Biopesticides

Steven Swain
Environmental Horticulture Advisor
Marin & Sonoma Counties
Definition

- **Pesticide, US EPA:** Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

- **Biopesticide, NPIC:** ... derived from such natural materials as animals, plants, bacteria, and certain minerals.
Natural pest control

• Some forms are reasonably common
  – Trichoderma was simply classified as a “common culture contaminant” for years in labs

• Organic
  – Most of these products / organisms are available in an organic formulation
Kingdoms

Animal:
- Diatomaceous earth

Fungal:
- Beauvaria bassiana
- Trichoderma harzianum, T. viride, T. hamatum

Bacterial:
- Bacillus subtilis
- Bacillus thuringiensis (Bt)
- Streptomyces lydicus
- Spinosad

Viral:
- Granulosis virus
Insecticides:
- Beauvaria bassiana
- Bacillus thuringiensis (Bt)
- Granulosis virus
- Diatomaceous earth
- Spinosad

Fungicides:
- Bacillus subtilis
- Streptomyces lydicus
- Trichoderma harzianum, T. viride, T. hamatum

Bactericides:
- Bacillus subtilis
- Streptomyces lydicus
Do They Work?

- **Insecticides:** Reliably
  - Sometimes very specific targeting
  - Mostly applied to leaves
  - Fairly homogenous environment

- **Fungicides:** Unreliably

- **Bactericides:** Define “work” …

The Disease Triangle
Do They Work?

- **Insecticides**: Reliably
- **Fungicides**: Unreliably?
  - Mostly applied to soils
  - Highly variable environment
  - May work best at certain sites
- **Bactericides**: Define “work” …
Do They Work?

- Insecticides: Reliably
- Fungicides: Unreliably?
  - Mostly applied to soils
  - Highly variable environment
  - May work best at certain sites
- Bactericides: Define “work” …
  - Help control antibiotic resistance in pear orchards (fireblight)
Do They Work?

- **Competition**: The biocontrol agent is more effective than the pathogen at gathering critical nutrients or space and, therefore, must be in place before disease onset.

- **Antibiosis**: The biocontrol agent produces a chemical compound of some type (antibiotic or toxin) that acts against the pathogen.

- **Predation or parasitism**: The biocontrol agent directly attacks the pathogen.

- **Induction of host plant resistance**: The biocontrol agent triggers a defensive response in the host plant that limits the ability of the pathogen to invade the plant.
Do They Work?

- **Therapy (curative)**
  - Insects, yes
  - Infections, not really
    - Can help in root disease?

- **Prophylaxis (preventative)**
  - Insects, for a while
  - Infections – yes, if it establishes in the environment
Are They Safe?

- Many have organic labels
- Caution signal words
- Many are live microbes
  - Spinosad and Bt usually aren’t
  - Advantages and disadvantages
  - Don’t inhale!
Summary

• Right tool for the job
  • Insecticides
    • Spinosad is broad spectrum
    • DE best in limited spaces
    • Bt and granulosis virus are highly targeted
  • Biofungicides
    • Environment is everything
    • Subtle distinctions matter
    • Don’t inhale
  • Bactericides
    • Preserving efficacy of antibiotics
    • Efficacy is’t the only consideration
Thanks!

- Presentation on-line tomorrow at: http://ucanr.edu/gardenwalks
- Steven Swain: 415 473 4226
  svs-swain@ucanr.edu