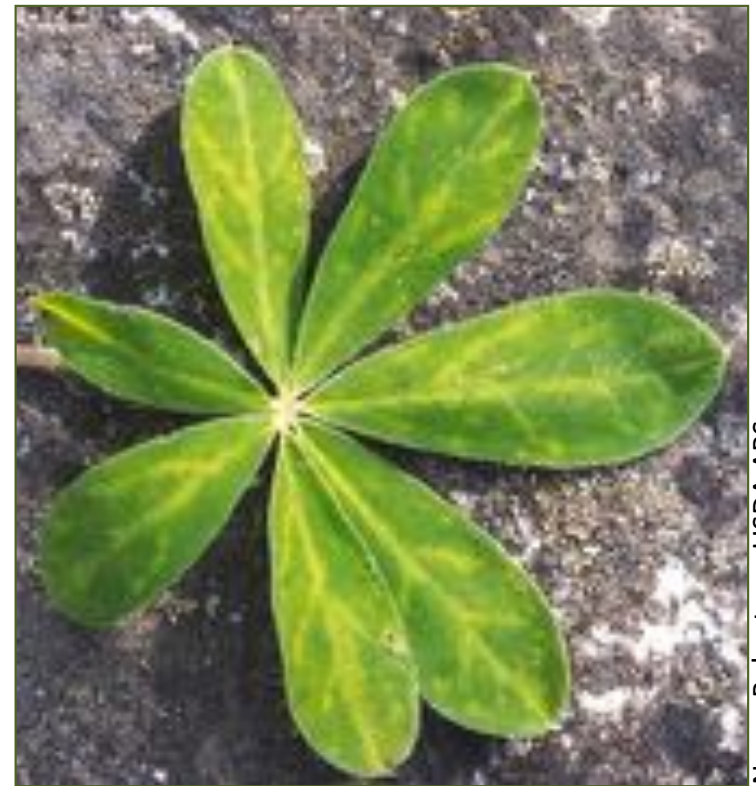
Photo by Julie Riley

Virus on peony



Tobacco rattle virus on peony
Tobravirus

Viral symptoms

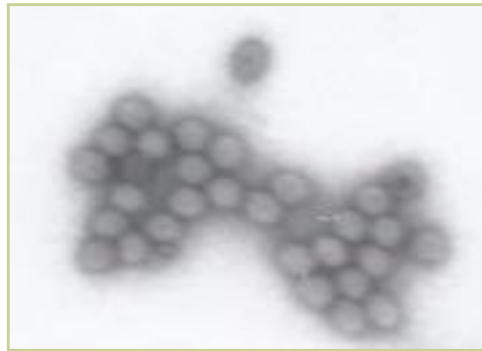


**Vein clearing on Alaska
lupine**

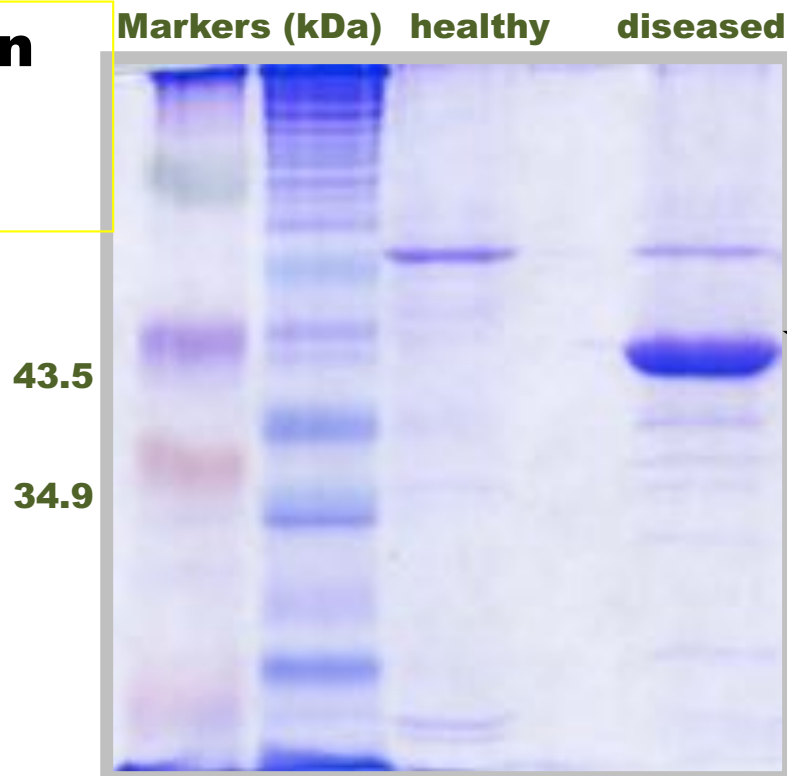
Identification of viral diseases

Characterization of 'Lupine virus'

Virions



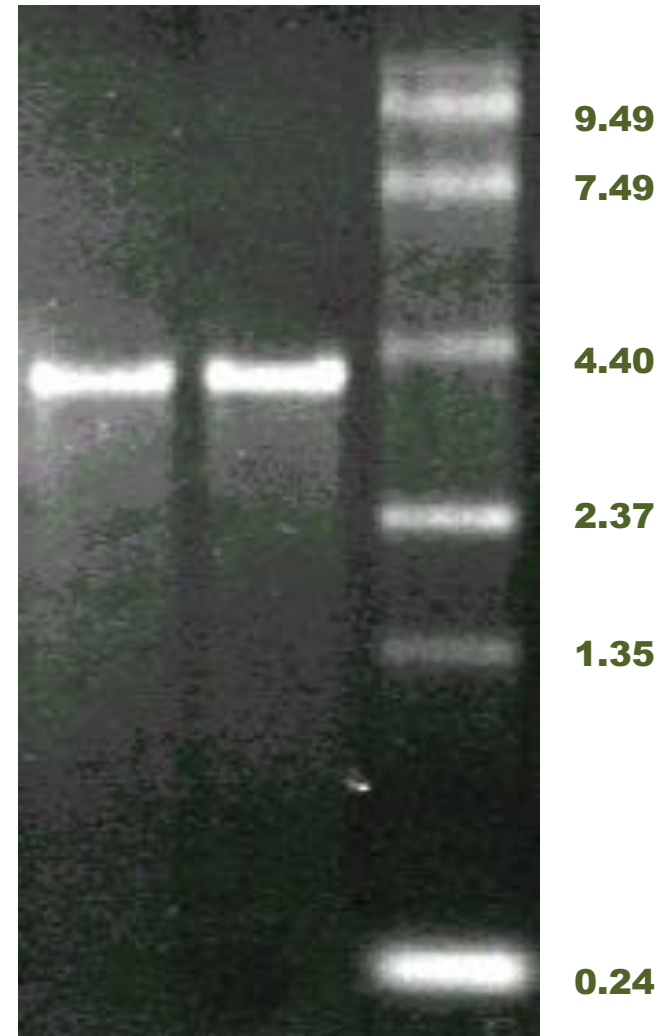
Protein SDS- PAGE



RNA Gel

Virion RNA

Marker (Kb)



Original slide by Nancy Robertson, USDA ARS

Nematodes



Photo: NC State Cooperative Extension

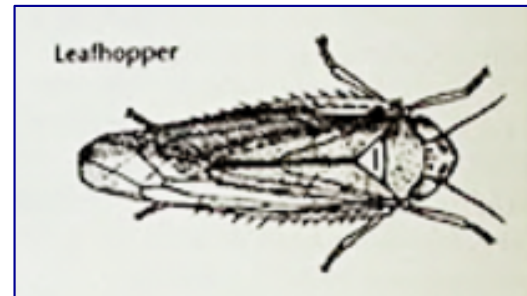
Root knot nematode symptom

Methods of Disease Control

- **Cultural practices**
 - site selection
 - proper planting time & methods
 - good nutrition
 - crop rotation -- sanitation
- **Resistant or tolerant varieties**
 - Dutch Elm, Chestnut blight,
apple scab

Disease Control continued

- Disease free seeds/plants
 - seed potatoes
- Control of **vectors**
 - especially important to prevent spread of viruses
 - **leafhoppers**,
aphids, mites



Disease Control continued

- **Chemical Control*:**

Fungicides

Bactericides

Nematicides



Photo by Julie Riley

* In disease management, pesticides are most effective against **fungal pathogens**.

CHEMICAL CONTROL

- Best used with cultural controls
- Spray before first infection or at first sign of infection
- Fungicide coverage of the lower leaf surface important



Photos by Julie Riley

- Alternate or tank-mix products with different modes of action



Fungicide Groups

Group Code	Target Site of Action	Product names (examples)
1	Mitosis	Mertect, Topsin
2	Cytochrome reductase in lipid peroxidation	Rovral
4	RNS polymerase	Ridomil, Ridomil Gold
7	Complex II of fungal respiration	boscalid/Endura, Moncut
11	Complex III of fungal respiration: QOI site	Strobilurins/Quadris, Headline
M	Multi-site contact	Copper hydroxide/Kocide, Champ

From presentation by Ronda Hirnyck, University of Idaho Extension