IPM

Integrated Pest Management For Beekeepers: AFB and Varroa

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For the Essex County Beekeepers Society

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IPM means:

- LOOK BEFORE YOU TREAT!

INTEGRATED

- Multifaceted approach to dealing with pests
- Integrate many different management techniques, including physical or mechanical, biological, cultural, chemical

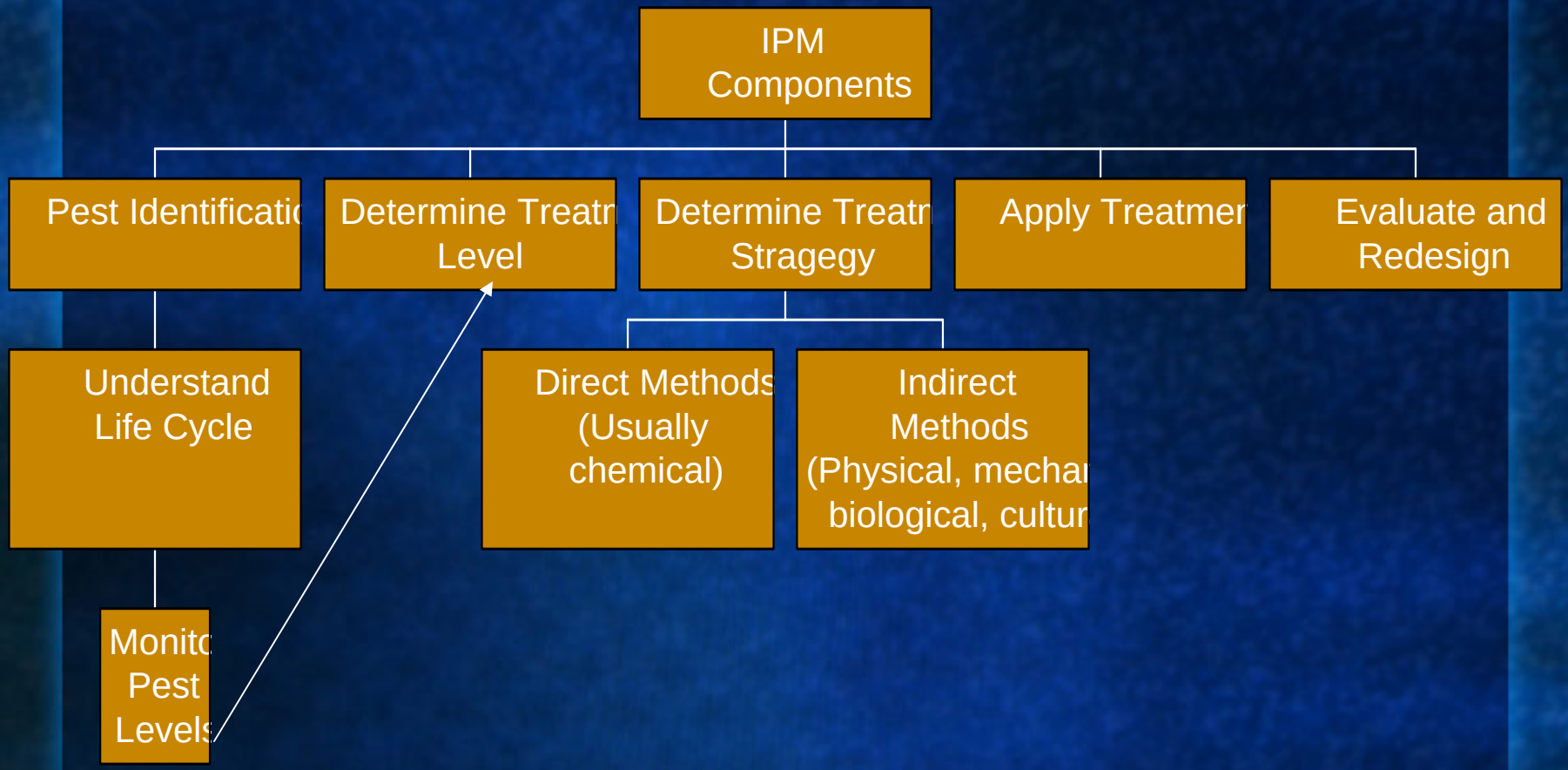
PEST

- Includes true pests such as wax moth
- Parasites such as the Varroa mite
- Pathogens such as AFB
- Predators such as bears

MANAGEMENT

- NOT eradication (except AFB)
- In IPM, we determine tolerable levels of pest populations and permit pests to exist below these levels.
- We use the least invasive, injurious or toxic control methods first.

Components of an IPM Program



American Foulbrood

- Pest Identification
  - Bacterial disease: *Paenibacillus larvae*
  - Infects <1% of managed US colonies
  - Causes >$5M in damage annually in US
  - Two Stages:
    - Vegetative
    - Spore (scale)

Symptoms (at individual level)

- AFB only infects worker larvae, not drone.
- Larvae die in upright position just after capping.
- Infected brood are dull yellow or coffee-colored
- Pupae that have died in capped cell may have proboscis sticking up (pupal tongue). This is DIAGNOSTIC.

Symptoms at Colony Level

- Cappings appear greasy and shrunken
- “Scattershot” brood pattern with punctured cappings
- *May* have distinctive molasses-like smell
- Dead brood dry into hard-to-remove scales that are a major source of infection.

Conditions that Mimic AFB

- Chilled brood (but all stages of dead brood are present)
- European Foulbrood (but larvae die before capping)
- Parasitic Mite Syndrome PMS (but lacks scale)

Diagnosing AFB

- Ropiness Test (only works for vegetative state)
- Holst Milk Test (only works if spores are present)
- Vita AFB Diagnostic Kit
- Send sample to Beltsville Bee Lab

Ropiness Test

- Remove capping & insert clean, dry toothpick.
- Stir and slowly withdraw.
- If larval remains stretch out at least an inch, AFB is likely present.

Holst Milk Test

- Only works if viable spores are present
- Can get false negatives but not false positives
- Make skim milk solution by adding 1/2 tsp. powdered milk to 50 ml of water (or follow package directions.)
- Scale or larva is placed in 3 to 4 ml of skim milk solution and warmed for 10 to 20 minutes to at least 98°. If solution becomes clear, AFB is present
- Bacteria produce proteolytic acid, which reacts with skim milk.

Laboratory Diagnosis - Free!

- Send a 4” x 4” sample of brood comb (no bees, please) wrapped in newspaper to:

  USDA
  Bee Disease Diagnosis
  Bee Research Laboratory
  Building 476, BARC-E
  Room 204
  Beltsville, MD 20705

Life Cycle of AFB

- Spores (non-active stage present in scale) are major means of spreading
- Spores are viable for >70 years
- Housecleaning bees ingest spores while cleaning scale, transfer to nurse bees.
- Nurse bees feed spores to larvae.
  - LD_{50} = 35 spores for 1 day old larva
  - LD_{50} > 1 million spores for 2 day old larva
  - Larvae are immune at 53 hours. Adult bees are immune.
  - One scale contains 2.5 billion spores.

Spores Can Be Spread to Honey

- Never, ever feed your bees honey from an unknown source.
- >90% of commercial honey contains AFB spores.
- Adult bees eating honey with spores will defecate spores out of the hive.
- Sunlight kills spores (but not deep in scale); rain leaches spores into soil.

Spread of AFB

- By bees: Primary mechanism is robbing
- By beekeepers:
  - Transferring comb, especially brood
  - Transferring wet extracted supers
  - Buying and using used equipment
    - *Never* use frames of drawn comb from an unknown source
    - Scorch used woodenware to burn propolis and wax
  - Hive tools and gloves.
    - Don’t use gloves if possigle
    - Clean hive tools by scraping and scorching
    - Dedicate hive tools to apiaries

Spread of AFB

- In packages and swarms (not high risk)
  - Both can contain AFB but risk is low. Safest bet is to hive on foundation and not feed for 3 days. Any spores present will go into making new wax.

Cultural IPM Techniques for AFB

- Clean hive tools with propane torch between hives; dedicate hive tools to apiaries
- Don’t wear gloves if possible
- Put wet supers back on hives they came from. In larger operations, return wet supers to their apiary of origin.
- Cull old comb every 5 years (good practice for many pathogens)
- Examine colonies carefully before transferring brood comb

Biological IPM Techniques for AFB

- Use resistant strains of bees
  - In 1964 Rothenbuler did early work on hygienic behavior in honey bees
  - Marla Spivak, University of Minnesota, revived and is expanding on this work
  - Hygienic bees detect diseased brood right through the capping and remove it before it can spread throughout the colony.
  - Hygienic bees are highly resistant to AFB (>90%) and to chalkbrood. They have moderately good resistance to Varroa mites.

Testing for Hygienic Behavior

Freeze a section of brood and return it to the frame. After 24 hours, Observe how much of the dead brood has been removed.

Treatment Thresholds for AFB

- Zero Tolerance Policy
  - No level of AFB is acceptable. Infected hives should be burned.
- Use of terramycin prophylactically breeds resistant AFB. Top bee experts in the country recommend terramycin NEVER be used this way. Terramycin masks symptoms by killing vegetative state but not spores.
- New antibiotic, Tylosin, available only by prescription. Not available for prophylactic use.

Destroying AFB

- Seal hive
- Kill bees by adding 7 Tbsp. dish liquid to 5 gallons water and pouring on hive.
- Obtain a permit and burn

Alternate (Saving Adult Bees)

- Shook-swarm adult bees
  - At night, away from other hives, onto foundation
  - Quarantine for at least 18 months
  - Scorch equipment and burn or bury frames
  - DO NOT GIVE TERRAMYCIN

IPM for *Varroa destructor*

Pest Identification: Historical

- *Varroa destructor* (formerly thought to be *Varroa jacobsoni)* arrived in U.S. in 1987.
- Native to *Apis cerana*
- Migrated to *Apis mellifera* in the far east
- Brought to South America by migratory beekeepers via Japan
- Has changed the face of beekeeping in America.

Varroa: Pest Identification

- Small pin-head size 8-legged brown to reddish brown parasite sucks hemolymph from bees
- Present in almost all U.S. colonies and in most countries
- Left untreated, will cause colony collapse within 2 years

Life Cycle of *Varroa destructor*

- Adult female mite feeds on bees 5-13 days then enters brood cell 24 to 60 hours before capping.
- Lays first egg 60 hours after capping, then every 30 hours thereafter
- First mite to emerge is male. Subsequent mites are female, which mate with male and feed on pupa
- Mature females emerge with bee; immature females and male remain in cell and die
- Mites are transferred bee to bee in brood nest; prefer nurse bees for cell access

Why Mites Prefer Drone Brood

	Worker	Drone	Queen
Days Capped	12 - 12.5	13 - 16	8
Average # Of Viable Mites	1.3 - 1.4	2.2 - 2.6	0

Effects of *Varroa:* Individual Bee

- Workers
  - Life span reduced by 50% (especially bad for overwintering bees)
  - Food and wax glands damaged
  - Reduced disease resistance
- Drones
  - Reduced sperm count
  - Less likely to mate successfully

BAD QUEENS

Effects of *Varroa:* Colony Level

- Pierced exoskeleton permits entry of multiple viruses normally present but dormant in the hive
- PMS: Parasitic Mite Syndrome. Easily confused with foulbrood
- Colony collapses under viral load, usually in late summer-fall

Monitoring Pest Levels: Ether Roll

- Still used in some states but kills bees
- Powdered sugar roll has replaced in most areas
- 200-300 bees in jar, spray 2-3 secs with lighter fluid, shake & roll. Count mites on side of jar.

Monitoring Pest Levels: Powdered Sugar Roll

- Add 400 bees (about 2 fingers) in a quart mason jar with hardware mesh screen on top
- Add 1 Tbsp. powdered sugar & shake
- Pour out sugar onto white paper
- Count mites
- Release bees

Monitoring Pest Levels: Sticky Boards

- Easiest to use with a screened bottom board (SBB) but can be used without
- Use commercial sticky board or use homemade marlite or plastic smeared with petroleum jelly
- Place below screen for 1 to 3 days
- Count mites
- Convert to equivalent 24 hour count

Determine Treatment Thresholds

- At a *minimum*, sample from late July to mid-August:
  - 24-hour natural fall on sticky board: Take action if >50 mites
  - Powdered sugar roll: Take action if > 10 mites

Treatment Thresholds in Winter/Spring

- Late Winter Sampling (early to mid-March)
  - 24 hour natural fall on sticky board: Take action if >2 mites
- Spring Sampling (late March to mid-June)
  - 24 hour natural fall on sticky board: Take action if >10 mites
  - Powdered sugar roll: Take action if >3 mites

IF YOUR BEES NEED TREATMENT, GET IT ON BEFORE THE END OF AUGUST!

Unless you'd rather have dead bees….

If testing indicates mite levels below treatment threshold,

DON’T TREAT!

(Unless you like to throw away money….)

Hives that don’t need treatment can be supered for a fall crop….

And for the *rest* of the story…..

- Including:
  - Cultural controls for Varroa: drone culling, comb replacement, reproductive interruption
  - Less toxic controls: essential oils, organic acids, mineral oil, fumigation techniques
  - *And* the “hard stuff” - coumaphos and fluvalinate
- You won’t have to force it out of me….

I’ll tell everything I know on June 12, 2007!

- At the *Varroa* Workshop
- At the Essex County Environmental Center
- 6:30pm Tuesday June 12, 2007
- See you then!