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Honeybee Diseases and Pests

Diseases	***Arthropod Pests***	***Vertebrates/Other Pests***
More Common	***More Common***	***More Common***
American Foulbrood	Varroa Mites	Bears
Bee Paralysis Viruses (Varroa mite as vector)	Wax Moths (Greater and Lesser)	Mice
Deformed Wing Viruses (Varroa mite as vector)	Small Hive Beetles	Skunks
Nosema (nosema apis, nosema ceranae)		
Less Common	***Less Common***	***Less Common***
Black Queen Cell Virus	Ants	Birds
Chalkbrood	Bee Lice (Braulids – mainly eastern US)	Opossums
European Foulbrood	Cockroaches	Raccoons
Kashmir Bee Virus	Dragonflies	
Sacbrood	Earwigs	
Stonebrood	Wasps (Yellow Jackets & Hornets)	
	Robber Flies	
	Termites	
	Tracheal & External Mites	

American Foulbrood

Causative Agent: *Bacillus larvae* (Bacteria)

Range: Worldwide

Life cycle:

- Young larvae can be fed as few as 10 spores to be infected.
- As larvae become older they have to consume more spores to be infected. Full grown larvae rarely become infected.
- Death occurs after the cell is capped.
- The larva or pupae within the capped cell will decay in place and the tongue is often left attached to the top of the cell.
- Progression of color: white to light brown to coffee brown to dark brown/black.
- Cadaver, including the head, deflates uniformly, dries into a scale and strongly adheres to the bottom of the cell.
- Consistency of dead brood is soft and becomes sticky and stringy
- A single dead pupa can produce approximately 2.5 billion spores.
- Spores can remain viable for up to 50 years.

Management:

- Frequent inspections of the hives often reveal this disease before it becomes damaging.
- When the infestation is low uncapping infected individuals will result in the hive removing the infected material.
- Treatment with Oxytetracycline can kill this disease but several precautions must be taken to prevent the contamination of honey and other products.

Misconceptions:

Odor is not a reliable method of distinguishing this disease.

Irregular brood pattern can be a sign of a problem (but not necessarily American Foulbrood)

Black Queen-Cell Virus

Causative Agent: Virus

Range: North America, Great Britain & Australia

Life cycle:

- Virus primarily attacks developing queens and in rare instances will affect developing workers
- Infected pupae die, darken, and the walls of the cell develop black patches.

Management:

- Uncommon, currently sanitation is the only way to regulate this virus.

Chalkbrood

Causative Agent: *Ascosphaera aphis* (Fungus)

Range: Europe and North America

Life cycle/ Symptoms:

- Typically attacks mature larvae & pupae (young larvae only attacked during heavy infestations). Infection enters the hive via infected pollen.
- Fungus grows quickly and rapidly encloses the infected larva or pupa in fine white strands (mycelium). At this point the larva or pupa is commonly called a mummy.
- The mummy is originally soft and fluffy but quickly hardens to the consistency of sidewalk chalk.
- This disease is particularly hard on German black bees.

Management:

- Strong colonies will quickly remove the dead and the disease will be kept under control. However if the hive is stressed the workers may not be able to remove the diseased dead promptly.
- Many believe that this is a secondary disease that only becomes a problem in hives that are already weakened or infected with another pathogen.
- Since its introduction to the US in the 1970's this disease has become less severe. It is believed that the highly susceptible colonies were eliminated and more resistant breeds have replaced them.
- No direct control options are available but if a colony is experiencing problems you can try the following: Re-queen with a young queen, move the colonies into direct sunlight, remove empty supers to reduce hive volume to allow the bees to better regulate temperature and humidity, replace wet boards for dry ones, elevate the hives to reduce moisture from contact with the ground, and/or add bees and brood from a strong colony to the weak colony to help increase numbers.

Misconceptions:

- Although hives kept in cool and moist environments seem to have a higher occurrence of this disease, dry and warm hives are not immune to this disease, colonies kept in desert environments are occasionally infected.

Deformed Wing Virus (DWV)

Causative Agent: RNA Virus

Range: Worldwide

Life cycle/ Symptoms:

- DWV tends to remain in low levels in healthy colonies and exists as a low-grade infection with no symptoms.
- If the colony becomes stressed the virus load increases and adults emerge from the cell with deformities proportionate to their viral load
    - stubby, useless wings
    - shortened, rounded abdomens,
    - discoloring
    - paralysis
- Deformed adults are quickly driven from the hive and die within 48 hrs.
- Infected queens may be able to pass the virus to her offspring/eggs.

Management:

- Varroa mites harbor the virus and can have viral loads far exceeding the most heavily infected bees. Controlling Varrora populations can reduce transmission and stress on the colony

Misconceptions:

- Colonies infected with Deformed Wing Virus do not become more aggressive.
- Kakugo virus is closely related to Deformed Wing Virus but only found in guard bees where it increases the aggression levels. Kakugo virus can only be isolated from the head of the bees

European Foulbrood

Causative Agent: *Streptococcus pluton* (Bacteria)

Range: Wherever European honey bees occur (some reports from African bees as well)

Life cycle:

- This disease is more often a problem in the spring.
- Only fatal to young uncapped larvae.
- Later stages can be infected but the disease only affects the silk glands, and capping may be sparse but is not fatal.
- Fatalities typically occur when the bees are only 4 or 5 days old.
- After the larva dies the bacteria enters a spore stage. Unlike American Foulbrood this stage cannot survive extended periods of time (typically no more than 6 months).
- Dead larvae remain soft, pliable and usually twist/curl in the cell. Workers can easily remove the cadavers.
- Progression of color: white/yellowish white to brown/dark brown/black.
- Consistency of dead brood is watery (rarely sticky or stringy) and granular.

Management:

- European Foulbrood is most common a few weeks after a colony looses a high number of the adult workers due to pesticides or other causes. If a cause can be identified, steps should be taken to avoid it reoccurring in the future.

- Treatment with Oxytetracycline can kill this disease but several precautions must be taken to prevent the contamination of honey and other products.

Misconceptions:

- Odor is not a reliable method of distinguishing this disease
- Irregular brood pattern can be a sign of a problem (but not necessarily European Foulbrood)

Nosema

Causative Agent: *Nosema aphis; Nosema ceranae* (Microsporidia: fungi)

Range: Worldwide

Life cycle/ Symptoms:

- Newly emerged adults are always free of the disease but may become infected at feeding. The spores are ingested and develop in the gut. The spores rupture the lining of the gut and within 5 days new spores form and can be passed via feces to a new host.
- Problems most often occur following winter, it is believed that the pathogen builds in numbers during the winter season.
- In spring adult bees infected with this disease typically exhibit dysentery and individual bees may die. In rare cases when the hive is severely infected the colony may collapse.

Management:

- Positive identification is only possible by extracting the gut and looking for spores under a microscope. However there are several things which serve as good indicators of the disease:
  - Colonies heavily infected will have adults outside of the hive crawling on the ground (often without wings and obviously balding)
  - Signs of dysentery include the accumulation of fecal material on the bars of the comb and at the hive entrance.
  - Bees can be field checked for infection by pinching off the head and then pulling the last segments of the abdomen from the body. The gut should be removed from the body by doing this. A healthy bee should be brownish-red to yellow and appear to be ribbed (similar to corrugated pipe) when viewed with a hand-lens. An infected bee's gut will be gray/white, the mid-gut should be twice the diameter of that of the healthy bee, and will lack ribbing.

Traditionally, Fumagilin-B has been used to treat for nosema. However, it is currently unclear whether Fumagilin-B is effective against nosema ceranae.

Misconceptions:

- There are several different species of Nosema each has a specific host. Therefore cross species transmission is not possible (e.g. honey bees with Nosema cannot transmit the disease to mason bees and vice versa.)

Sacbrood

Causative Agent: Virus

Range: Worldwide

Life cycle:

- This disease is more often a problem in the spring or after a substantial loss of workers.
- Larvae are infected and die on their backs with the head slightly elevated.
- The internal structures of the larva break down however the exoskeleton remains uncompromised making it a sack of sorts.
- Progression of color: white to yellow to brown to dark brown.
- Cadavers if not removed by the workers deflate uniformly, dry into a dark scale. Unlike American Foulbrood the scale is not adhered to the cell and can be easily removed.
- Consistency of dead brood is watery and granular inside the tough leathery sack.

Management:

- Sacbrood is most common a few weeks after a colony looses a high number of the adult workers due to pesticides or other causes. If a cause can be identified, steps should be taken to avoid it reoccurring in the future.

- Weak colonies can be reinforced with additional workers, a new queen, or improved environmental conditions

Misconceptions:

Odor is not a reliable method of distinguishing this disease

Irregular brood pattern can be a sign of a problem (but not necessarily Sacbrood)

Stonebrood

Causative Agent: *Aspergillus flavus* or *Aspergillus fumigatus* (fungus)

Range: North America

Life cycle/ Symptoms:

- Disease of the larvae and occasionally pupae, symptoms are similar to Chalkbrood.
- Fungus grows quickly and rapidly, turning the infected larva or pupa white eventually the cadaver turns brownish or yellow-green and becomes hard.
- Experts differ in opinions as to whether this disease affects adults or not. Some believe that the disease causes the gut of the adult to mummify and the abdomen to become rigid.

Management:

- Not considered a serious pest of honey bees at this time.

Greater Wax Moth

Causative Agent: *Galleria mellonella* (Lepidoptera, Pyralidae)

Range: Worldwide

Life cycle:

- No stage can survive freezing temperatures
- Adult moths fly to hives and lay eggs in crevices
- The eggs hatch and the larvae burrow through the comb uncapping the honey and causing it to leak. Additionally the larvae lay silk as they burrow contaminating the honey

Management:

- Rarely a problem in colder climates until July and August.
- Healthy colonies are able to fend off this pest

Lesser Wax Moth

Causative Agent: *Achroia grisella* (Lepidoptera, Pyralidae)

Range: Worldwide

Life cycle:

- Similar to the greater wax moth
- Persistence in the hive results in the disorder known as Bald brood (brood cells are uncapped and the head can be seen in later stages of development).

Management:

- Less of a problem then the greater wax moth
- Healthy colonies are able to fend of this pest

Small Hive Beetle

Causative Agent: *Aethina tumida* (Coleoptera, Nitidulidae)

Range: S. Africa, & since 1998 United States (established in Florida, Georgia, South Carolina, North Carolina, Pennsylvania, Ohio, Minnesota, Wisconsin among others)

Life cycle:

- Adults may live up to 6 months.
- Eggs are laid in cracks near the comb and hatch in 2-3 days.
- Larvae feed on pollen, honey and damage the combs. Feeding by the larvae discolors the honey and often leads to the honey fermenting and pouring out of the comb. This makes the hive and extraction process very messy.
- Larvae require 10-11 days to complete larval development, and then leave the hive to pupate in the soil.
- High small hive beetle populations, even in strong colonies, can lead to absconding or collapse.
- In warm climates (Florida and Georgia) there may be 4-5 generations per year.

Management:

- Beetle traps may be used to capture beetles within the hive thereby reducing or eliminating the population. Mechanical and chemical approaches may be used to disrupt pupation in the soil around a hive.

Tracheal Mites

Causative Agent: *Acarapis woodi* (Acari)

Range: Originally South & Central America

Life cycle:

- Live in the thoracic and occasionally the abdominal tracheal tubes of all 3 casts of bee.
- When in high densities it affects the bee's ability to work (decreases production and efficiency).
- Feeding occurs in the tracheal tubes where the mite penetrates through the tube to feed on hemolymph (blood).
- Female mites move to new emerged adults and begin laying eggs within 3-4 days.
- Eggs take 3-4 days to hatch and newly hatched mites move to newly emerged adults.
- Mites move by bee-to-bee contact.
- Mite populations usually decrease during the foraging season and rarely show signs of infestation in the summer and fall.

Management:

- Menthol and Aluminum phosphide can be used in the hive during periods when there is no honey overflow.
- There are newly proposed methods involving coating the bees with oil/shortening which prevents the mites from transferring bee-to-bee. These methods are untested and should be used with caution.

Misconceptions:

Eradicating mites from a hive is impossible; however it is possible to keep population levels low enough so that there are no ill effects.

Varroa Mites

Causative Agent: *Varroa destructor* (Acari)

Range: Worldwide

Life cycle:

- Optimal developmental temperature for the mite is 32.9°C (bee developmental temperatures are: capped workers 34-36°C, capped drones 30-34°C; uncapped workers or droned 25°C)
- The rate at which eggs are laid is temperature dependent, ranging from 1.5 to 7 eggs per 31 to 39 hrs.
- The female must prepare a feeding site for her young (their mouthparts cannot penetrate the insect cuticle).
    - A mated female mite enters the cell before it is capped and hides in the bottom of the cell.
    - She promptly climbs through the jelly without eating it, to the top of the cell.
    - She waits for the pre-pupa to molt before laying her eggs so they are not discarded to the bottom of the cell with the exuviae (moult).
    - The female creates a feeding site and moves the honeybee's metathoracic leg (leg III) to allow access to a feeding site.

Management:

- **Monitoring**:
    - **Sampling adults**: capture 300-500 bees in jar directly or via shaking (warning: be careful not to collect the queen). Add 70% EtOH and let sit for several minutes or use powdered sugar. Gently swirl the jar and pour the contents into a light colored pan. Using tweezers and a small brush remove the bees one by one inspecting and removing any mites.
    - Sampling may also be done using a process referred to as the powdered sugar roll. 300-500 bees are captured and placed into a mason jar with a #8 screen on top. One hivetool full of powdered sugar is added to the jar and the bees are vigorously shaken and rolled around in the sugar. After shaking, the bees are left to stand for a minute during which the bees groom off the sugar and the

mites (the mites foot pads become coated with sugar and they are not able to cling onto the bees as well). After standing the sugar is shaken from the jar into a white pail or pan. A little water can be added to the pail to dissolve the sugar and make the mites more visible. The advantage of this method is that the bees are not sacrificed, but instead are dumped back into the hive.

Infestation level is estimated using: (# of mites x 100) ÷ # of bees = % infested:

5%=slight, 5-10% seriously infested treat soon, 10-20% treat immediately, >20% great probability of colony failure in days to a weeks.

- **Examination of sealed brood**: using a 8 x 4 cm template and a sharp knife, remove approximately 300 sealed brood cells. Using tweezers carefully remove the pupae and wash them in 70% EtOH. Using a fine brush remove any attached mites and wipe the inside of the emptied cell to search for mites. Record the number of bees that have mites **not** the number of mites.

Infestation rates can be estimated by using (# capped cells with mites x 100) ÷ # of bees. Infestation levels are the same as above.

- **Natural-mite-fall:** collect the number of mites that die on a daily basis (best for use after making a chemical application). This procedure involves using a collecting tray covered with margarine with a 3 x 3 mm screen to keep the bees off the tray. The tray should be rigid and easy to grease. The mites and margarine are scraped off and hot water is added to melt the margarine, wax and propolis. The mixture is then gently mixed and pored through a fine strainer. The mites left in the strainer can be removed with a sharp tap onto a white cloth or paper. Mortality rate can be calculated using: # of mites ÷ # of days the trap was out.

- Numerous chemical options are available. Currently soft chemicals, such as Apiguard, Apilife VAR, or MiteAway II are being suggested until more is known about CCD.

- Cultural/ Biotechnological: Uncapping/destroying drone brood to remove developing mites. The developmental temperature range of drones best fits the mites, therefore removing drones may be an option. This can be done by manually uncapping and washing the cells, removing the frame from the colony and letting it die naturally or by freezing.