

# Aspects of insect pest management in organic agriculture

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## Topics I will address:

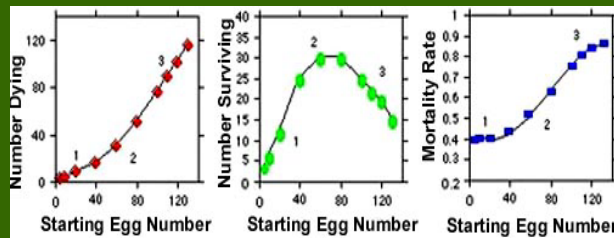
- The question of 'ecological balance'
- Why do we have pests?
- Some IPM basics
- Biological control options
- Organic-compatible insecticide options

## Some comments on 'Ecological balance'

- A definition: 'Ecological balance is the equilibrium between, and *harmonious coexistence* of, organisms and their environment'.
- But – more like 'dynamic tension' – at least for insects. Natural enemies and pests are not harmonious with each other, but antagonistic!
- They have population cycles, rather than being stable.

## Insect population regulation

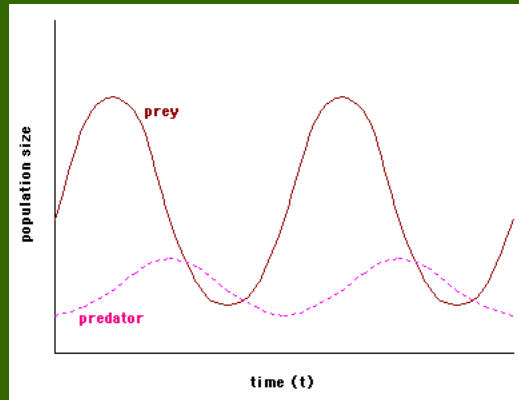
- Density *dependent* mortality – natural enemies, diseases ("Imperfect mortality")



- Density *independent* mortality – weather, food quality

## Lag time - pest and natural enemy populations

- Natural enemies will typically lag behind pests in numbers



## Why do insects become pests?

- Escape their natural enemies when introduced to new areas;
- Monocultures promote pest status;
- Pesticides reduce natural enemies;
- Insect number exceed Economic Injury Level, and yield is lost.

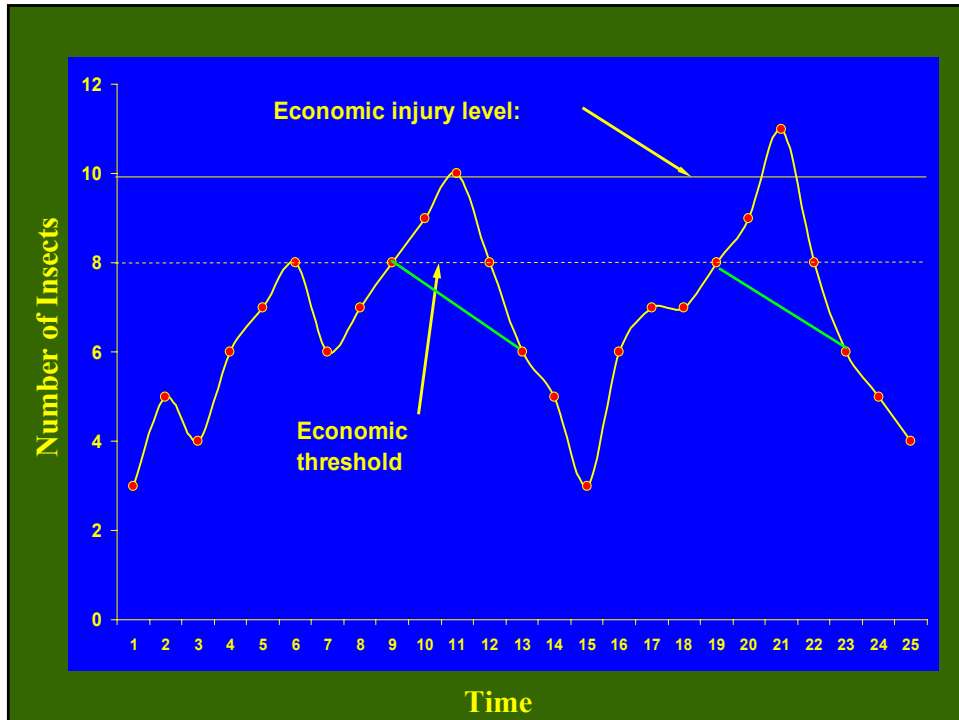
## Some IPM basics

- Integrated Pest Management – objective is to reduce *dependence* on single pest suppression techniques;
- Emphasize biological, cultural and physical control, chemical control is last resort;
- Based on the EIL, environmental compatibility

## The EIL

- EIL = minimum number of pests that will cause economic damage





## Organic agriculture and pests

- Emphasis on low input; low pesticide use;
- Prefer plant health management to pest management;
- Attempt to develop healthy agro-ecosystem – including pests and their natural enemies.

## Some major pests in HI

- Lots of sap-suckers – aphids, scale insects, mealy bugs;
- Virus vectors, energy drain on plants, cause sooty molds



Whiteflies – huge numbers, vector some viruses; sooty molds



# Thrips

- Thrips (Thysanoptera) – on tomatoes, bananas, many vegetables, ornamentals. Physical damage and virus vectors (e.g. TSWV)

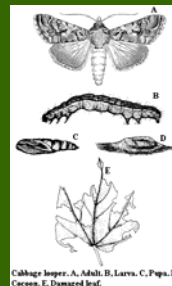


# Caterpillars (Lepidoptera)

Diamond back moth



Cabbage looper



## Biological control:

- Natural enemies of pests cause mortality;
- Can maintain pest population at below-threshold levels



Predators →



Parasitoids ↙

Pathogens →



## Types of BioControl:

- Import natural enemies - establish in field - Classical BC;
- Augmentative releases: inundative or inoculative releases each season;
- “Conservation” BC: depend upon local natural enemies.
- All these approaches require *conservation* of natural enemies to be effective.

## Conserving natural enemies

- Reduce insecticide use;
- Use softer chemicals;
- Manipulate habitats, e.g. intercropping.



## Living mulches

- Use for example, white clover, sunn hemp as living mulch/cover crop;
- Effective in certain crops to reduce aphids, whiteflies
- Contact Dr. Cerruti Hooks for more information, [crrhooks@hawaii.edu](mailto:crrhooks@hawaii.edu)

## Some cover crop basics

- Should not be susceptible to the same diseases as the main crop;
- Should not interfere with harvest;
- Make sure the cover crop does not compete with the target crop!

## Why do they work?

- Attract natural enemies like wasps, predatory beetles; *Conserve* NE's that are already around;
- Reduce ability of certain pests to locate the target crop (particularly aphids);
- May 'trap' pests before they reach the main crop.

## Back to biological control

- Classical BC in Hawai'i – lots of natural enemies released against a range of pests;
- Some are very effective (e.g. parasitoids against whitefly);
- But there are gaps in what is covered – e.g. corn ear worm.

## Augmentative BC

- Mass rear natural enemies and release them (cannot import BC agents to Hawai'i);
- Sounds easy, needs a lot of research.
- Looking at *Trichogramma* now for corn ear worm....



## Biocontrol downfalls

- Must have a reservoir of pests for natural enemies to feed on!
- Do not stop spread of viral diseases vectored by insects – e.g. papaya ring spot, banana bunchy top.
- An 'imperfect' mortality factor for pests!

## Some insecticide options for organic farming

- Some plant extracts, some elements, bacteria, fermentation by-products provide biologically active chemicals that may be used in organic agriculture.
- Remember that these are still chemicals! Even though of 'natural' origin!

## Plant extracts:

- Neem oil – from the neem tree, *Azadirachta indica* – effective against some aphids, whitefly, thrips.
- Repellent and toxic effects;
- Commercially available (e.g. Azatin XL)

## Elements

- Sulfur – wettable powder
- Effective against thrips, aphids, whitefly
- Also works on some plant diseases....
- Be careful for phytotoxicity!

## Oils

- Horticultural oils, ultra-fine oils;
- Smother insects – good on scale insects;
- Can cause phytotox in humid conditions (ultra-fine oils are better)

## Bacterial products

- *Bacillus thuringiensis* (e.g. XenTari, DiPel);
- Selectively kill caterpillars, beetles, some flies (depends on which one you use);
- Watch out for over-use – this leads to RESISTANCE in the pests.

## Fermentation by-products

- Spinosad – from a fungus used in fermentation processes;
- Very good for thrips; some caterpillars;
- Watch out for over-use and resistance!

## Some resources online:

National Sustainable Agriculture Information Service: <http://attra.ncat.org/>

UC Davis - Insect Pest Management for Organic Crops (PDF file):  
<http://anrcatalog.ucdavis.edu/pdf/7251.pdf>

Resource guide for organic insect and disease management (Cornell University):  
<http://www.nysaes.cornell.edu/pp/resourceguide/>

Biologically intensive and organic agriculture (Washington State University):  
<http://csanr.wsu.edu/BIOAg/>

Online information service for non-chemical pest management in the tropics:  
[http://www.oisat.org/concept\\_of\\_oisat.html](http://www.oisat.org/concept_of_oisat.html)

Crop Knowledge Master – UH: <http://www.extento.hawaii.edu/kbase/default.htm>