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Organic Insect and Mite Pest "Control"

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Overview of Presentation

- **Introduction.** 
- **Pest Management Strategies.**
- **Organic Pest Control Materials.**  
- **Plant-Derived Essential Oils.** 
- **Questions and Discussion.**

Terms







- “Organic”=growing plants without the use of conventional pesticides, artificial fertilizers, human waste, or sewage sludge, and without ionizing radiation or food additives.
- “Sustainable”=use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials, and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations.
- OMRI=Organic Materials Review Institute
- NOP=National Organic Program

Restrictions by NOP: “Require that preventative, cultural, and physical methods, including introduction of beneficial insects must be the first choice for pest and disease control. If those materials are not effective, a botanical, biological or synthetic substance on the natural list may be used.” However, need to document.

Implement biological and cultural practices, particularly sanitation.

Common Arthropod Pests

- **Chewers**
 - Caterpillars: cabbageworms, corn earworm, cutworms, and hornworms
 - Beetles: Colorado potato beetle, cucumber beetle, flea beetles, striped cucumber beetle, and white grubs
 - Grasshoppers
- **Suckers**
 - Aphids
 - Spider mites
 - Squash bug
 - Leafhoppers
- **Borers**
 - Squash vine borer

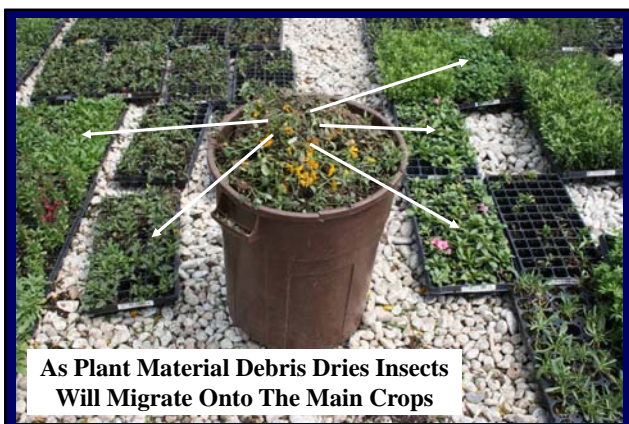
Pest Management Strategies

- **Scouting: Monitoring** 
- **Cultural: Sanitation**
- **Physical: Exclusion** 
- **Pest Control Material (Insecticides/Miticides)** 
- **Biological: Natural Enemies**

Scouting: Monitoring



Sanitation: Weed and Plant Debris Removal



As Plant Material Debris Dries Insects Will Migrate Onto The Main Crops

Sanitation: Keep Weeds and Plant Debris Away From Main Crops



Exclusion: Row Covering



Pest Control Materials for Certified Organic Production (OMRI Listing)

- *Bacillus thuringiensis* (Dipel and Gnatrol)
- *Beauveria bassiana* (Mycotrol/Naturalis)
- Potassium salts of fatty acids (Insecticidal Soap or M-Pede)
- Azadirachtin (Azatrol and Neemix)
- Neem oil (Triact)
- Pyrethrum (Pyganic)
- Spinosad (Entrust)
- Kaolin clay (Surround)



Pest Control Materials for Certified Organic Production (OMRI Listing)

Horticultural Oils:

- Petroleum oils (PureSpray Green)
- Plant oils (GC-Mite and Golden Pest Spray Oil)
- Fish-based oils (Organocide)



Characteristics of Organic Pest Control Materials

- Short-residual activity.
- Sensitive to ultra-violet light and rainfall.
- Are active on the young stages of insect and mite pests.
- Less harmful to natural enemies (parasitoids and predators).
- Low mammalian toxicity.
- May take longer to kill target insect and mite pests.



Bacillus thuringiensis

- *Bacillus thuringiensis* spp. *kurstaki* (Dipel).
- *Bacillus thuringiensis* spp. *israelensis* (Gnatrol).
- Insects must consume the material in order to be affected.
- In general, young larvae are more susceptible than older larvae.
- Susceptible to ultra-violet light (sunlight) degradation and rainfall.
- May indirectly impact natural enemies.



Bacillus thuringiensis spp. *kurstaki* (Btk) Product

How Btk Kills Caterpillars

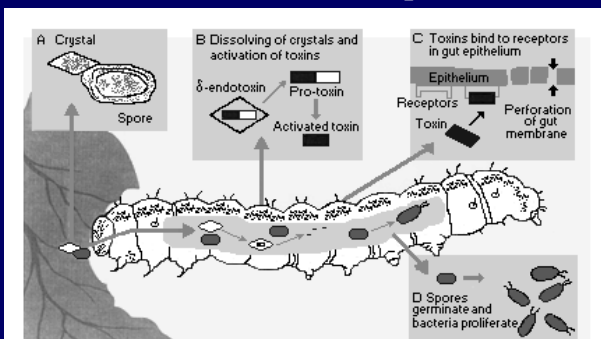


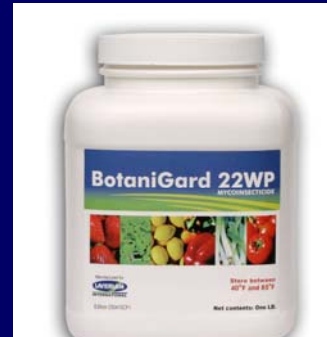
Fig. 1. Mechanism of toxicity of *Bt*



Bacillus thuringiensis spp. *israelensis* (Bti) Product

Beauveria bassiana

- Products: Mycotrol and Naturalis (BotaniGard)
- Insects are affected either by consuming the fungus or the fungus penetrates the cuticle.
- Speed of kill depends on number of spores contacting the insect, insect age, and environmental conditions (temperature and relative humidity).
- Active on soft-bodied insects such as thrips, whiteflies, aphids, and caterpillars.
- Susceptible to ultra-violet light (sunlight) degradation.
- Multiple applications may be required.
- In general, young larvae are more susceptible than older larvae.



Beauveria bassiana Product

Potassium Salts of Fatty Acids

- Product: M-Pede.
- Kill target insect (and mite) pests by disrupting the cuticle resulting in desiccation.
- Contact only so thorough coverage is essential; short-residual activity.
- Primarily effective against soft-bodied arthropods such as aphids, whiteflies, spider mites, and mealybugs.
- Water hardness may reduce effectiveness.
- Harmful (=phytotoxic) to plants if used "too often."
- In general, not indirectly toxic to natural enemies.



Potassium Salts of Fatty Acids Product

Azadirachtin

- Products: Azatrol and Neemix.
- Derived from the neem tree, *Azadirachta indica*.
- Multiple modes of action: insect growth regulator, antifeedant, sterilant, and oviposition inhibitor.
- Primarily active on caterpillars; more so than other arthropod pests.
- Multiple applications are typically required.
- Susceptible to ultra-violet light (sunlight) degradation and rainfall.
- More effective on young stages than eggs and adults.
- Works best under warm temperatures (>70°F).

Azadirachtin Product



Neem Oil

- Products: Triact and Organica (neem oil and soap).
- **Active ingredient: clarified hydrophobic extract of neem oil.**
- Works by suffocating (blocking breathing pores) arthropod pests.
- **Primarily active on soft-bodied arthropod pests such as aphids, spider mites, whiteflies, mealybugs, and scales.**
- Harmful to plants if used “too often.”
- **May directly affect natural enemies.**

Clarified Hydrophobic Extract of Neem Oil Product



Pyrethrum

- Products: Pyganic.
- **Pyrethrum=generic name; pyrethrins=six constituent compounds derived from chrysanthemum flowers.**
- Contact only with short-residual activity.
- **Highly toxic to bees.**
- Susceptible to ultra-violet light (sunlight) degradation.
- **May be active on a broad range of arthropod pests including true bugs, caterpillars, flies, aphids, and whiteflies.**
- A synergists such as piperonyl butoxide (PBO) may be added to enhance efficacy; however the use of piperonyl butoxide is not allowed under the NOP.

Pyrethrum-Based Product



Spinosad

- Product: Entrust.
- **Active ingredient: *Saccharopolyspora spinosa*.**
- Composed of spinosyns A (85%) and D (15%).
- **Fast-acting, and has both contact and ingestion activity.**
- Supposedly, minimal impact on beneficial insects and mites.
- **Active on caterpillars, thrips, flies, and certain beetles.**
- May directly or indirectly harm certain natural enemies (wet vs. dry residues).
- **Registered for use on herbs.**

Spinosad Product



Kaolin Clay

- Product: Surround.
- Mode of action:
 - Acts as a physical barrier thus preventing insects from reaching vulnerable plant tissue.
 - Acts as a repellent; creating an unsuitable surface for feeding or egg-laying.
 - Disrupts the insect's host-finding capability by masking the color of plant tissue.
 - Irritates the insect by attaching to the body and causes excessive grooming; distracts the insect from feeding.
- Leaves white thin layer on surfaces treated.
- May be harmful to natural enemies.

Horticultural Oils

- Products: PureSpray Green, Golden Pest Spray Oil, Organocide.
- Types: Petroleum (or mineral), fish, and plant oils.
- Work by preventing normal exchange of gases or suffocating (block respiratory system) arthropod pests.
- Kill egg, young, and adult.
- Primarily active on soft-bodied arthropods such as aphids, spider mites, scales, thrips, whiteflies, mealybugs, and psyllids.
- Minimal risk of resistance developing.
- Contact only so thorough coverage is essential; however, may be harmful to plants if applied "too often" or if applied during conditions of high humidity.
- May be directly harmful to natural enemies.



Petroleum-Based Oil Product



Sesame and Edible Fish Oil Product



“Preventative, cultural, mechanical, and physical methods must be first choice for pest control, and conditions for use of a biological material must be documented in the organic system plan.”



Plant-Derived Essential Oils

- * Garlic oil
- * Thyme oil
- * Clove oil
- * Sesame oil
- * Rosemary oil
- * Orange oil
- * Peppermint oil
- * Clarified hydrophobic extract of neem oil
- * Almond oil
- * Cedar oil
- * Canola oil
- * Geranium oil
- * Lemongrass oil
- * Citronella oil
- * d-limonene
- * Cinnamon oil
- * Soybean oil



Plant-Derived Essential Oils

- Obtained by steam distillation of plant leaves.
- Broad spectrum of insect and mite activity due to multiple “modes of action”: 1) antifeedants, 2) molting and respiration inhibitors, 3) growth and fecundity reducers, 4) cuticle disruptors, and 5) act on octopamine (CNS) pathway.



Essential Oil Products



Concerns Associated With Plant-Derived Essential Oils

- **Efficacy: consistent and reliable control.**
- **Phytotoxicity: directly harmful to ornamental plants.**



Issues with Plant-Derived Oil Products

* Consistency Depends on the Following:

- @ Time of year or season harvested
- @ Geographic location plant is grown
- @ Temperature and light exposure
- @ Plant nutritional quality
- @ Plant parts harvested
- @ “Stress” factors (environment) plant is exposed to
- @ Formulation



@ Concentration of active ingredient



- @ Phytotoxicity may be due to the inerts in the formulation such as solvents or carriers, and not the active ingredient
- @ Laboratory vs. field results
- @ Allergic reactions

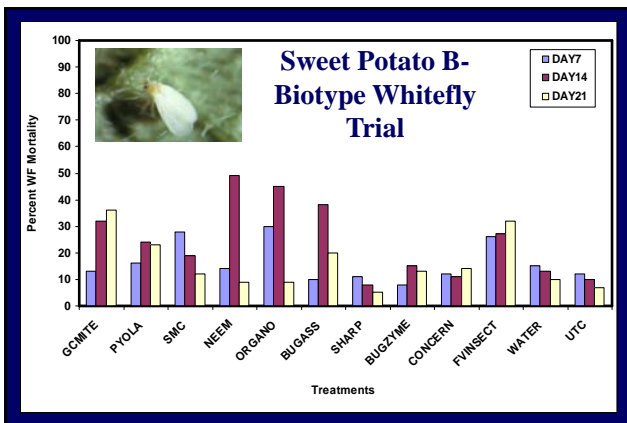
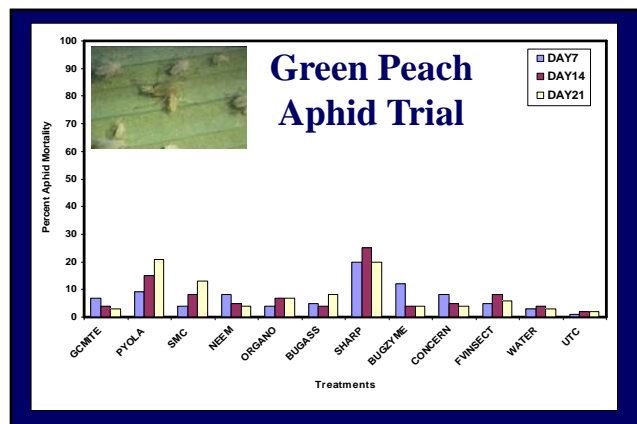
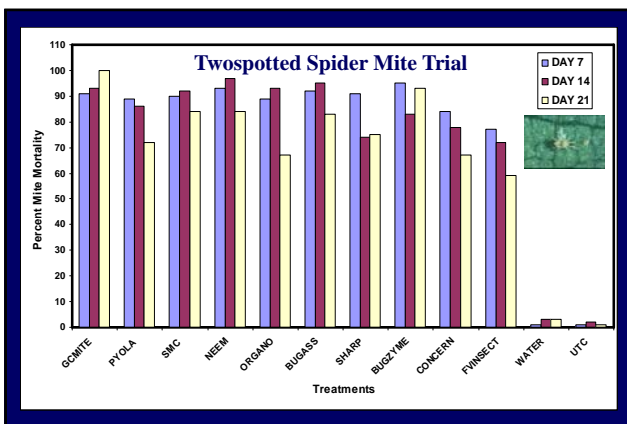


Products Evaluated and Active Ingredients

- * GC-Mite* (40% cottonseed oil, 20% clove oil, and 10% garlic oil)
- * Pyola (0.5% pyrethrins and 89.5% canola oil)
- * SMC (1% coriander oil, 94% canola oil, and 5% triethanolamine)
- * Neem Oil* (70% clarified hydrophobic extract of neem oil)
- * Organocide* (5% sesame oil, 92% edible fish oil, and 3% lecithin)

Products Evaluated and Active Ingredients

- * Bug Assassin (0.52% eugenol, 0.35% sodium lauryl sulfate, 0.15% peppermint oil, and 0.006% citronella oil)
- * Sharpshooter (5% clove oil and 10% sodium lauryl sulphate)
- * Bugzyme (0.18% citric acid)
- * Concern (96% canola oil)
- * Fruit and Vegetable Insect Spray (0.40% rosemary oil, 0.30% cinnamon oil, 0.30% clove oil, and 0.30% garlic extract)

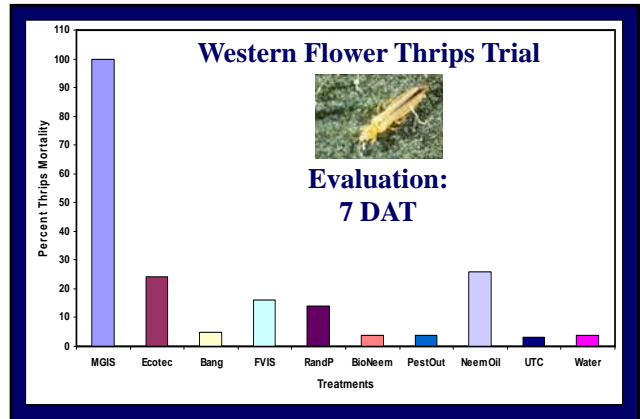


Products Evaluated and Active Ingredients

- * Monterey Garden Insect Spray* (0.5% spinosyn A and D)
- * Ecotec AG (10% rosemary oil and 2% peppermint oil)
- * Bang (30% piperecae by volume)
- * Fruit & Vegetable Insect Spray (0.4% rosemary oil, 0.3% cinnamon oil, 0.3% clove oil, and 0.3% garlic oil)

Products Evaluated and Active Ingredients

- * Rotenone-Pyrethrins Spray Concentrate (1.1% rotenone, 0.8% pyrethrins, and 2.2% other cube extracts)
- * BioNeem (0.09% azadirachtin)
- * Pest Out* (40% cottonseed oil, 20% clove oil, and 10% garlic oil)
- * Pure Neem Oil (100% neem oil)



2005 Resource Guide For Organic Insect and Disease Management

www.nysaes.cornell.edu

Thank You For Your Attention!

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Questions or What's Bugging You??