

Biopesticides

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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.



Western tarnished plant bug (*Lygus hesperus*) killed by the entomopathogenic fungus, *Beauveria bassiana* (photo by Surendra Dara)

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



Western tarnished plant bug (*Lygus hesperus*) killed by the entomopathogenic fungus, *Beauveria bassiana*
(photo by Surendra Dara)



Kingdoms

Animal:

Diatomaceous earth

Fungal:

Beauveria bassiana

Trichoderma harzianum, *T. viride*, *T. hamatum*

Bacterial:

Bacillus subtilis

Bacillus thuringiensis (Bt)

Streptomyces lydicus

Spinosad

Viral:

Granulosis virus

Western tarnished plant bug (*Lygus hesperus*) killed by the entomopathogenic fungus, *Beauveria bassiana*
(photo by Surendra Dara)



Function

Insecticides:

- Beauveria bassiana
- Bacillus thuringiensis (Bt)
- Granulosis virus
- Diatomaceous earth
- Spinosad

Fungicides:

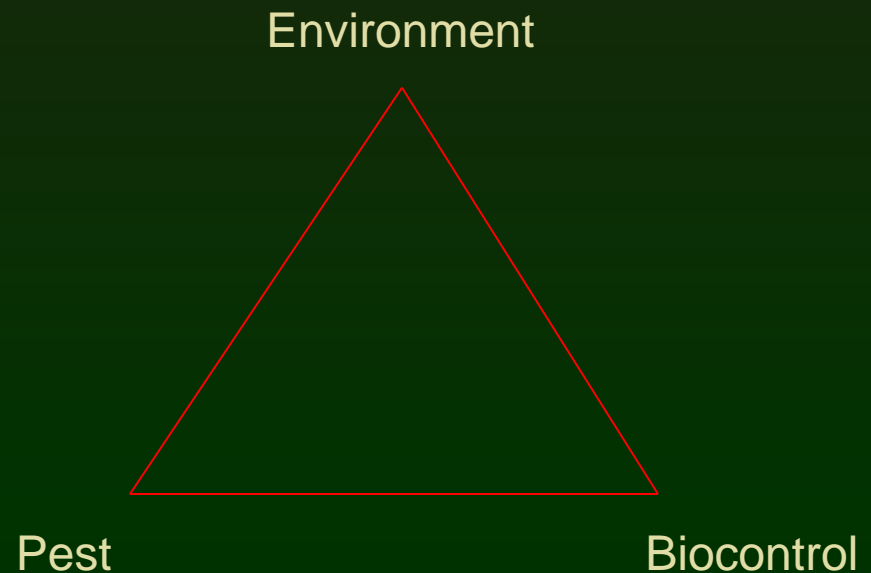
- Bacillus subtilis
- Streptomyces lydicus
- Trichoderma harzianum, T viride, T. hamatum

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 isn't the only consideration

Thanks!

- Presentation on-line tomorrow at:
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