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

- Pathogen
- Environment
- Host

Disease
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!
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 persimilis*
  • 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