Apiary program

Disease & Pest Management

Presentation Overview

- I. Apiary Program
- II. Diseases
- III. Pests
- IV. Malady Management

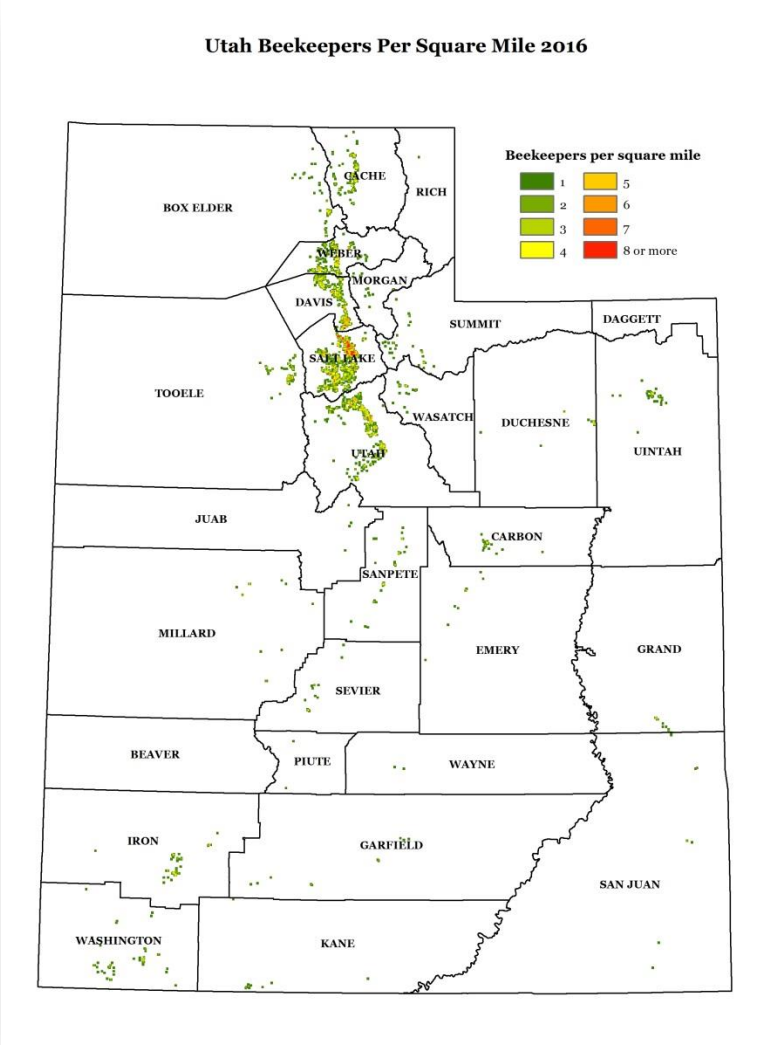
Preface

The honeybee (*Apis mellifera*) is an insect of great importance in the State of Utah.

- Pollination services for Utah's commercial apple, pear, apricot, and sweet cherry orchards.
- Used for alfalfa seed production.
- 30,000 hives produce 900,000 lbs. of honey produced per year.
- The beehive became part of the state's official seal when Utah joined the Union in 1896.
- Official insect of the state.

Preface

- There are currently over 1,800 beekeepers registered with the UDAF.
- The popularity of beekeeping increases every year.
- The UDAF Apiary program and County Bee Inspectors are important partners with Utah's growing beekeeping community.



Organizational History

Beekeeping has been popular in Utah since it was a territory; problems managing hives date back just as far.

- Foulbrood diseases plagued Utah's early settlers.
- The problems with these diseases became so widespread that the distinguished entomologist A.J. Cook of the Michigan Agricultural College came to Utah.
- He helped found the Utah-Beekeepers Association.
- The organization lobbied for passage of a bee inspection law in 1892.
- The law allowed every county to appoint an inspector to examine hives and dispose of the those which were diseased.
- The act helped reduce the spread of foulbrood.

Professor A.J. Cook
Michigan Agricultural College
Used with Permission
Michigan State University

Organizational Description

Over 100 years have passed since passage of the bee inspection law, but it still relevant today!

Today's beekeepers continue to battle brood diseases, as well as newer pressures such as Varroa mites.
Rob Snyder, Bee Informed Partnership

The Apiary program employs:

- A State Entomologist
- Two State Bee Inspectors

The Apiary program relies on:

- The generous, voluntary work of 14 County Bee Inspectors

The UDAF Apiary Program and the County Bee Inspectors continue to help ameliorate the maladies of Utah's managed bees.

Organizational Description

Major Products and Services

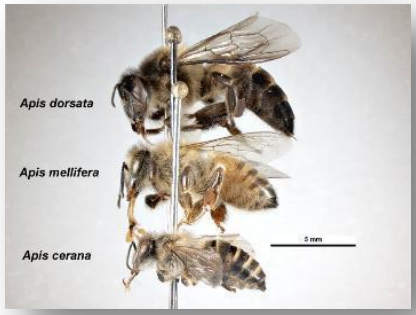
- Health certification for commercial beekeepers.
- On demand health inspections.
- Exclusion of exotic honey bee pests.
- Free testing through the UDAF Insect Lab for AFB, EFB, Nosema, tracheal mites, and other maladies.
- Literature and resources on honey bee health.
- Outreach—Farmers' markets, beekeeper clubs, public lectures, etc.
- Lobby local governments to legalize beekeeping.

USDA Honey Bee Survey

UDAF gathered samples for the APHIS Honey Bee Pest and Disease Survey

- The primary objective is to confirm the absence of exotic pests and pathogens in the United States.
  - Tropilaelaps mite (*Tropilaelaps clareae; T. mercedesae*)
  - The Asiatic Honey Bee (*Apis cerana*)
  - Slow Bee Paralysis Virus
- The secondary objective is to evaluate U.S. Honey Bee Health
- 8 hives per apiary were sampled
  - Wet/alcohol sample: Nosema and Varroa testing
  - Bump sample: Tropilaelaps mite
  - Live bee sample: Molecular analysis
    - Apis cerana
    - Viruses
    - *Nosema spp.*

Varroa mite (left) & Tropilaelaps (right)
Photo by I.B. Smith Jr., USDA-BRL



Giant honey bee (top)
European honey bee (middle)
Asiatic honey bee (below)
Photo by Ken Walker, Museum Victoria

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American foulbrood (AFB)

- The most devastating of the brood diseases.
- Caused by a bacteria (*Paenibacillus larvae*)
- Spore forming bacteria.
  - Spores can live over 40 years
- Only infects immature bees (up to 3 days old).
- Bees can pick up the disease when they are robbing infected hives.
- Humans can transmit the disease by exposing a healthy colony to contaminated equipment or bees.

Photo by Rob Synder, Bee Informed Partnership

American foulbrood (AFB)

Symptoms and diagnosis

Photo by Rob Synder, Bee Informed Partnership

Photo by Clint Burfitt, UDAF

1. Spotty brood pattern
2. Sunken caps
3. Perforations in capping
4. Pupae with extruded tongues
5. Irremovable scale
6. Ropy dead larvae (more than 1 inch)
7. Bad odor

Photo by Jack Wilkins, UDAF

American foulbrood (AFB)

- Prevention is the best method for managing the disease.

1. When purchasing a colony, ask for a health certificate
2. Don't purchase or accept used beekeeping equipment unless you are certain it is free of disease
3. Find out if the bees that you purchased have received antibiotics
4. Never switch frames, boxes or other equipment from a hive that is suspected to be infected with AFB to a hive that is healthy
5. Sterilize tools and gloves (10% bleach concentrate or flame) after working in a hive that is potentially infected before working in a hive that is healthy
6. Prevent robbing

American foulbrood (AFB)

Treatment

- Burning
  - The best option for ensuring the disease does not spread
- Antibiotics
  - Terramycin & Tylan
  - Only suppresses symptoms
  - Resistant strains
- BYU Phage Therapy
  - Experimental treatment

Photo by Jack Wilkins, UDAF

European Foulbrood (EFB)

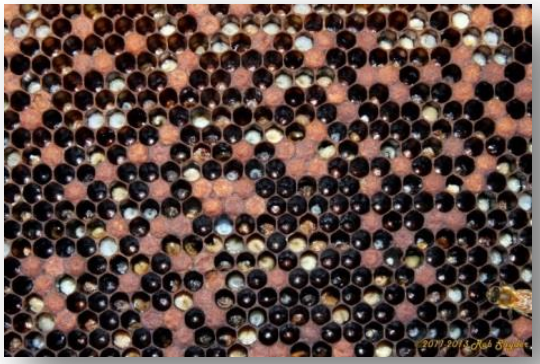

Photo by Rob Snyder, Bee Informed Partnership

- Caused by a bacteria (*Melissococcus pluton*)
- Bacteria does not form spores
  - Pathogen can overwinter however
- Considered a stress disease
- Bees can pick up the disease when they are robbing infected hives
- Humans can transmit the disease by exposing a healthy colony to contaminated equipment or bees

European Foulbrood (EFB)

Symptoms and diagnosis

- Change in color of larvae
- Larvae usually die before they are capped
- Spotty brood pattern
- Ropy dead larvae (1.5 cm)
- Scale (easily removable)
- A foul smell on occasion

Photo by Rob Synder,
Bee Informed Partnership

European Foulbrood (EFB)

Treatment

- Requeening
- Antibiotics
  - Terramycin
  - Treatment will eliminate disease (unlike AFB)
  - No reported resistance
- Mild cases may recover on their own

Sacbrood

Diagnosis and treatment

- Caused by a virus
- Usually doesn't cause severe losses
- Larvae changes color and head turns black
- Contents become a watery sac that is easily removed
- Robber and nurse bees transmit
- Requeen in severe cases

Photo by Rob Synder,
Bee Informed Partnership

Chalkbrood

Photo by Rob Synder, Bee Informed Partnership

Diagnosis and treatment

- Caused by a fungus (*Acosphaera apis*)
- Spore forming
  - Equipment can be contaminated for years
- More prevalent in late spring.
- Infected immatures are turned into fluffy, cotton-like "mummies"
- Improve ventilation for prevention and treatment
- Disease often clears up when temperatures get warmer
- Requeen if conditions do not improve

Nosema

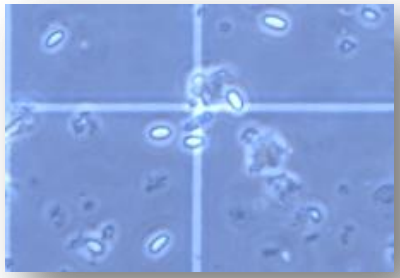
Photo by Katie Lee, Bee Informed Partnership

- Caused by microsporidians
- Two strains (*Nosema apis*)
- & (*Nosema ceranae*)
- Spore forming pathogen (present in feces)
- Queen can become infected
- Spores ingested by eating contaminated food or water, which infects the gut
- Can be transmitted by packages, splits and contaminated equipment

Nosema

Symptoms and diagnosis

Nosema apis

- Bees wandered on the ground
- K-wing
- Dysentery
- Reduced adult lifespan
- Can only be diagnosed by testing
- Health surveys indicate this species is less prevalent than *N. ceranae*

Photo by Rob Synder,
Bee Informed Partnership

Nosema

Symptoms and diagnosis

Nosema ceranae

- Bees wandered on the ground near the colony
- K-wing
- No dysentary
- Reduced adult lifespan
- Can only be diagnosed by testing
- Health surveys indicate this species is more prevalent than *N. apis*

Nosema

Treatment

- Antimicrobial medicine
  - Fumagillin
  - Effective against *N. apis*
    - Use at 1 million spores or higher
  - May not be effective against *N. ceranae*
    - Treated colonies do have better overwintering chances however
- Infections may recover on their own

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Varroa Mite

Photo by Scott Bauer, USDA-ARS

History

- First transmitted to *A. mellifera* from *A. ceranae* 70 years ago when European honey bees were brought into Asia
- Originally thought to be *Varroa jacobsoni* found predominately in Indonesia
- Actually *Varroa destructor* from mainland Asia

Varroa Mite

Photo by Scott Bauer, USDA-ARS

History

- Reported in the United States in 1987 in Florida
- Apparently the result of an accidental introduction of South American queen bees
- By 1989 19 states had become infested
- Utah's quarantine slowed the spread, but was eventually penetrated
- Australia the only major land mass without Varroa today

Varroa Mite

Photo by Scott Bauer, USDA-ARS

Biology

- External parasite of adults and brood
- Pregnant female moves from adult bee into an uncapped brood cell
- 3 days from capping, eggs are laid
- Eggs hatch and females mate with males
- Egg to adult about 6-7 days
- Adult mites emerge attached to host bee (phoretic)

Varroa Mite

Affects on Bee Health

Photo by Scott Bauer, USDA-ARS

- The most serious pest of honey bees and one of the principal causes of bee decline
- The mite feeds on the bee hemolymph (similar to blood)
- Feeding weakens the immune system, spreads disease (viruses) and ultimately reduces lifespan

Varroa Mite

Photo by Scott Bauer, USDA-ARS

Viruses

- Viruses have been known to infect honey bee colonies for over 50 years
- These diseases were generally benign until the introduction of Varroa
- Varroa acts as a vector (disease transmitter)
- Nearly 20 viruses have been identified
- There are no cures for bee viruses

Varroa Mite

Viruses

Photo by Katherine Aronstein

Photo by Michael E. Wilson

- Deformed Wing Virus (upper left)
- Sacbrood (lower left)
- Black Queen Cell Virus (upper right)
- Chronic Bee Paralysis Virus (lower right)

Photo by Rob Synder, Bee Informed

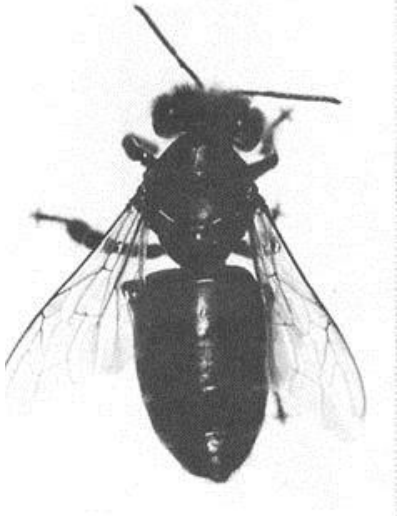


Photo by Brenda V. Ball

Varroa Mite

Parasitic Mite Syndrome

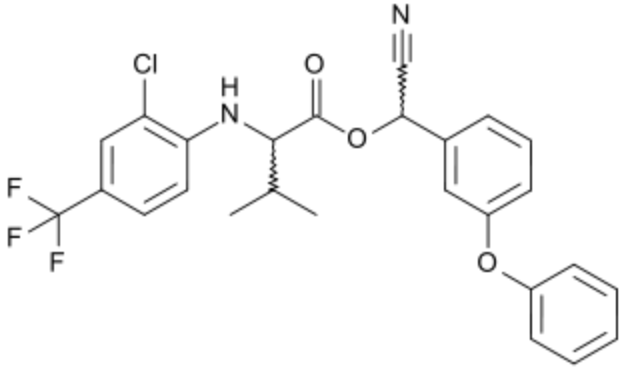
- Looks similar to EFB
- Spotty brood pattern
- Discolored larvae
- Chewed down pupae
- No roping
- DWV often present
- Managed by keeping mites under control

Photo by Rob Snyder, Bee Informed Partnership

Varroa—Synthetic Chemicals

Apistan—Fluvalinate

- Fast acting
- Must remove honey supers
- Kills phoretic mites
- Resistance has developed

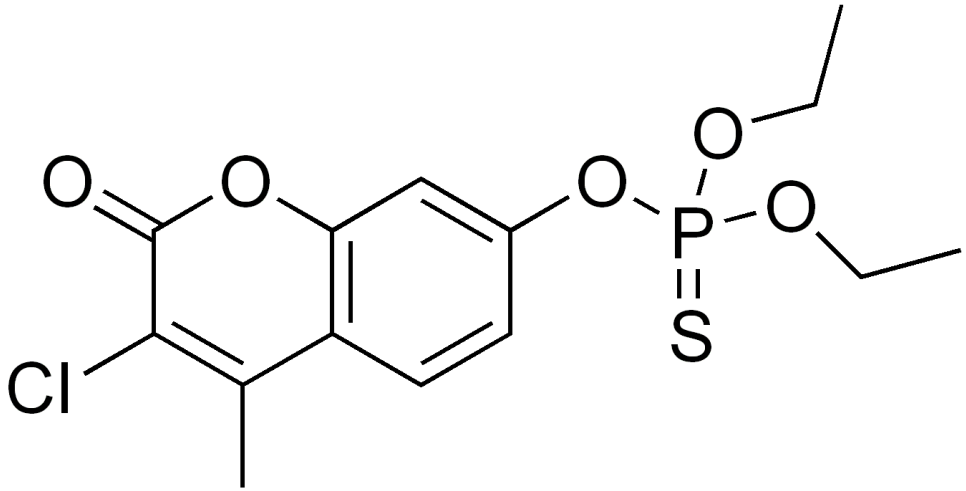


Wikipedia

Varroa—Synthetic Chemicals

Checkmite—Coumaphos

- Must remove honey supers
- Only kills phoretic mites
- Resistance has developed



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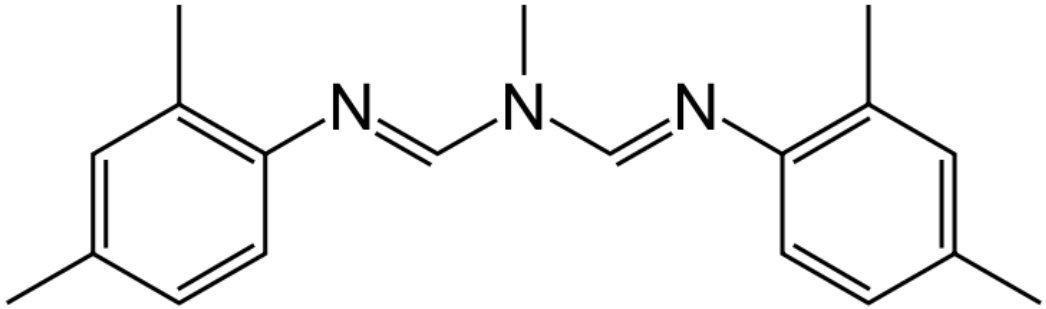
Varroa—Synthetic Chemicals

Apivar—Amitraz

- No significant residues left in wax or honey
- Not recommended with honey supers
- Kills phoretic mites



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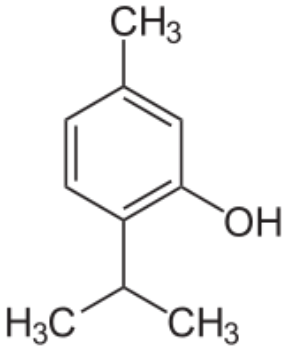
Varroa—Natural Chemicals

Apiguard & Apivar Life—Thymol

- Not recommended with honey supers
- Temperature must be between 60-105 F
- No known resistance
- Kills phoretic mites; not immediate



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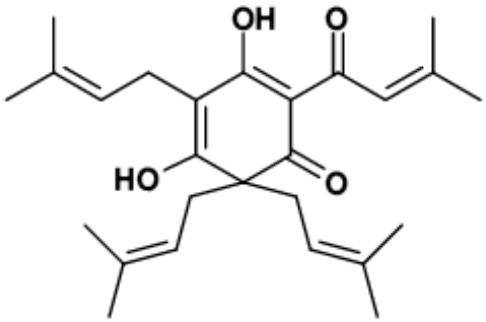
Varroa—Natural Chemicals

Hopguard—Hop Beta Acids

- Can apply with honey supers
- Organic acid
- Quickly effective
- No known resistance
- Kills phoretic mites

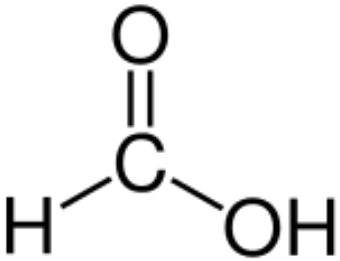


Lupulone

Varroa—Natural Chemicals

Mite Away—Formic Acid

- Can apply with honey supers
- Organic acid
- 50-80F Applying at temperatures above 92 may harm brood or the queen
- Don't disturb colony at time of application
- No known resistance
- Kills phoretic and brood mites

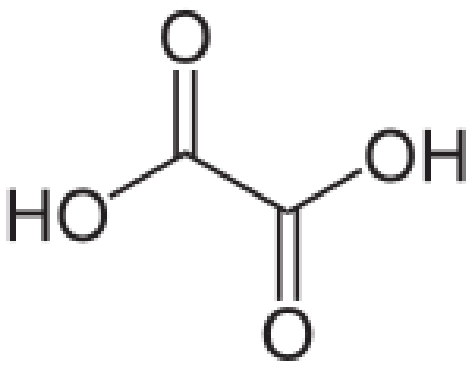


Wikipedia

Varroa—Natural Chemicals

Oxalic Acid

- Must remove honey supers
- Organic acid
- Works best in broodless period
- No known resistance
- Drench or fumigating
- Kills phoretic mites



Wikipedia

Tracheal Mite

Symptoms and treatment

Lilia de Guzman, USDA-ARS

- Internal parasite that lives in the breathing tubes in thorax of adult bees
- Shortens life of adult bees by feeding on hemolymph
- Symptoms include bees crawling on the ground unable to fly and K-wing
- Can only be diagnosed by dissection
- Grease patties, menthol crystals, Mite-Away and thymol
- Rare pest

Wax Moth

Rob Synder, Bee Informed Partnership

Rob Synder, Bee Informed Partnership

- Larval stage damaging
- Eat beeswax and comb
- Weak and dead colonies most susceptible; strong colonies keep this pest under control
- Kill with freezing temperature (0 F) for 24 hrs
- Para-Moth (Paradichlorobenzene)

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Integrated Pest Management

What is it?

- IPM is an effective approach to mitigating pest and disease problems
- Relies on a combination of approaches, instead of a single method of control
- Environmentally sensitive
- Utilizes pesticides as a last resort
- Slows the development of resistance
- Can be applied to beekeeping

Integrated Pest Management

How does it work?

- **Prevention:** applying methods which reduce the risk of pests from becoming a threat
- **Monitor and Identify Pests:** regularly inspecting for pests/diseases
- **Setting Action Thresholds:** the point at which pest control action must be taken
- **Control:** implementing the least risky option
- **Records:** keeping records for future management

Integrated Pest Management

Disease Prevention

- Ask for a health certificate
- Beware of used equipment
- Practice good hygiene with tools and equipment
- Share ideas, not equipment
- Prevent robbing
  - Robber screens
  - Don’t throw propolis or burr comb on the ground
  - Don’t leave out honey frames

Integrated Pest Management

Disease Monitoring

- Know the signs of diseases and refresh your knowledge frequently
- Inspect for diseases
  - Examine at least 3 frames of brood for diseases each time you inspect
  - Look at the wings of your bees for K-wing and deformed wings
  - Watch for bees crawling on the ground
  - Monitor overall colony strength

Integrated Pest Management

Disease Action Thresholds

- Action Thresholds will be different for every disease
  - AFB—no level of infection is acceptable (burn/treat)
  - EFB—minor infections may clear up if a nectar flow is on the way, treat if conditions don't improve
  - Nosema—treat if above 1 million spores per bee
  - Chalkbrood, stonebrood and sacbrood—requeen if symptoms worsen or don't improve

Integrated Pest Management

Disease Control

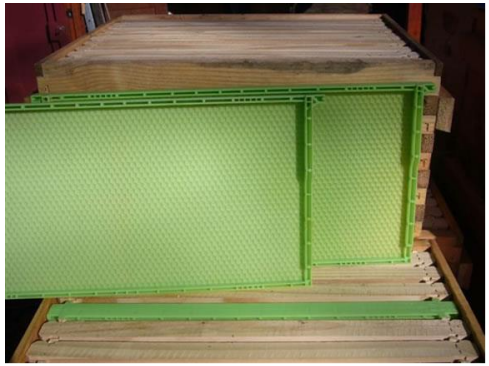
- Use the correct medicine
  - Terramycin = AFB, EFB
  - Tylan = AFB
  - Fumagillin = Nosema
- Follow the label instructions precisely
- Prophylactic treatment
  - Pro: can prevent disease transmission
  - Con: increases likelihood of resistance
    - If you treat prophylactically, continue to treat
    - Treatment does not guarantee recovery or prevention

Integrated Pest Management

Varroa Prevention

- Ask for a health certificate
- Drone brood removal
- Varroa Sensitive Hygiene (VSH)
- Breeding your own resistant stock
- Screened bottom board
- Other methods

Steve Tilmann



Randy Oliver, Scientific Beekeeping

Integrated Pest Management

Varroa Monitoring

- Merely looking for mites on bees does not provide good information
- You can't manage what you don't measure
- Use an accurate method
  - Powdered sugar roll
  - Ether roll
  - Sticky screen

Peggy Greb, USDA-ARS

Integrated Pest Management

Varroa Action Thresholds

- Every colony has a different tolerance level to Varroa
- General recommendation
  - Mite load kept below 3% of colony's population

Integrated Pest Management

Varroa Control

- Use the correct medicine
- Follow the label instructions
- Rotate chemicals
  - Helps prevent resistance from developing
  - Rotate out brood frames every three to five years or to reduce pesticide interactions

Toxicology

Paracelsus
(1493-1541)

Wikipedia

- Father of toxicology
- "All things are poison, and nothing is without poison: the dose alone makes a thing not poison"
- Substances that are natural are not necessarily safer than chemicals which are synthetic

Integrated Pest Management

Keeping Records

- Record keeping is an important component of IPM
- It helps inform future management decisions
  - Keep track of what methods are working and what are failing
  - Chronic problems may need to be resolved by resistant stock
  - Important in developing treatment thresholds that are specific to your apiary

Contact Information

Utah Apiary Program

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