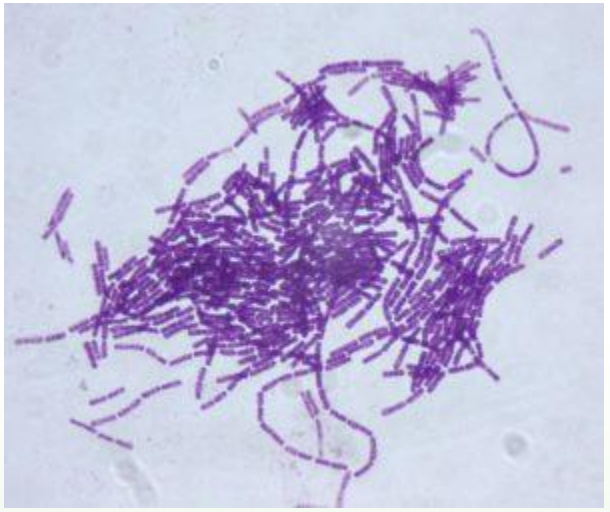
Natural* Pest Control in the Home Garden



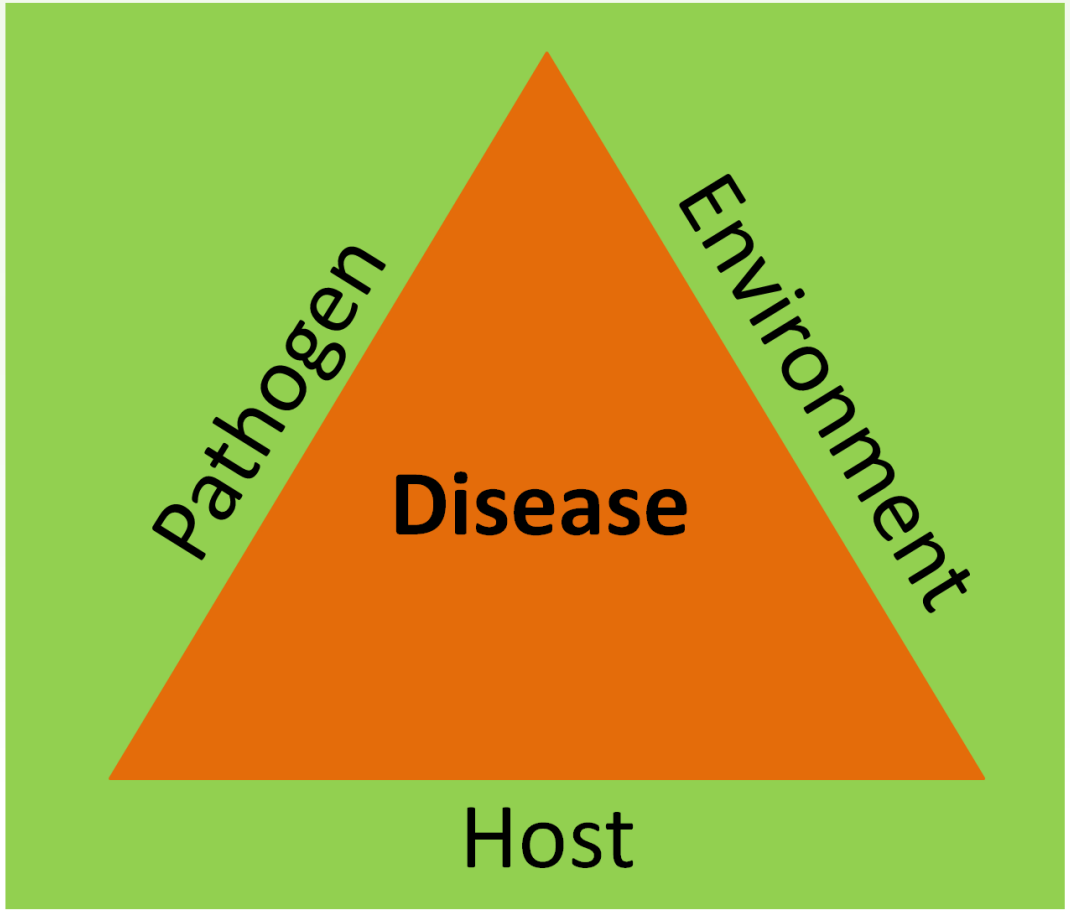
Why go the natural route?

- Safety
- Sustainability
- Insect resistance
- Cost considerations
  - $
  - Time
  - Health

Natural Controls

- At least some natural forces act on all organisms, causing populations to rise and fall
- Be aware of the influence of natural forces and whether or not you can harness them to balance the scales in your favor
  - Climate
  - Natural enemies
  - Geography/Environment
  - Sustenance
  - Shelter

Disease Triangle



So I want to go more natural. What are my strategies?

First Thing's First:

Document everything.

Plant/Variety Selection

- Right plant, right place (think of the disease triangle)
  - Stressed plants emit pheromones that attract insect pests
- Some plants resist pest attacks better than others
  - Heirlooms vs hybrids

Timing

- Time plantings so that majority of crop will avoid peak pest infestations

Cultural/Mechanical Control

- Spacing
  - Plant strength
  - Airflow/circulation
    - Pathogen dispersal
    - Plant Strength

Cultural/Mechanical Control

- Weeds, grass around garden may harbor harmful pests
- Gardens started on formerly turfed area may contain harmful larvae and formidable weeds

Cultural/Mechanical Control

- Crop Rotation/Cover Crop
  - Soil health
  - Weed control

Cultural/Mechanical Control

- Row Covers

Cultural/Mechanical Control

Sanitation

- Removal of sick, dying, dead plant material
- Mulch
- Know when to call it quits

Trapping

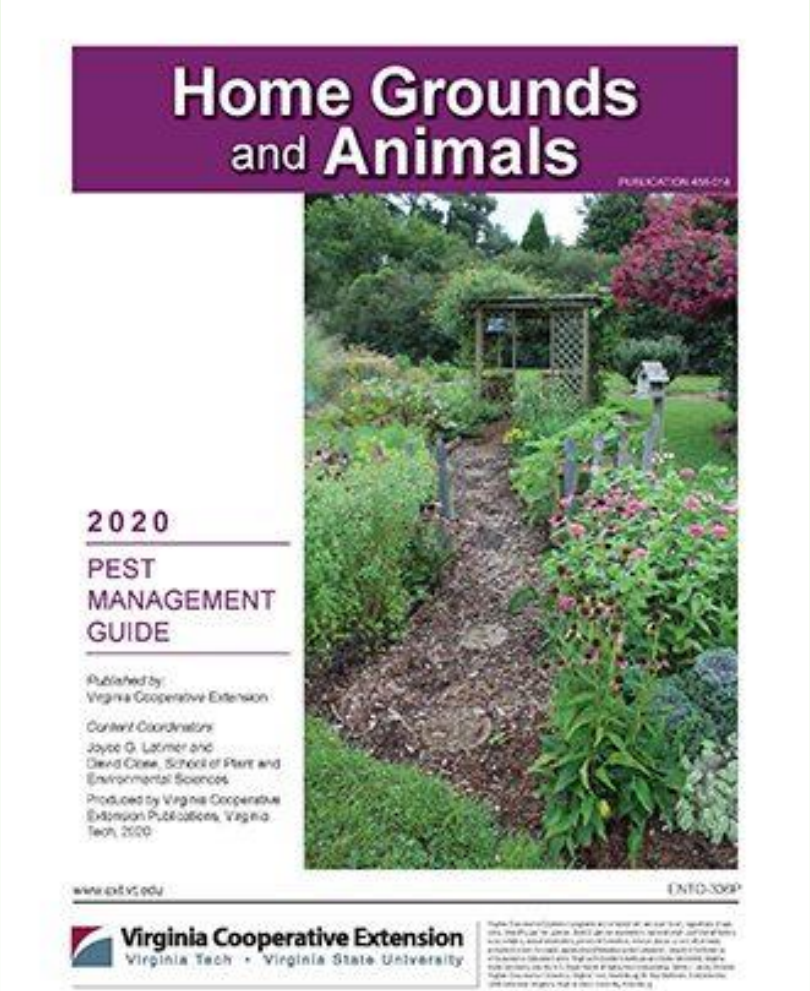
- Very practical, just require a threshold
- Traps for wide range of pests available commercially

Scouting

- Not just what you see – context is key (disease ▲)
- Inspect transplants at purchase
- Inspect plants regularly - **learn** insects, life cycles
- Hand pick pests, don't be afraid to prune
- Tolerate damage, establish **threshold**
- Look for natural predators
- **Learn** about natural predators, support them.

Insect Identification

- Where did you find it?
- What time of year is it?
- What color is it?
- Is it's body hard or soft?
- What kind of damage if any?
- What kind of legs, mouth parts, wings or antennae?
- Context!



Virginia Cooperative Extension Home Grounds and Animals Pest Management Guide

Abiotic

- Azadirachtin
  - Derivative of the Neem tree seed kernels (active ingredient)
    - Growth regulator
    - Anti-feeder
    - Repellant
    - Oviposition inhibitor

  - Highly versatile, readily obtainable, labeled for nearly all garden pests
  - Beetles, aphids, caterpillars, others

Abiotic

- Neem Oil
  - Clarified hydrophobic extract of neem oil
  - **Does not contain azadirachtin**
  - Broad spectrum insecticide/fungicide
  - **Suffocates and smothers**
    - Coverage is crucial
  - Works best on small, soft bodied insects

Abiotic

- Horticultural Oils
  - Function similar to neem oil, **suffocate and smother** soft bodied insects non-selectively
  - Also serve as fungicides
  - Dormant oil vs. All-seasons (summer) oil

Abiotic

- Insecticidal Soap
  - Damage protective covering of soft bodied insects, causing them to **dehydrate**
  - Homemade remedies using common hand/dish soaps can cause foliar burns, not recommended

Abiotic

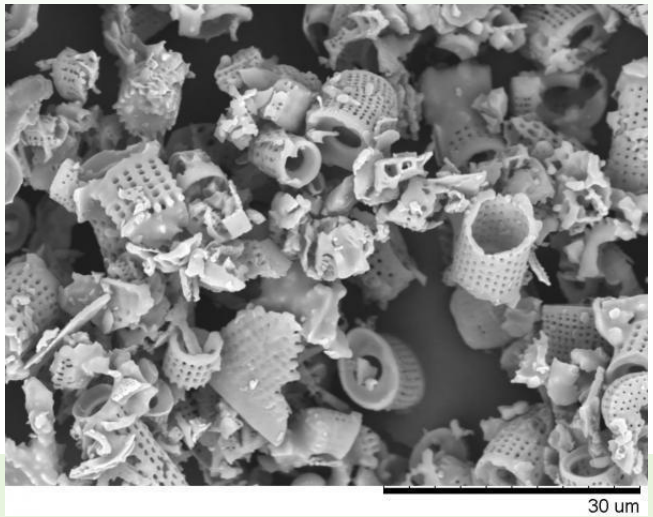
- Hot Pepper Wax
  - Capsaicin – material that makes peppers hot
  - Typically derived from cayenne
  - Works as **repellant**, not an eradicator
  - Can be used indoors and outdoors to repel aphids, mites, thrip, white fly, lace bugs, leaf hoppers, others
  - Also effective for deer, rabbits and squirrels

Abiotic

- Kaolin Clay
  - Non-toxic clay product that **coats and disguises** plant in white film
  - Preventative
  - Commonly used for pears, apples
  - Known to be effective against Japanese beetles, thrip, leaf hoppers, cucumber beetles and potato beetles on veggies

Abiotic

- Diatomaceous Earth
  - Powder composed of fossilized one-celled organisms called diatoms
    - Microscopic, have razor sharp edges that **lacerate insect bodies**
  - Controls slugs, millipedes, cockroaches, ants, soft-bodied insects
  - Lethal to honeybees – don't apply to crops in flower
  - Prolonged exposure can cause lung, skin irritation
  - Use "Natural" grade



Abiotic

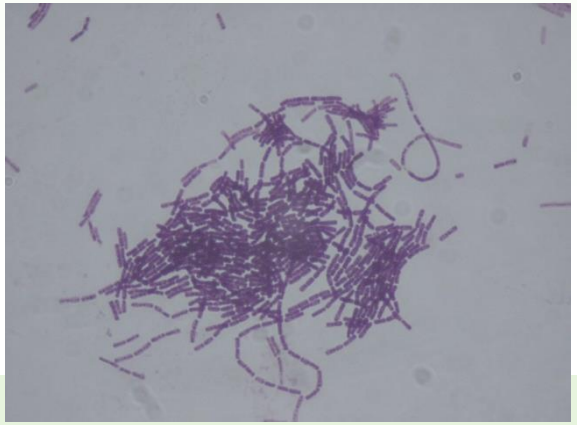
- Pyrethrum
  - Made from flowers of certain species of chrysanthemum
    - **Pyrethrins**: Insecticidal compounds extracted from Pyrethrum
    - **Pyrethroids**: synthetically produced compounds *similar* to pyrethrins
  - Contact insecticide, **paralyzes but may not kill**
  - Often formulated with other insecticides to ensure eradication
  - Low mammalian toxicity, high toxicity to other insects, aquatic wildlife

Biotic, Microbial

- Contain microorganisms
  - Viruses, bacteria, fungi, nematodes, protozoa
- Low toxicity to animals and humans
- Most have a relatively narrow target range (non-"nuclear"), making them helpful tools to use along side beneficial insects

Biotic, Microbial

- *Bacillus thuringiensis* ("Bt"/ Thuricide)
  - Most widely used microbial insecticide in U.S. (soil dwelling bacterium)
  - Different subspecies effective against different groups of insects and their larvae
  - Generally effective against young larval stages of many insects – read label!



Biotic, Microbial

- *Bacillus thuringiensis*
  - **Must be consumed** by target insect to become effective – target selection/coverage is key
  - Bacteria paralyzes digestive tract, may parasitize the insect
  - Liquid typically more effective than dust formulations
  - Bt breaks down rapidly in direct sunlight – application timing is key
  - Does not kill immediately – patience is key

Biotic, Microbial

- *Bacillus thuringiensis* var. *kurstaki* (Btk)
  - Toxic only to Lepidoptera larvae
  - Effective on common leaf-feeders, vegetable pests, bagworms, tent caterpillars, European corn borer (for now)
    - Surfactant critical for Brassicas

Biotic, Microbial

- *Bacillus thuringiensis* var. *israelensis* (Bti)
  - Effective on mosquito, black fly, fungus gnat larvae
  - "Dunk" products
  - Typically, eliminating standing water more effective

Biotic, Microbial

- Milky Spore – *Bacillus popillae*, *Bacillus lentimorbus* (bacterium)
  - Applied to turf, watered so that it penetrates below
  - Controls Japanese beetle larvae, others to lesser extent
  - Bacteria parasitizes after larvae consumes it
  - Best to apply around August
  - Can survive in the soil for many years if larval infestation is high

Biotic, Microbial

- Spinosad
  - Chemical compounds derived from soil-dwelling bacteria *Saccharopolyspora spinosa*
  - Kills via contact and ingestion – neural disruptor
    - Fire ants, caterpillars, thrip, leaf miners, some beetles
  - Toxic to bees* - careful with timing, target
  - Relatively safe for humans, animals
  - Ornamentals, lawns, veggies

Biotic, Microbial

- Beauveria bassiana
  - Fungus that attacks and kills a variety of immature and adult insects
    - Whiteflies, aphids, mites, caterpillars, leaf hoppers, grasshoppers, CO potato beetle, Mexican bean beetle, bark beetles, sod webworms, fire ants, European corn borers, others
  - Harmful to lady beetles, other beneficials
  - Contact is critical in application – good coverage is key
  - 3-7 days after application for fungal spores to germinate, penetrate, grow throughout pest and begin killing it

Biotic, Microbial

- Nematodes
  - Microscopic worm-like parasites – some good, some bad
  - Nematodes we deem beneficial cannot develop inside vertebrates
  - Control of weevils, cutworms, webworms, mole crickets, white grubs, and more
    - Type of nematode depends on target– know what you're buying!
  - Proper environmental conditions must be maintained throughout shipping and storage, application
    - Moisture, high humidity, 55°-90° F (generally)

Beneficial insects

- Assassin Bug – *Reduviidae*
  - Naturally occurring, about 160 species in North America
  - Most species only have one generation/year (mating in early summer)
  - Aphids, caterpillars, CO potato beetle, Japanese beetles, leaf hoppers, Mexican bean beetle, webworms, tent caterpillars
  - Careful!

Beneficial Insects

- Bean Beetle Parasite - *Pediobius foveolatus*
  - Shipped inside host
  - Adults emerge, lay eggs in host larvae
    - 20-25 wasps/mummy, need about 100 wasps/400 sq. ft. of beans
  - Do not overwinter

Beneficial Insects

- Damsel bug – *Nabidae*
  - Similar to assassin bug, smaller
  - Generalist feeder – aphids, leafhoppers, mites, caterpillars
  - Multiple generations per year
  - Plant diversity aids proliferation
  - Not commercially available

Beneficial Insects

- Big-eyed bug – *Gocoridae*
  - Abundant, found in most landscapes, gardens, crops
  - Voracious generalist predators
    - Aphids, caterpillar eggs and larvae, immature bugs, leaf hoppers, spider mites
  - Multiple generations per year, present throughout grow season
  - Plant diversity aids proliferation
  - Not commercially available

Beneficial Insects

- Predacious Stink Bug – *Pentatomidae*
  - Feed on more than 100 garden pest insects
  - Adults and nymphs attack prey larger than themselves
    - CO potato beetle, caterpillars
  - Overwinter in plant debris (year-round ground cover)
  - Spined soldier bug, two-spotted stink bug
  - Some species commercially available

Beneficial Insects

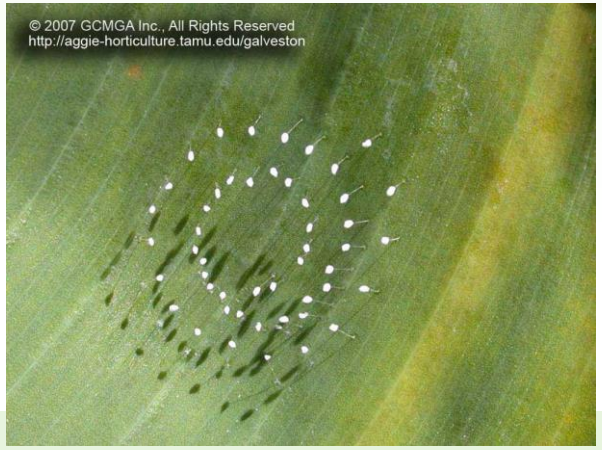
- Syrphid fly larvae – *Syrphidae*
  - AKA Hoverfly
  - Feeds on aphids, mealy bugs, thrip, whiteflies
  - Adult lays eggs near aphid colonies, larvae emerge and feed on aphids – 70-100% control when hoverfly populations are high
  - Not commercially available

Beneficial Insects

- Lady Beetles – *Hippodamia convergens*
  - Feeds mainly on aphids and other soft-bodied insects like mealybug, spider mite
  - Commonly sold, but mobility makes them not very practical

Beneficial Insects

- Green Lacewing larvae – *Chrysoperia sp.*
  - Hatching larvae will consume anything it encounters
  - "Aphid lions"
    - Aphids, insect eggs, mites, thrip, leafhopper nymphs, small caterpillar larvae
  - Adults not predacious
  - Considered a good alternative to lady beetles, less prone to dispersing



Beneficial Insects

- Predatory Mites – *Phytoseiulus persimilus*
  - not actually insects, belong to the class, *Arachnida*
  - Occur naturally
  - Widely available commercially in different subspecies with different behavioral traits
  - Become active in spring before spider mite populations
  - Feed on two-spotted spider mite, can also target thrip
  - Many supplement diet with plant pollen, meaning they tend to stay in one place, act as "bodyguards" to a plant

And Speaking of Arachnids…

- How could you say no to this face?

- Of over 43,000 species of spider in the world, only a handful pose any danger to humans
- The majority of them hunt smaller insects that humans consider pests

Beneficial Insects

- Trichogramma Wasp – *Trichogrammatidae*
  - Tiny wasp that attacks eggs of hundreds of pest species
    - Cutworms, corn borers, earworms, armyworms, cabbage moths
  - Release time is key
  - Adult lays egg in host egg, larvae and pupa develop there
  - Commercially available, but usually used in conjunction with other control methods/insects
  - Plant diversity encourages populations

Beneficial Insects

- Encarsia Wasp – *Encyrtidae*
  - Used worldwide commercially for whitefly control in greenhouses
  - Will feed on any developmental stage of host except egg
  - Prefer 3rd, 4th whitefly larval instars for oviposition

Beneficial Insects

- Minute Pirate Bug – *Orius*
  - One of the first predators to appear in spring
  - Very active general predators of all life stages of most smaller, soft-bodied pests
    - Aphids, spider mites, thrip, psyllids, whitefly, small caterpillars, insect eggs
  - Can kill up to 80 thrips/day