Diseases & Pests
Overview

- Brood Diseases
  - American Foulbrood (AFB)
  - European Foulbrood (EFB)
  - Chalkbrood
  - Sacbrood

- Adult Diseases
  - Nosema
Overview

- Parasites
  - Varroa Mites (varroa destructor)
  - Tracheal Mites

- Predators
  - Wax Moths
  - Small Hive Beetles
  - Mammals
Considerations

- Cause
- Symptoms
- Signs
- Diagnoses
- Transmission
- Control/Prevention
American Foulbrood

American foulbrood disease occurs throughout the world where honey bees are kept. About 3 percent of all colonies inspected in the United States are found to be infected.
American Foulbrood

Cause

*Paenibacillus larvae ssp. larvae*, the causative organism of American foulbrood disease, is a spore-forming bacterium which produces over a billion spores in each infected larva. Only spores are capable of inciting the disease. The spores are extremely resistant to heat and chemical agents. Worker, drone, and queen larvae are susceptible to the disease. Under natural conditions, infected queen and drone larvae are rarely seen.
American Foulbrood

Symptoms

Spotty brood pattern, perforated sealed brood with coffee brown larvae inside, sunken sealed brood, coffee brown larvae sunken to the bottom of the cell.

Moisture on sunken sealed brood, protruding pupa tongue (rare), and rotting smell (compared to rotting meat or sulfurous chicken house).

Light to dark brown to black scale that is hard to remove.

Often colonies next to infected colonies will show symptoms of the disease.

Larvae rope at least 2 cm.
Healthy Brood
American Foulbrood
American Foulbrood
American Foulbrood
American Foulbrood

Diagnosis

- A good field test is the “ropey” test. Stick a toothpick into a capped cell and draw out the dead larvae/pupae. The “rope” should stretch about 2 cm.
- American Foulbrood also has a characteristic odor
- Field Test kits
- State Bee Inspector
- Lab testing is necessary for definitive diagnosis
American Foulbrood

Transmission
- Introduced to the hive by drifting bees from nearby colonies
- Infected equipment/tools, beekeepers and robbing
- AFB is very contagious and all equipment must be cleaned before using it in healthy hives
- Nucs (nucleus hives)
- Infected Honey – do not feed store bought or honey from other beekeepers to your bees
American Foulbrood

Control/Prevention/Treatment

- Good management practices.
- Inspection by state bee inspector
  - You must follow his instructions
- Destroy equipment by burning: It is best to burn all colonies infected with AFB but you can treat infected colonies with antibiotics.
- The recommended treatment for AFB is Terramycin
  - Follow the label – IT IS THE LAW

Radiation Programs
In some areas, European foulbrood is a more serious threat to beekeepers than American foulbrood. This disease is serious because it occurs most frequently at the time that colonies are building their peak populations, often before honey flows.
European Foulbrood

Cause

European Foulbrood (Melissococcus plutonius) is transmitted when the bacteria become mixed with the bee bread, nectar or diluted honey, and then fed to young larvae. The bacteria then replicate in the larvae mid-gut, killing the larvae within 4-5 days. This causes the larvae to die before sealed in most cases.
Symptoms

Spotty brood pattern, whitish-yellow to brown larvae, curled upward or twisted.
Deflated larvae in the bottom of the cell with a defined tracheal system.
Odors produced can be sour or fish-like, or no odor at all (different odors can come from secondary bacteria.) Scale is usually from brown to black sunken to the bottom of the cell.
Outside frames of the brood nest are usually infected first.
European Foulbrood
European Foulbrood
European Foulbrood
European Foulbrood

Transmission

- Infected equipment/tools, beekeepers and robbing
- EFB is very contagious and all equipment must be cleaned before using it in healthy hives
- Nucs (nucleus hives)
- Infected Honey – do not feed store bought or honey from other beekeepers to your bees
European Foulbrood

Control/Prevention/Treatment

- Good management practices.
- Inspection by state bee inspector
  - You must follow his instructions
- The recommended treatment for AFB is Terramycin
  - Follow the label – IT IS THE LAW
- Radiation Programs
- Re-Queening
Chalkbrood
Healthy Brood
Infected Brood
Chalkbrood

Cause
- (Ascosphaera Apis)
- Fungus (spores viability: 15 years)

Symptoms/Diagnosis
- Spotty brood pattern.
- Chalk-like mummies at the colony entrance, chalk-like mummies in open brood.
- Early stages of chalkbrood look very similar to SBV but the head is less defined and more round with a sunken appearance.
Chalkbrood

Treatment
- Apiguard or thymol based products are active against Chalkbrood
- Increase ventilation
- Re-queening
Sacbrood Virus
Sacbrood Virus
Sacbrood Virus

Cause

Sacbrood Virus (Morator aetatulas) often appears during spring or colony buildup and causes larval death.

Symptoms/Diagnosis

- Perforated sealed brood, pupa present with undeveloped head.
- Color ranges from pearly white to pale yellow to brown and eventually to black, when it is in scale form it is brittle and easily removed.
Sacbrood Virus

Transmission
- Worker bees spread virus by:
  - Feeding young uninfected larvae
  - Exchanging food with other adult bees
  - Contaminating food stores

Treatment
- The only known treatment is to re-queen.
Nosema is a genus of microsporidian parasites that infect the digestive tract of the honeybee. Nosema disease in U.S. honey bees is caused by one of two (or both) fungi named *Nosema apis* and *Nosema ceranae*. Nosema disease is difficult to diagnose without using laboratory equipment.
Nosema

Nosema Apis
- Most problematic in the winter and spring
- Bees will begin to expel waste in the hive and on the outside (dysentery)
- Brown spotting on the outside of the hive will appear
- Affects mostly worker bees
- Bees may be unable to fly (crawling around) due to disjointed wings
- Lack of progression in hive build up
- May requeen themselves (supercedure)
Nosema ceranae
- Can affect a hive at any time of the year
- Can cause rapid colony decline
- No symptoms will be present
- Lack of progression in hive build up
- May requeen themselves (supersedure)
Nosema

Control
- Good management practices
- Maintain healthy hives
- Good supply of protein pollen in the fall
- Replace old frames
- Clean equipment
Nosema

Treatment with Fumagilin-B

Nosema apis in bees is very well controlled using Fumagilin-B as directed in our insert.

In the fall, after all honey supers have been removed, apply medicated syrup (1:1 or 2:1) at a rate of 190mg fumagillin activity per colony.

In the spring, feed medicated syrup (1:1 or 2:1) at a rate of 95mg fumagillin activity per colony.

The best treatment method for Nosema ceranae or Nosema apis in conjunction with Nosema ceranae has not yet been established.
Nosema
Tracheal Mites

- *Acarapis woodi*
- Microscopic – infects drones, workers, queens
- Entrance – 1st thoracic spiracle
- Transmission: bee-to-bee contact
- Prefers young beens: <4 days old
- Treatment: menthol
  - Northeast best in mid-July to mid-August
  - <80° Farenheit – top of frames
  - >80° Farenheit – bottom board
  - Melts at 95-97° Farenheit
Tracheal Mites Indications

- Positive id only with microscope
- Bees crawling at hive entrance
- Poor clustering in cold weather
- “K-wing” (wings remain unfolded)
- Unchecked, these parasites live, feed and reproduce inside the breathing tubes, blocking oxygen flow and eventually killing their host
Tracheal Mites Indications
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites
Varroa Mites

- *Varroa destructor* is an external parasitic mite that attacks the honey bees *Apis cerana* and *Apis mellifera*.
- The disease caused by the mites is called *varroosis*.
- *Varroa destructor* can only reproduce in a honey bee colony. It attaches to the body of the bee and weakens the bee by sucking hemolymph.
- In this process, RNA viruses such as the deformed wing virus (DWV) spread to bees.
A significant mite infestation will lead to the death of a honey bee colony, usually in the late autumn through early spring.

The *Varroa* mite is the parasite with the most pronounced economic impact on the beekeeping industry.

It may be a contributing factor to colony collapse disorder, as research shows it is the main factor for collapsed colonies in Ontario, Canada and Hawaii, USA.
Varroa Mites

Mites reproduce on a 10-day cycle.

The female mite enters a honey bee brood cell. As soon as the cell is capped, the *Varroa* mite lays eggs on the larva.

The young mites, typically several females and one male, hatch in about the same time as the young bee develops and leave the cell with the host. When the young bee emerges from the cell after pupation, the *Varroa* mites also leave and spread to other bees and larvae. The mite preferentially infests drone cells.
Varroa Mites

Why are the mites killing our bees?

- Bring in opportunistic bacterial and viral infection
- Weaken bees’ immune system thus allowing other diseases to kill the colony
- Directly damage workers
Bacteria, Fungus, & Viruses

Bacterial
- American foulbrood
- European foulbrood

Fungal diseases
- Chalkbrood

Viral diseases
- Chronic paralysis virus
- Acute bee paralysis virus
- Israeli acute paralysis virus
- Kashmir bee virus
- Black queen cell virus
- Cloudy wing virus
- Sacbrood virus
- Deformed wing virus
Treatment for Varroa Mites?

YES
How, when and what?

- Mite Counts is your first step!
  - Sticky boards
  - Drone brood sampling
  - Sugar roll
  - Alcohol roll

- When to count?
  - Packages – Starting in June
  - Nucs – Starting in June
  - Every 3 week or so
  - Before AND after treatments
How, when and what?

- **Sticky Boards – plastic inserts**
  - If you use screened bottom boards, sticky boards can easily be used to sample for mites. The drawbacks of using sticky boards are that they are messy, they must be left in the hive for several days, they collect not only dropped mites but also a fair amount of hive trash and it can be very difficult to accurately count the mites stuck. The mite drop varies widely based on the brood rearing activity in the hive. Spray the insert with PAM.
How, when and what?

Drone Brood Sampling

This method provides for a ready visual inspection but it is hard to draw direct conclusions about the infestation level without sampling at least 100 drone brood cells in the correct stage of development from a number of locations within the brood chamber. During hive inspections we frequently find burr drone comb at the bottom of frames that is pulled apart when the frame is removed. Careful inspection of this opened comb can reveal the presence of mites.
How, when and what?

Drone Brood Sampling

Varroa prefer drone brood over worker brood by a ratio of 10:1. To sample for mites using an uncapping fork scrape open a few drone cells. You are looking for drone brood in the pink-eye stage. Push your uncapping fork into a section of cells from the side, skewering 20 or so through their thoraxes, then lift the pupae out of the comb. Tap the frame over a white surface to dislodge any mites remaining in the cells. Hold the exposed pupae over the same white surface and inspect for mites.
How, when and what?

Sugar Roll

This is a non-destructive method of sampling for mites. This is accomplished by covering a sample of bees with powdered sugar, causing the mites to lose their grip and falling off, assisted by aggressive grooming behavior as bees try to clean themselves up. The mites which drop off are collected and counted.
How, when and what?

Sugar Roll

You will need the following:
- Mason Jar with 1/8 wire mesh cover
- Confectioner sugar
- Container to shake bees into (white wash tub is best)
- Container of water
How, when and what?

Sugar Roll

Pull a frame of brood from the top box. You want a frame from the center of the brood nest. Open brood is good but not essential. Do not collect the bees for the test from the inner cover, or a honey frame or from the beard hanging on the front of the colony. Inspect the frame for the queen. If you see her place her on another frame. The goal is to get a sample of nurse bees, which are the primary transport vehicle for mites awaiting the opportunity to jump into a cell that is about to be capped.
How, when and what?

Sugar Roll

Vigorously shake the frame over a white wash tub, knocking as many of the bees as possible into the tub. Wait a couple of minutes to let the older bees fly away. The young nurse bees will not fly. Tip the tub at an angle to slide the bees into a corner. Take a ½ cup measuring cup and scoop through the bees to collect a level ½ cup of bees. This will be about 300 bees. Pour the ½ cup of bees into the mason jar and put the wire mesh lid on the jar.
How, when and what?

Sugar Roll

Pour a rounded teaspoon of powdered sugar through the mesh into the jar. Roll the jar until all of the bees are white. Roll for a few seconds more. Then set the jar aside for four minutes.
Sugar Roll

While the jar is sitting, pour water into the wash tub to a depth of about 1 inch. After four minutes invert the jar over the water and gently shake the jar. Continue shaking for a minimum of one minute and as long as you see mites continuing to fall. Once all of the mites are out, open the jar and pour the bees onto the landing board in front of the hive.

Count the mites floating in the water.
How, when and what?

**Alcohol Wash**

This is perhaps the best method of sampling but it is destructive. The bees will be killed. Proceed as above to collect a ½ cup sample of bees from the brood nest. Fill the mason jar half full of rubbing alcohol. Pour the bees into the jar of alcohol and cap the jar. Vigorously shake the jar for a couple of minutes. Pour the alcohol through the wire mesh onto a coffee filter or clean white cloth (a feed sack dish towel works well). Add more alcohol and repeat until no more mites drop through the mesh. Discard the bees. Count the mites on the filter or cloth.
Interpreting the Counts

For both the alcohol and sugar rolls, divide the number of mites counted by 3 – this yields the percentage infestation rate. For example, if the count is 21 mites, the infestation rate is 7% (21 divided by 3). It is recommended that a hive that tests over 2% be treated. This means a count greater than 6 mites.
How, when and what?

Research has shown that 300 bees is the statistically appropriate number of bees. Any less and the sample is too small to yield an accurate count and little additional precision is gained by sampling more than 300 bees.
How, when and what?

When to Sample?

Sampling during the spring brood build up offers good insight into hive conditions. The varroa population doubles every month beginning in spring so the infestation rate depends on the mite count present when brood production begins in late winter. Though the mite population growth is slower than the brood build up during this time, the infestation rate can easily exceed the 2% threshold in a short number of weeks. Continued sampling throughout the season is recommended.
How, when and what?

It is up to the beekeeper to determine when to treat. We now have tools (MAQS®) than can be used during the nectar flow while honey supers are on the hive, giving us the opportunity to treat during this time if necessary. Other treatments like Api-Life Var® and Apiguard® can only be used once the honey supers have been removed.
How, when and what?

How Many Hives to Sample?
- If you have a small bee yard (less than 10 hives) with the hives in close proximity and each hive having the same size brood nest (number of boxes), you will get good results if you sample only one hive. The bees drift among the hives and the mite count is generally consistent from one hive to the next. In larger bee yards or yards where you are running both two and three deep hives sampling more than one hive is recommended. Keep good records and sample different hives each time you sample.
How, when and what?

Following Up After A Treatment
- It is recommended that you do your mite counts before you treat, obviously, to determine if you need to treat.
- But more importantly, that you count again as soon as your treatment is over.
How, when and what?

What to do if your mite counts are high?
- Treat, treat, treat, treat!

Prescribed Treatments
- Mite Away Quick Strips
- Apiguard
- Api-Life Var
- OAV – Safety first

Varroa Mite Groups
- Contact your local VMG leader
Small Hive Beetle
Small Hive Beetle

- It is called: Aethina tumida
- June 1998, discovered in U.S (Florida)
- Transported via packages to other states, included Massachusetts
- Destructive to colonies
- Prefers sandy soil
- Heavy infestation may cause hive abandonment
Small Hive Beetle

- Infects stored frames and honey in the comb awaiting extraction
- Discoloration and fermentation of honey
- Damage caused by feeding activity of the larvae
- Rapid collapse of otherwise strong colonies
- The small beetle is black and can be found moving rapidly inside the hive when exposed to sunlight.
Small Hive Beetle
Small Hive Beetle

Treatment
- Healthy Strong hives
- Good hive management
- Small Hive Beetle Traps
Wax Moth Larvae

- Complete metamorphosis: egg, larva, pupa, adult
- Larvae tunnels into wax
- Debris in comb
Wax Moth

- Galleria mellonela
- Large loss of stored comb
- Prefers warm, year-round temps
- Does not kill colony but can be early warning signal
- Weak colonies susceptible
- Treatment/prevention
  - Cold
  - Heat
Wax Moth Larvae on Frames
Wax Moth Infestation
Wax Moth Infestation
Wax Moth Infestation
Wax Moth Treatment

Cold
- 4.5 hours @ 20° f / -7° c
- 4.3 hours @ 10° f / -12.2° c
- 4.2 hours @ 5° f / -15° c

Hot
- 80 minutes @ 115° f / 46° c
- 40 minutes @ 120° f / 49° c
Integrated Pest Management

- Threshold
  - Acceptable level of infestation
  - Treatment
- Mechanical vs. Chemical
- Organic vs. Synthetic
- Read the label….It’s the law!