

Honeybee Diseases and Parasites

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Major Honeybee Diseases

- Bacterial Diseases
 - American Foulbrood-AFB
 - European Foulbrood-EFB
- Fungal Diseases
 - Chalkbrood
- Viral Diseases
 - Kashmir Bee Virus (KBV)
 - Israeli Acute Paralysis Virus (IAPV)
 - Chronic Bee Paralysis Virus (CBPV)
 - Acute Bee Paralysis Virus (ABPV)

American Foulbrood (AFB)

- Bacterial disease that attacks the bee larva
 - Symptoms appear hours before capping of the cell
 - Larva is destroyed and turned into infectious spores
 - Spores are permanently infectious
 - Can be killed by temperatures of 250°F for an hour
 - Gamma radiation
 - Ethylene oxide treatment
 - Can be cleaned out by hygienic worker bees
 - Usually the disease infects only worker larva
 - Queen cells and drone cells rarely infected by AFB

AFB Treatment

- Treatment
 - Terramycin TM has been used as regular treatment
 - Mixture of powdered sugar and TM
 - Applied as dust to top bars of hive away from open brood
 - Treatment once per week for 3 weeks
 - Grease patty's of powdered sugar, shortening and TM
 - Used twice per year spring and fall
 - Also helped with Trachael mite infestations
 - No longer used
 - TM has become problematic as some strains of AFB are resistant
 - Not recommended for treatment

AFB Treatment

- Tylan is current chemical treatment recommended
 - No routine application
 - Only applied when infection is discovered
 - Applied in powdered sugar mixture as dust
- Mixture
 - 100 gram bottle of Tylan
 - 22 Lbs powdered sugar
 - Applied 3 Tablespoons per applications weekly for 3 weeks

Recommended Practice for AFB

- Destroy AFB infected bees and burn infected comb
- Chemical treatment will not remove spores
 - Exception of ETO or Gamma radiation
 - Spores will be destroyed
 - Comb can be reused
 - Spores will permanently infest combs
 - Hive will break down later with AFB again
 - Burning of combs is best practice
- Prefer using new equipment
- Used equipment may be contaminated with AFB spores
 - Used comb should be destroyed
 - Other woodware can be scorched with propane torch

European Foulbrood

- Often confused with AFB
- Disease appears after the egg hatches and before the cell is capped
- Larva will be discolored
 - Normally pearly white
 - EFB infected will be off shade of white to brown
 - At later stages larva may turn black
- AFB infected larva sticks to cell walls
- EFB infected larva can be completely removed from cell

EFB Treatment

- EFB disease usually will not be serious
 - Clears up without treatment
 - Little effect on colony development
 - Often will occur during wet stress full spring conditions
- Can be treated with Terramycin
 - Powder mixture of powdered sugar and Terramycin
 - Same as for AFB
- Equipment is not permanently infected and can be used without destroying combs or scorching woodware

AFB Diagnosis

- Identifying Symptoms for AFB
 - High levels of infections (several combs) will have a strong sulfur putrefaction odor (rotting flesh)
 - Cells will be partially uncapped with ragged edges to hole
 - Larva when poked with small straw will have ropy stringy material attached to straw when removed from cell
 - Larval material will stick to sides of cell
 - Once larval material is dried scales form in lower region of the cell
- Collect sample and send to USDA Lab
 - Information available on line
 - Beltsville Md USDA Lab
 - No cost, takes several weeks
- Get an experienced beekeeper to look at comb

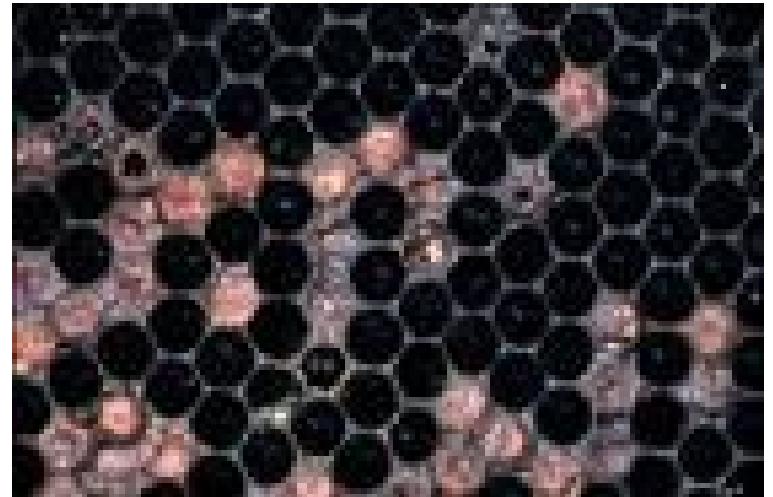
AFB Diagnosis

- AFB strings like taffy
- Use small stick like a toothpick
- Push into material in cell
- Pull out and observe string rubbery like goo
- Pick cell that has not dried out
- Material hardens into a scale once dry



AFB Diagnosis

- Cells appearance
 - Partially opened
 - Very spotty brood pattern
 - Unopened cappings are sunken rather than dome shape
 - Capping is off color
- Frames with lots of infestation have sulfury putrefaction odor



EFB Diagnosis

- Larva turn brown to grey
- Die before cell is capped
- Some cells may be capped with dead larva
- Larva twists upon dying
- Larva can be removed from cell without sticking to cell wall
 - AFB sticks to cell
 - AFB forms sticky rubber like string
- May smell like rotten fish



Chalk Brood in Cell

- Dead larva appears chalky white
- May also have grey to black color
- Can be easily removed from cell



Chalk Brood

- Chalk brood mummies outside hive or on bottom board
- Bees will remove from cell and drop outside hive



Control Chalk Brood

- Fungal disease
- Often appears during wet cold periods of late spring
- Usually not a significant problem
 - Disappears with warm dry weather
 - Can be related to the queen
 - Replacement of queen may be required on heavy infection cases

Viruses

- Serious problems
- Not currently treatable with any medications
- Many seem to be vectored by varroa mites
- More to be learned as present research discovers causes
- Best current practice
 - Keep varroa mites below economic threshold
 - Pay very careful attention to number of mites in colony

Parasites

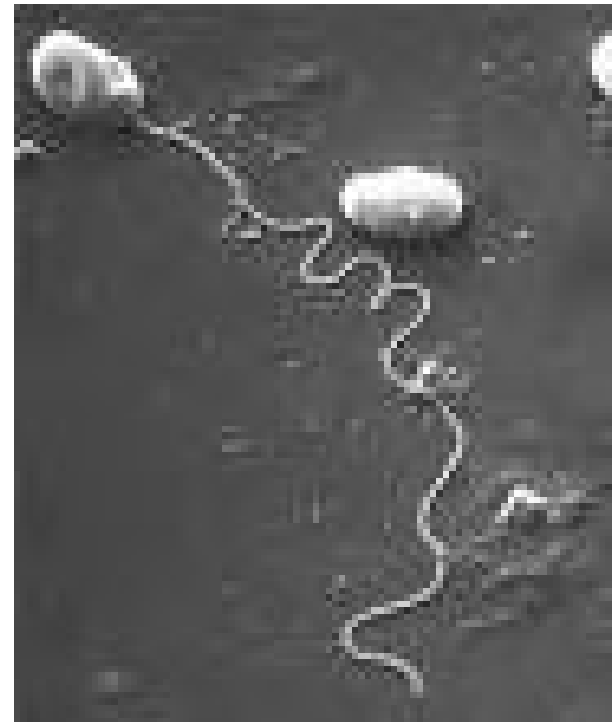
- Nosema
 - Nosema apis originally infecting apis mellifera
 - Nosema ceranae originally infecting apis ceranae
- Mites
 - Acarapis woodi or tracheal mite
 - Varroa jacobsoni or varroa mite
 - Varroa now in N America is new species
 - Referred to as Varroa destructor
- Control of nosema and mites is imperative if you are to be successful with your bees

Nosema

- Nosema is a protozoa parasite infecting the mid gut of the bee
 - *Nosema apis* originally infecting *apis mellifera*
 - *Nosema ceranae* originally infecting *apis cerana*
 - Both now present in our honeybees
- Spread by a spore that comes from bee droppings
- Bees are infected by swallowing spores
- Spores germinate into a vegetative state which then produce spores
- Takes 6 to 10 days for new spores to develop after infection

Nosema Spores

- Slightly oblong in shape
 - Observable 250 to 500 x microscope
 - Size is 3 to 5 microns
- Spore germinates after entering the ventriculus
- A hollow polar filament pierces the epithelial cells of the ventriculus
- Vegetative state is introduced through the hollow filament



Practical Aspects of Nosema

- Infects the adult bees
- Most healthy bees will have some spores
- Colony effects
 - Infection peaks in the early spring
 - High levels infection will kill hive over winter
 - Adult bees lack vigor and have shortened life spans
 - Colony strength and brood rearing is reduced
 - Honey production is reduced
- Must dissect bee to verify infection

Nosema Ceranae

- Original host *Apis ceranae* the asian honeybee
- Recently discovered in *Apis mellifera* our honeybee
 - Has been in our bees since 1995
 - Only recently has it been noticed as a serious problem
- Fumigilin-B is being evaluated to control it
- Infection peaks in the warm months
- Many reports of it killing colonies during the warm months
- Major research efforts have begun

Nosema Diagnosis

- Best method requires sample of 60 to 100 old bees and 250-500x power microscopic examination of prepared sample
- Visible evidence during late winter
 - Feces about entrances of hive
 - Feces on top bars and face of comb
 - Small clusters often dead on the comb
 - Hive usually has ample honey stores
 - Usually indicates nosema apis
- Heavily infected colonies dwindle in spring

Normal Hives in Early Spring



Likely Nosema Infected Hive



Likely Bad Case of Nosema

- Alive but will die
- Feces on top bars
- Few bees left
- Lots of honey left



Nosema Apis Treatment

- Fumigilin-B should be fed to all hives in the fall
- Two gallons of 2:1 (sugar:water) and recommended amount of Fumigilin-B
- Probably should be fed first in the fall to insure the bees get the medications
- Final feeding to provide sufficient winter stores can be done after Fumigilin-B
- Must be fed before average daily temperatures are below 60°F or bees **may not** take the feed

Nosema Ceranea Treatment

- Parasite peaks in summer months
- Early results show Fumigilin-B may be effective
- Treatment is different than for n. apis
- Spring treatment may be best
- 4 smaller feedings one week apart
 - Same label dosage
 - Quantity $\frac{1}{4}$ quantity per feeding
 - Could use more sugar syrup as bees may need the feed with the same amount of Fumigilin-B
- Spring feeding amounts
 - 1 Gallon per 20,000 bees or 2 boxes
 - $\frac{1}{2}$ Gallon per 8 to 12,000 bees or 1 box
- Goal is to feed enough over time to allow bees to clean up spores within hive and themselves

Tracheal Mites

- Mites infect breathing passage of bee
 - Lives and breeds within tracheal tubes
 - Ten spiracles or openings
 - Mites live in larger branches near the spiracles
 - Tracheal tubes get smaller as they branch
 - Live on bee blood they reach by perforating the trachea wall
- Young mites leave host and infect new host
- One generation per host
 - Second generation may be possible
 - Longer lived bees in fall and winter
- Complete life cycle occurs within tracheal tubes

Tracheal Mites in Trachea



Tracheal Mite Diagnosis

- K-Wing symptom
 - The hind wing unhooks from front wing
 - Bee body and wings form letter k
 - Not a good way
- Microscopic analysis
 - Sample of bees are examined under microscope
 - Bees are dissected
 - Tracheal tubes are observed under 20-40x magnification

Tracheal Mite Treatment

- Menthol crystals
 - Placed on top box top bars in late summer early fall
 - Daytime temperatures should be above 55°F
- Other methods
 - Formic acid registered for varroa is effective
 - Apiguard registered for varroa is effective
- Resistant honeybees
 - New World Carniolan and Russian bees show excellent resistance
 - Other bee breeders claim resistance

Varroa Jacobsoni or Varroa Destructor

- Originally parasite of *Apis ceranae*
 - Lived on colony without destroying it
 - Infected only drone larva
- Transported to Europe
- Entered North America in late 80's



Varroa Mite

- Infects worker and drone brood on *Apis mellifera*
- Destroys colony within 2 years of infestation
- Recent research shows it likely vectors other honeybee viruses
 - DWV deformed wing virus
 - KBV Kashmir bee virus
 - IPBV Israeli Paralysis Bee Virus
 - Others



Deformed Wing Virus DWV

- Young bees emerge with deformed wings
- Soon die
- Once virus gets extensive colony will collapse
- Virus is vectored by the varroa mite



Male Varroa Mites

- Smaller than the mature female mite
- Whitish in color
- Can see them on the bottom board or sticky board



Detection of Mites

- Ether roll
 - Several hundred workers placed in large mouth quart jar
 - Jar is sprayed for a few seconds with auto starting fluid containing ether
 - Lid is placed on jar
 - Jar is vigorously shaken for a few minutes
 - Other liquids such as soapy water, isopropyl or ethyl alcohol, vegetable oil can be uses
- Jar surfaces are examined for mites which come loose from the bees
- Bees should be taken from the brood nest
- Other methods use fluids which are then poured from the container through a filter which screens out the bees from the fluid and mites

Screen Board Detection

- Screen board is placed on hive bottom
- Mites fall through screen and onto a paper
 - Mites that are dieing or fall from bees that are still alive
 - Immature mites that fall from emerging brood cells
 - Male mites
 - Mite exoskeltons from emerging brood cells
- Paper is marked with squares to simplify counting
- Mite fall is periodically counted
 - Use a defined period such as one day
 - Can use a larger number of days if the mite fall is very low
- Method is an accurate way to assess colony infestation

Evaluation of Screen Board Counts

- Protocol for Eastern Washington
 - Economic threshold 25 mature female mites/day
 - Treatment threshold
 - Total number of mites in August could be 30 to 400x 24 hr drop
- Infestation varies during year
 - Aug may have 3/100 bees
 - Approximately 1800 phoretic mites
 - Total 6000 mites
 - Much lower in winter months
 - For 20000 bees at 3/100 bee, assuming no brood
 - Total of 600 mites
- Brood hatching
 - Large brood hatches will increase counts
 - Hard to distinguish immature mites from mature mites with naked eye
 - Males and exoskeletons also add to counting confusion
- Use screen board as diagnostic during and after treatment

Detection using Drone Brood

- Varroa mites prefer drone brood
- Longer developmental period
- Detect by opening capped drone brood
- Use comb scratcher or simply a pocket knife

Sticky Board with Large Mite Fall

- Mites density varies in different comb
- Mite fall accumulates under comb spaces
- This is a very large fall
- Other debris also confuses count



Treatment Methods

- Apistan and Checkmite strips
 - Mites have become partially or fully resistant to chemicals
 - Use these with great reservation
 - Active chemicals contaminate comb
 - Place 1 strip per 5 frames of bees between combs
 - Leave on the hive
 - Checkmite 42 to 45 days
 - Apistan 6 to 8 weeks

Treatment Methods (cont)

- Sucroside
 - Mixed with water and sprayed on combs
 - Must get mixture on mites
 - Does not contaminate comb
 - Effectiveness varies
- Apiguard
 - Slow release thymol gel
 - Applied in summer to early fall
 - Placed on top bars of top box
 - Maximum daily temperatures between 60 and 105°F
 - Applied in two consecutive 14 day periods
 - No honey supers on hive and must cover screened bottom board
 - Does not contaminate comb
 - Also is effective on tracheal mites
 - Efficacy >95%

Treatment (cont)

- ApiLife Var
 - Material containing thymol, euclyptus, menthol, camphor
 - Tablet is broken into four equal size pieces on the frame bars top box
 - Treatment is applied for 7 to 10 day interval three times
 - Applied late summer early fall after honey is removed
 - Daily Temperature in the range of 65 to 85°F
 - Efficacy is >75%
 - Does not contaminate combs

Formic Acid

- Commercial material Mite Away II
- Safely packaged
- Applied to top of hive
 - Must have a 1.5” rim on colony
 - Material placed on spacers on top box
 - Left for 21 days
- Daily temperature maximums in the 50-79°F range
- Close hive screen board and make hive tight with normal hive entrance
- Efficacy 93.5+/-5.5%
- Apply twice per year spring and fall
- Controls varroa and tracheal mites
- Also kills varroa within the capped cell

Drone Trapping

- Comb is placed in hive with drone foundation
- One comb per box
- Once comb is filled with capped drone brood it is removed
- Placed in freezer for a day
- Returned to hive for bees to clean up and use again
- Must be routine as leaving drone brood to hatch out provides an excellent means increasing mite levels!!

Summary

- AFB is a major disease that is best treated by burning combs and scorching other equipment
- Nosema must be controlled to survive winter and be able to make a honey crop
- Nosema ceranae a new parasite has no current treatment
- Tracheal mites are best controlled with varroa treatment and selection of mite resistance stock
- Many virus are present and are best controlled by controlling varroa mites within economic levels
- Varroa mites must be controlled or hives will die within 2 years
- Using a screen board is the best method for detecting the level of varroa mite infestation