Biological Control

The wasp parasitoid *Cardiochiles nigriceps* Viereck, approaches a potential host, an adult tobacco budworm, *Heliothis virescens* (Fabricius).
http://creatures.ifas.ufl.edu/field/c_nigriceps01.htm

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Objectives

1. Define biological control
2. Describe the three major types of biological control
3. Describe six typical augmentation products
4. Name and describe, using a specific example, three types of cultural control methods
5. Explain how the sterile release method of insect control works and give an example of its effective use

This wasp is commercially sold.
It is injecting eggs into the host.

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Introduction

Biological control is:
The intentional (deliberate) manipulation (we do something to cause a change) of populations (not just one praying mantis) of living (not chemicals derived from dead organisms) beneficial organisms, called natural enemies, in order to limit (not eliminate) populations of pest insects.

This mole cricket was killed by insecticidal nematodes. The nematodes are leaving the mole cricket in search of other mole crickets to infect.

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Types of Biological Control

Biological Control can be divided into:

1. Classical Biological Control
2. Conservation
3. Augmentation

Classical - "The reuniting of old enemies"
- Most serious pests lack the natural enemies of their original geographies.
- Natural enemies are imported from the country of origin and released.

Control of Alligatorweed in Florida using a beetle.

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Cottony-Cushion Scale: A Case Study

A foreign invader, **the cottony-cushion scale**, appeared in the **west** and began *destroying* citrus trees.

An entire industry was threatened.

A heroic entomologist sought the homeland of the dread scale.

The entomologist allied himself with the well fortified Vedalia beetle.

With great haste, the Vedalia beetle army crossed the Pacific to defend America.

Within just 18 months, the beetles successfully suppressed the cottony-cushion scale.

The Vedalia beetles were so successful, that they continue to suppress the scale even today.

Vedalia beetles feeding on scale insect.

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Classical Biological Control Summary

- The process of finding natural enemies of invasive pests.
- Importing and establishing these natural enemies to control the pest.
- Involves traveling to foreign countries.
- The results can be dramatic.
- Must avoid importation of insects that may do more harm than good.
- Permits from the government are required before importation.
- The new insect is placed in a quarantine facility.
  - ❑ One of these facilities exists at UF Entomology

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Classical BC Summary Continued

While in quarantine, the natural enemy is examined to see:

1. if it effectively controls the pest it is supposed to.
2. that it won't kill other non-target insects, or feed on non-pest plants.
3. that no hyperparasites came with it.

- In other words, if I bring in a thousand larvae of a wasp parasitoid, I may have accidentally also imported a parasitoid of that parasitoid, inside one of the larvae. In quarantine, the new natural enemy is reared through at least two generations to make sure none of its own natural enemies was also imported.

Trials to control a type of pest leafminer.

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Conservation

Conservation – Make your natural enemies work better.

- Providing resources for the natural enemy.
- Reducing the use of insecticides or using insecticides that don't harm the natural enemies.

Tomato hornworm larva parasitized by braconid wasps

W. D. Hitchison, University of Minnesota Vegetable IPM Education Program

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Augmentation

Augmentation – Continuous re-release of the natural enemies

- Releasing large numbers of natural enemies in a specific area.
- Usually reared commercially.
- Not expected to live more than one season.

Inundation – "Living insecticide"
release of a huge number of natural enemies
expected to have an immediate impact on the pest population.
Often involves microbial sprays (viral, bacterial or fungal)

Inoculation – Prepared to defend against threats
Release of smaller numbers of natural enemies.
Expected to provide control in the future after reproducing.

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Augmentation (Continued)

Augmentation is commonly used in:

- •Greenhouses
- •Barns (to control filth flies)
- •Orchards and vineyards
- •Vegetable and small fruit production
- •Field crops
- •Home gardens

Green lacewing

Commercially sold lacewing eggs

Typical Augmentation Products include:

- •Lady beetles
- •Lacewings
- •Predatory mites
- •Praying mantids
- •Nematodes (can be sprayed)
- •Insect viruses (can be sprayed)
- •Fungi (can be sprayed)
- •Protozoa (can be sprayed)
- •Parasitic wasps

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Common Natural Enemies

Lady beetles (lady bugs):

- ❑ One of the most common natural enemies sold.
- ❑ Most lady beetles are collected in the mountains of California.
- ❑ Beetles' first instinct is to fly from the mountain down to the valley and then eat.

So, as soon as you release your beetles they fly to the next county.

Lady beetle feeding on aphids

- ❑ Praying mantis:
- ❑ Eat other good insects.
- ❑ Eat other praying mantids.

This means you end up with one very full praying mantis instead of the 200 you released.

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Mole Cricket Bio-control

Mole crickets live mainly underground and can be a serious problem here in Florida where they can kill an entire lawn or rampage golf course turf grass.

Mole cricket damage is primarily mechanical: tunneling through the soil near the surface, severing the roots and uprooting the grass.

Check out the following internet site these three researchers have developed and answer the questions on your study guide.
http://entnemdept.ufl.edu/fasulo/molecrickets/mcri0204.htm.

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Assignment

Journal Assignment
You are faced with the following problem: Your neighbor calls you up one day and says, "I know that you have taken an entomology class and I desperately need your help. My cat has a terrible flea problem, I think he is getting them somewhere in our back yard. And my geraniums have lots and lots of aphids! I don't know where they all came from! On top of that, snails are crawling all over my flower bed and eating the geraniums, too! I love my geraniums and I don't want them to die. I have heard there are insects you can buy to put in your yard that may eat the bad organisms. What do you suggest I do? I don't want to use pesticides because my cat is always getting into the geranium flower bed and prowls around the yard. I don't want him accidentally ingesting toxic chemicals"

You decide to go over and take a look at her yard. After measuring her flowerbed, you find that her garden bed is 15 square feet and that her lawn is about 500 square feet. Using the internet sites below (or any others you wish to use), come up with a plan to help her treat for the aphids, snails and fleas. She is on a limited budget and only has $40 dollars to spend.
http://www.marchbiological.com/ .

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ASSIGNMENT

Cultural Control and Sterile Release Method

Currently sterile release is being used to control the Medfly and Caribbean fruit fly here in Florida. Learn about cultural control and how sterile release works by answering the questions on your study guide.

Read:

http://www.freshfromflorida.com/pi/methods/images/sirfbooklet.pdf

Be sure to review the unit objectives before continuing to Unit 15.

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Conclusion

You have now learned numerous techniques of how to effectively control insect pests.

Which is your favorite?

Do you think you may try some of these techniques at your home?

Mole cricket damage to turf

I hope you take the knowledge you have learned and apply it to your lives. Insects are pests to us all at some point in our lives and it is nice to know the options on how to safely control them

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