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 ago-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

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
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.

- Repellant 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 on 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/


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

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