

INTEGRATIVE PEST MANAGEMENT PART 1

Michael Rocky Trevizo



The biggest enemy of an insect is another **INSECT!!**

Bio-control is the use of a pest insect's natural insect enemies for its control.

Bugs eat Bugs

1) As direct **predators**

2) As **parasites & parasitoids**

BIBLICAL TEXTS ABOUT PEST, CROPS & SOILS

- He spake, and the locusts came, and caterpillers, and that without number, And did eat up all the herbs in their land, and devoured the fruit of their ground.

KJV — Psalm 105:34-35



BIBLICAL TEXTS ABOUT PEST, CROPS & SOILS

- If I shut up heaven that there be no rain, or if I command the locusts to devour the land, or if I send pestilence among my people; If my people, which are called by my name, shall humble themselves, and pray, and seek my face, and turn from their wicked ways; then will I hear from heaven, and will forgive their sin, and will heal their land.

KJV — 2Chronicles 7:13-14



UNTO THE EGYPTIANS

- But he, being full of compassion, forgave their iniquity, and destroyed them not: yea, many a time turned he his anger away, and did not stir up all his wrath. For he remembered that they were but flesh; a wind that passeth away, and cometh not again. How oft did they provoke him in the wilderness, and grieve him in the desert! Yea, they turned back and tempted God, and limited the Holy One of Israel. They remembered not his hand, nor the day when he delivered them from the enemy. How he had wrought his signs in Egypt, and his wonders in the field of Zoan: And had turned their rivers into blood; and their floods, that they could not drink. He sent divers sorts of flies among them, which devoured them; and frogs, which destroyed them. He gave also their increase unto the caterpillar, and their labour unto the locust. He destroyed their vines with hail, and their sycomore trees with frost. He gave up their cattle also to the hail, and their flocks to hot thunderbolts. He cast upon them the fierceness of his anger, wrath, and indignation, and trouble, by sending evil angels among them. He made a way to his anger; he spared not their soul from death, but gave their life over to the pestilence; And smote all the firstborn in Egypt; the chief of their strength in the tabernacles of Ham: KJV — Psalm 78:38-51



RETURNING UNTO GOD

- I have smitten you with blasting and mildew: when your gardens and your vineyards and your fig trees and your olive trees increased, the palmerworm devoured them: yet have ye not returned unto me, saith the LORD. KJV —
Amos 4:9



RETURNING UNTO GOD

- Will a man rob God? Yet ye have robbed me. But ye say, Wherein have we robbed thee? In tithes and offerings. Ye are cursed with a curse: for ye have robbed me, even this whole nation. Bring ye all the tithes into the storehouse, that there may be meat in mine house, and prove me now herewith, saith the LORD of hosts, if I will not open you the windows of heaven, and pour you out a blessing, that there shall not be room enough to receive it. *And I will rebuke the devourer for your sakes*, and he shall *not destroy the fruits* of your ground; neither shall your vine cast her fruit before the time in the field, saith the LORD of hosts. And all nations shall call you blessed: for ye shall be a delightsome land, saith the LORD of hosts.

KJV — Malachi 3:8-12



GODS PROMISE

- And I will restore to you the years that the locust hath eaten, the cankerworm, and the caterpillar, and the palmerworm, *my great army which I sent among you*. And ye shall eat in plenty, and be satisfied, and praise the name of the LORD your God, that hath dealt wondrously with you: and my people shall never be ashamed.

KJV — Joel 2:25-26



PROMISE MADE AT THE TEMPLE COMMISSIONING

- If there be in the land famine, if there be pestilence, blasting, mildew, locust, or if there be caterpillar; if their enemy besiege them in the land of their cities; whatsoever plague, whatsoever sickness there be; What prayer and supplication soever be made by any man, or by all thy people Israel, which shall know every man the plague of his own heart, and spread forth his hands toward this house: Then hear thou in heaven thy dwelling place, and forgive, and do, and give to every man according to his ways, whose heart thou knowest; (for thou, even thou only, knowest the hearts of all the children of men;) That they may fear thee all the days that they live in the land which thou gavest unto our fathers.

KJV — 1Kings 8:37-40



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Bugs eat Bugs

1) As direct **predators**

2) As **parasites & parasitoids**

Predators: exist by preying upon other organisms

- Usually larger than prey
- Need multiple prey to complete lifecycle



Can be **Voracious** feeders of

- aphids
- scale insects
- mites
- thrips
- white flies
- caterpillars
- beetle larvae
- other soft-bodied insects

Photo: Scott Bauer, USDA-ARS photo library

Common Predators

Lacewing



Syrphid Fly (Hover Fly)

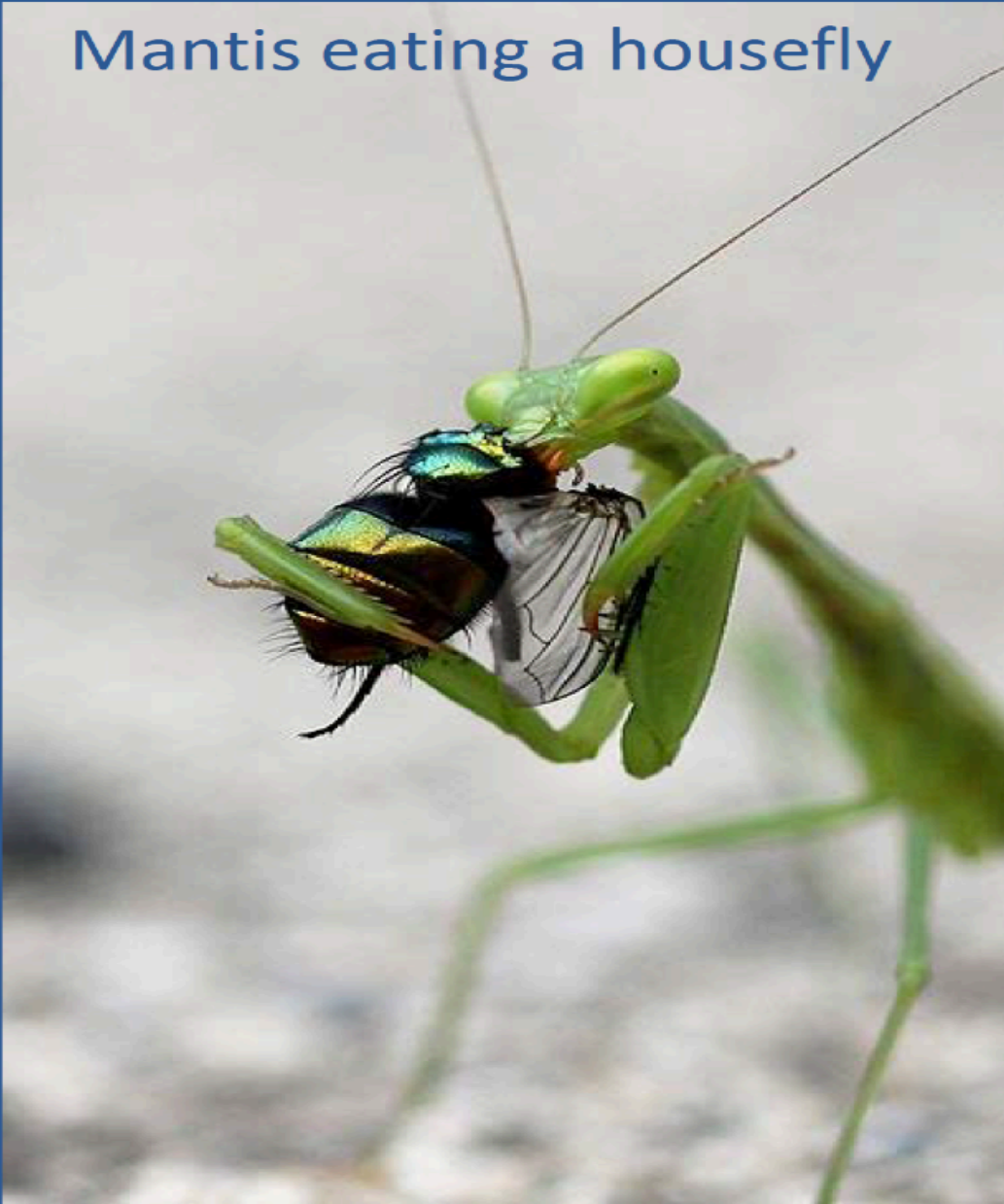


Ladybird Beetle (Ladybug)



Charismatic Predators...

Mantis eating a housefly



[Watch this video!](#)



Wheel Bug eating a Japanese beetle

Parasite: lives on, or in, a host organism and benefits by deriving nutrients at the host's expense

Parasitoid: same as above, except it ultimately kills (or sterilizes) and sometimes consumes the host



- Usually smaller than prey
- Needs one host organism during lifecycle
- Many are parasitic during the early growing stages and emerge as free-living adults

Common Parasitoids

Hymenoptera (wasps)
Diptera (flies)

HUGE! Tarantula Hawk



Wasp on stinkbug eggs



On plants: "Look familiar? I did that."



Biological Control – Advantages

- **Self-perpetuating**
- **Pest specific**
- **Density dependent**
- **Cost effective**
- **Environmentally compatible**

Biological Control – Constraints

- Not immediately effective (may take years)
- Not eradicated (is this really a constraint?)
- Biocontrol agents unknown for many pest species.
- Doesn't always work
 - Historically only **one** out of **four** attempts has been successful

What makes an effective biocontrol “agent”??

- High to complete prey specificity
- Multivoltine with respect to target species
- Well adapted to habitat of target species
- Excellent searching ability



Lacewing
immature
at “lunch”

Classic Biological Control

“Control of an exotic insect pest by the introduction of its natural enemies”

- foreign exploration
- quarantine processing
- mass propagation
- field colonization (release)
- evaluation of impact

100 successes in the past 100 years!!

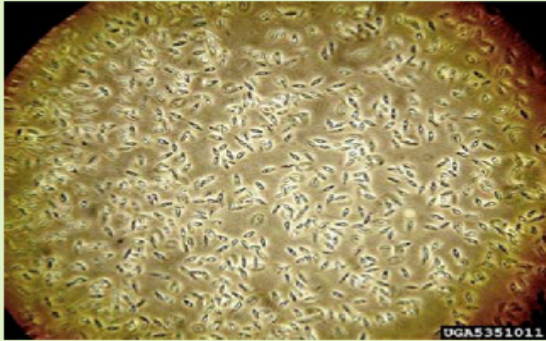
In addition to Classical Biocontrol (bug vs. bug/plant), **we also use:**

- Insect Pathogens
 - **Viruses** - Japanese Beetle Milky Disease
 - Nuclear Polyhedrosis Virus
 - **Bacteria** - the classic *Bacillus thuringiensis*
 - **Microsporidians** - against grasshoppers
 - Entomopathogenic fungi
 - **Entomopathogenic nematodes**

Viruses

Milky Spore: *Bacillus popilliae*

DIY



Japanese beetle



Nuclear Polyhedrosis Virus (NPV)

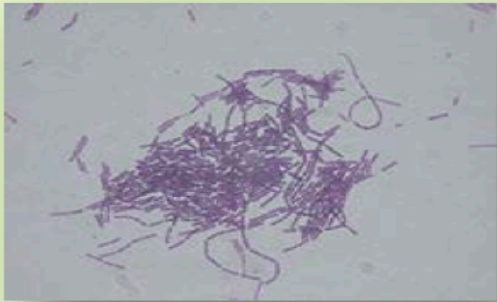
Infects moths & butterflies
(like Gypsy Moth)



I don't feel
so good...

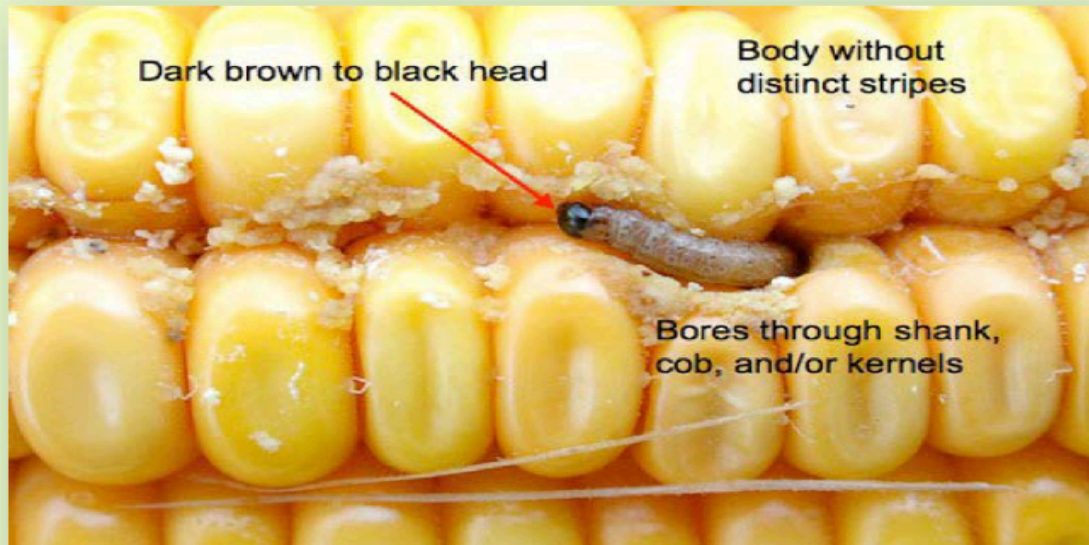
Bacteria

Bacillus thuringiensis (Bt)



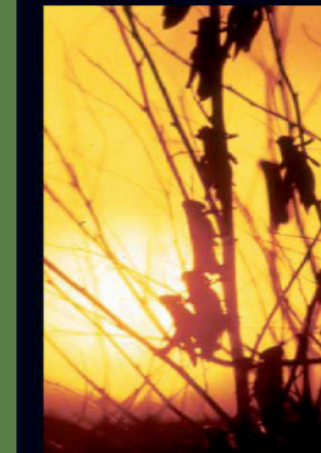
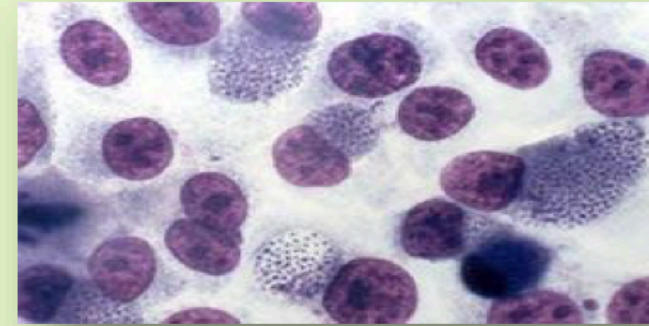
- stomach poison
- insect dies of starvation

European corn borer



Microsporidians

Nosema locustae



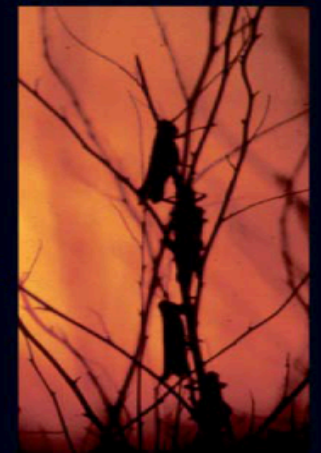
FOR ORGANIC PRODUCTION

NOLO BAIT
BIOLOGICAL INSECTICIDE

Nosema locustae
Biological Insecticide

Manufactured in the USA by:
M&R Durango, Inc.
6565 Hwy. 172, Ignacio, CO 81137
Tel: 970-259-3321

For use in suppressing grasshoppers and Mormon Crickets
Active Ingredient: *Nosema locustae* (Curing)..... 0.05%
Inert Ingredients..... 99.95%
Total..... 100.00%
*Contains at least one Million viable spores per 424 grains (1.0 pound)
Net contents: _____ Bait Formulation
Lot# _____



KEEP OUT OF REACH OF CHILDREN
SEE FIRST AID AND PRECAUTIONARY STATEMENTS ON BACK PANEL
EPA Registration #48149-2
EPA Establishment #46140-C0-001

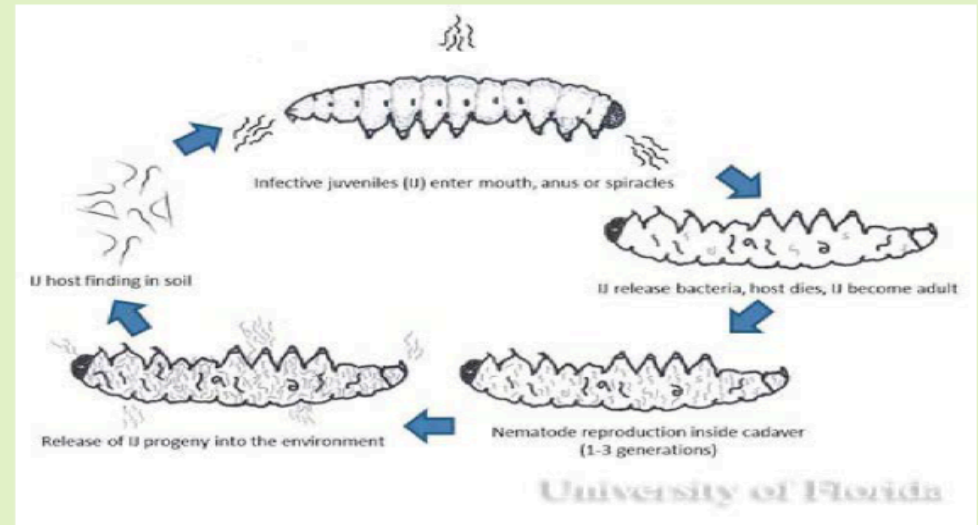
Fungi

Beauveria bassiana



Nematodes

(EPN)



IMPORTANCE OF PROPER NUTRITION CLIMATE AND MOISTURE

- Soil nutrient balancing
- Proper organic matter content
- Appropriate climate for the desired crop
- Proper moisture content in soil/root zone



IMPORTANCE OF PROPER NUTRITION CLIMATE AND MOISTURE

- Remember the words of EGW;

No one can succeed in agriculture or gardening without attention to the laws involved. The special needs of every variety of plant must be studied. Different varieties require different soil and cultivation, and compliance with the laws governing each is the condition of success. ED 111.3

- BY "different soil and cultivation" implies a variety of soil moisture, nutrients, textures and temperatures.



MAIN FACTS TO KNOW ABOUT I.P.M.

- A scouting program, for best result you must find the pest as early as possible
- Numbers, numbers, numbers
- Application rates per square feet of growing space
- Selection of the right predators/organisms for the target pest
- Insuring the selected organisms will work on the host crop



IMPORTANT MAIN FACTS TO KNOW ABOUT I.P.M.

- Prevention application rates

VS

- Treatment application rates
- Where can you find these numbers?

