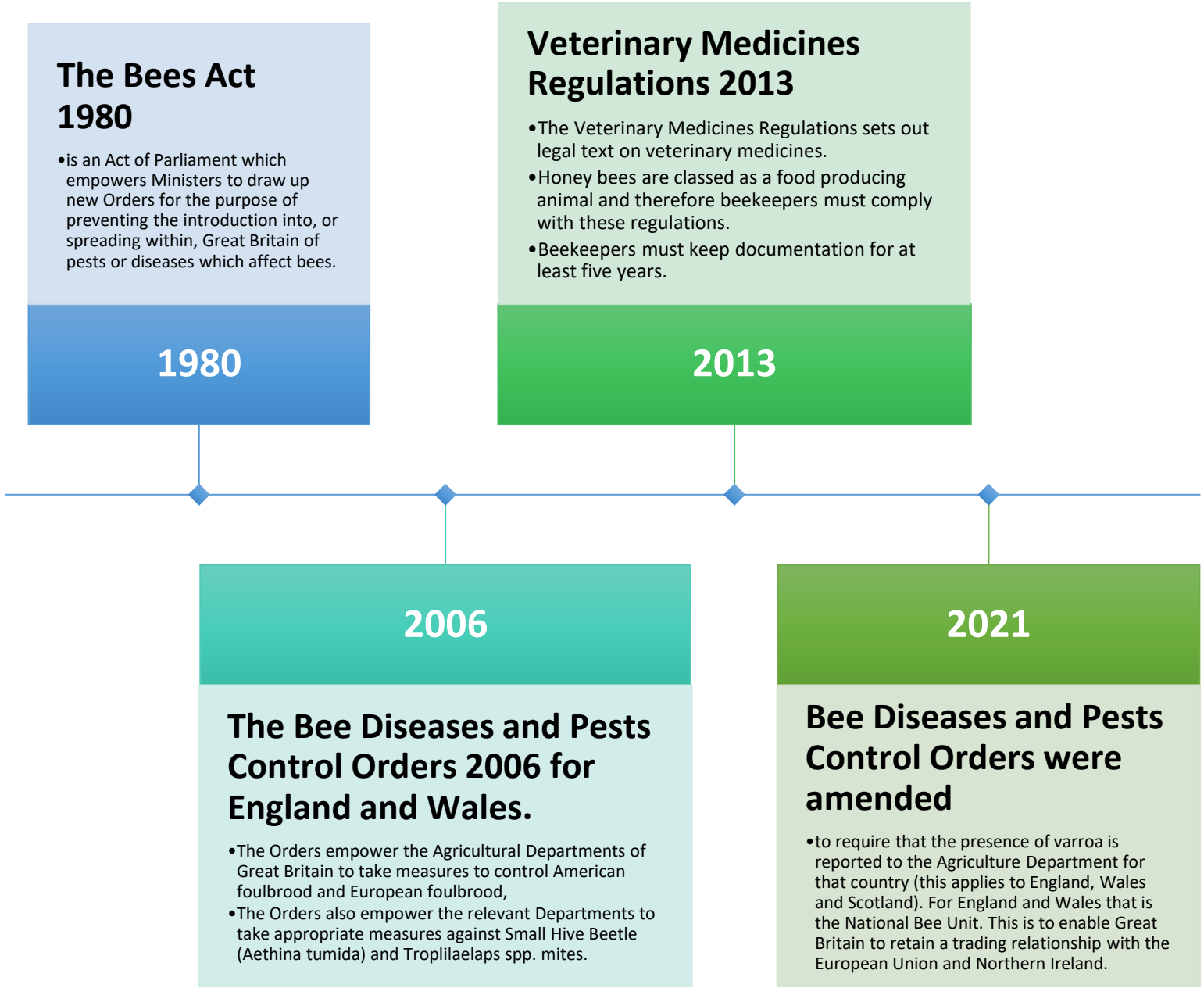
BBKA Honey Bee Health Assessment Theory Part 1

Statutory requirements



Legal Obligations of the Beekeeper In relation to Notifiable Diseases and Pests

A Beekeeper shall immediately notify the National Bee Unit if they know or suspect:

- that any bees from the hive are infected with a notifiable disease;
- a notifiable pest is present in the hive; or is present on or in the same premises or vehicle as the hive

The Beekeeper shall not, without the approval of the Bee Inspector, remove, or permit to be removed, from the premises or vehicle on or in which the hive is situated

- any hive, bees, combs, bee products, bee pests, hive debris or appliances; or
- any other thing liable to spread the notifiable disease or the notifiable pest.

Marking of Hives and Appliances.

- If the Bee Inspector marks a hive, the marking shall not be interfered with by the Beekeeper

Notices Prohibiting Removal.

- Where a Bee Inspector has reasonable grounds for suspecting that a notifiable disease or pest is present on or in any premises or vehicle, he shall serve on the Beekeeper a Notice not to move items as described above

Disease Control Measures if disease confirmed American foul brood has been confirmed in a hive, The Beekeeper is served a notice requiring:

- the destruction any bees, combs or bee products from the infected hive;
- Treatment or destruction of any appliances or other things liable to spread the disease

Disease Control Measure where the presence of European foul brood has been confirmed in a hive, The Beekeeper may be served notice to treat

Imported Bees.

- The Beekeeper must abide by the procedures when importing bees to this country

Provisions of Facilities and other obligations.

- The Beekeeper must give access to all facilities and provide full information as to their beekeeping activities and locations
- No treatment shall be applied by the Beekeeper

If the Beekeeper does not comply with notices, the NBU will arrange for notices to be fulfilled and the Beekeeper will be liable for the costs of doing so

Varroa and Asian Hornet

The presence of Varroa in a colony or apiary is recorded on Beebase

- By default all colonies registered on Beebase are assumed to have varroa
- If colony is registered as free of varroa and varroa is detected the record on Beebase must be updated

Asian Hornet is reported to the Non Native Species Secretariat who coordinate responses to sightings

- NBU are involved in the contingency plan

Veterinary Medicines Regulations 2013 Beekeeper Obligations

Beekeepers must keep a Medicine record card containing details of veterinary medicinal products administered in colonies for at least five years, irrespective of whether or not the colony concerned is no longer in that keeper's possession or has died during that period.

When a veterinary medicinal product is bought beekeepers must, at the time, record:

- The name of the product and the batch number;
- The date of acquisition;
- The quantity acquired; and
- The name and address of the supplier.

When administering the medicine, beekeepers must record on a medicine record card:

- The name of the product;
- The date of administration;
- The quantity administered;
- The withdrawal period; and
- The identification of the animals treated.

A beekeeper who disposes of any or the entire veterinary medicinal product other than by treating a colony must record:

- The date of disposal;
- The quantity of product involved; and
- How and where it was disposed of.

American Foul Brood

Paenibacillus larvae

Images from https://beeaware.org.au/

AFB Typical Symtoms

- Irregular and patchy brood pattern.
- Cell cappings on infected brood may appear sunken, darker coloured or greasy.
- Cappings may also be perforated by bees trying to remove the dead brood
- The larvae die after capping and become a light to dark brown semi-liquid mass.
- Infected hives may also have a sulphurous smell due to the decomposing brood.
- Infected brood changes from a healthy pearly white to a dark brown (a ‘ropiness test’ can be carried out at this stage).
- The dead larval remains become a tough, but brittle scale that is difficult to remove from the cell.
- If older larvae are infected the ‘tongue’ of the pupae may become stuck to the top of the cell wall.

AFB Disease Cycle

Spore Forming Bacteria

AFB infections start when spores on the nurse bee's mouthparts are spread to larvae when feeding the developing brood.

- Only around 10 spores are required to cause an infection in a day old larvae.
- A bee larva less than 24 hours old is the most susceptible stage to be infected by AFB.
- The younger the larvae, the more susceptible and less spores required to cause infection.
- Larvae older than 48 hours and adult bees are not susceptible to it

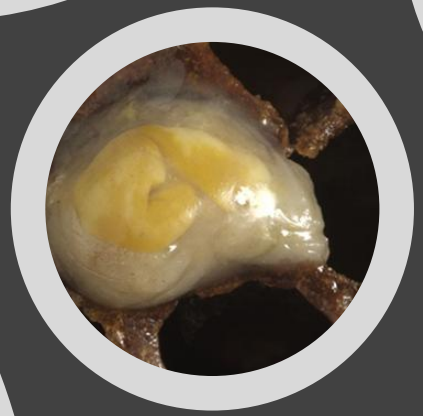
After feeding by the nurse bees, the young larvae ingest spores of the bacterium, which germinate in the larvae's gut.

- A day after ingestion the spores germinate in the larval mid-gut into the vegetative form (rod stage), becoming bacteria.
- The rods penetrate the gut wall, entering the tissues where they proliferate rapidly and at an enormous rate, feeding at the expense of the tissues, until the larva dies.
- On death of the larva the bacteria sporulates
- Once the larva has died it becomes a dried scale that sticks to the side of the cells.
- Billions of AFB spores are able to be produced by any dead pupae or dried scales which are further spread around the hive by adult bees as they attempt to remove the dead pupae.

The disease cycle of AFB means that any spores that enter the hive are quickly spread and once they reach larvae the bacteria can multiply rapidly.

- The disease weakens the colony,
- Which subsequently makes the colony a target for robbing bees.
- The robbing bees then carry spores back to their colony further spreading the disease and starting the cycle in a new colony.

Holding frame for AFB inspection



European Foul Brood

Melissococcus plutonius

Images from https://beeaware.org.au/

EFB Typical Symptoms

- An uneven or patchy brood pattern.
- Dead and discoloured larvae in uncapped cells; in some circumstances larvae may die after capping.
- Infection with EFB may sometimes have a strong ammonia-like (sometimes described as sour) smell.
- Loss of segmentation
- Infected larvae may have moved within the cell and sit in a coiled or twisted position (rather than sitting in the characteristic ‘C’ shape of healthy larvae).
- Dead larvae change colour from a healthy pearly white to yellow and then to a brown colour and become a liquefied mass
- The trachea of infected larvae may also appear a more prominent yellow colour as the larvae’s colour changes.
- Over time the dead larvae will begin to dry out, becoming a dark brown coloured ‘rubbery’ scale that adheres loosely to the cell.

EFB Disease Cycle

Non-spore forming bacteria

EFB infection starts when larvae ingest the bacteria

- Which can be present in the brood food,
- Can be transmitted from infected nurse bees.

The bacteria then multiply in the mid-gut of infected larvae.

- Do not invade the epithelium
- Contained within peritrophic membrane
- The multiplying bacteria compete with the larvae for food,
- Often causing the larvae to die before capping.

The larvae then becomes a semi-fluid (sometimes described as molten)

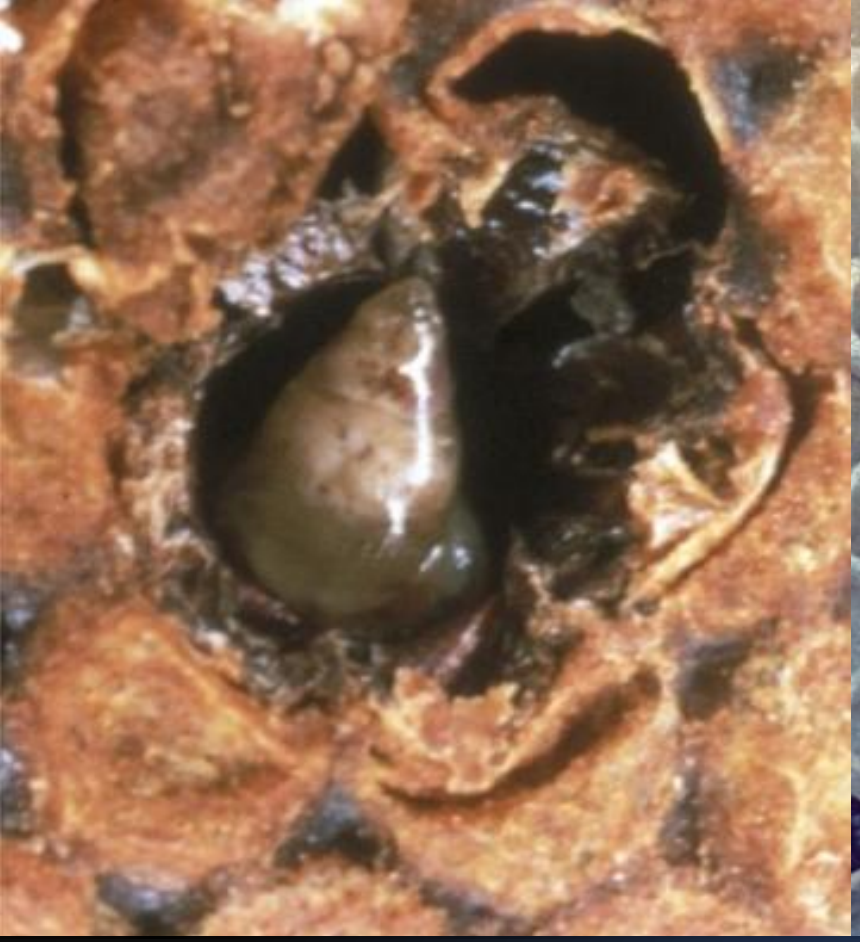
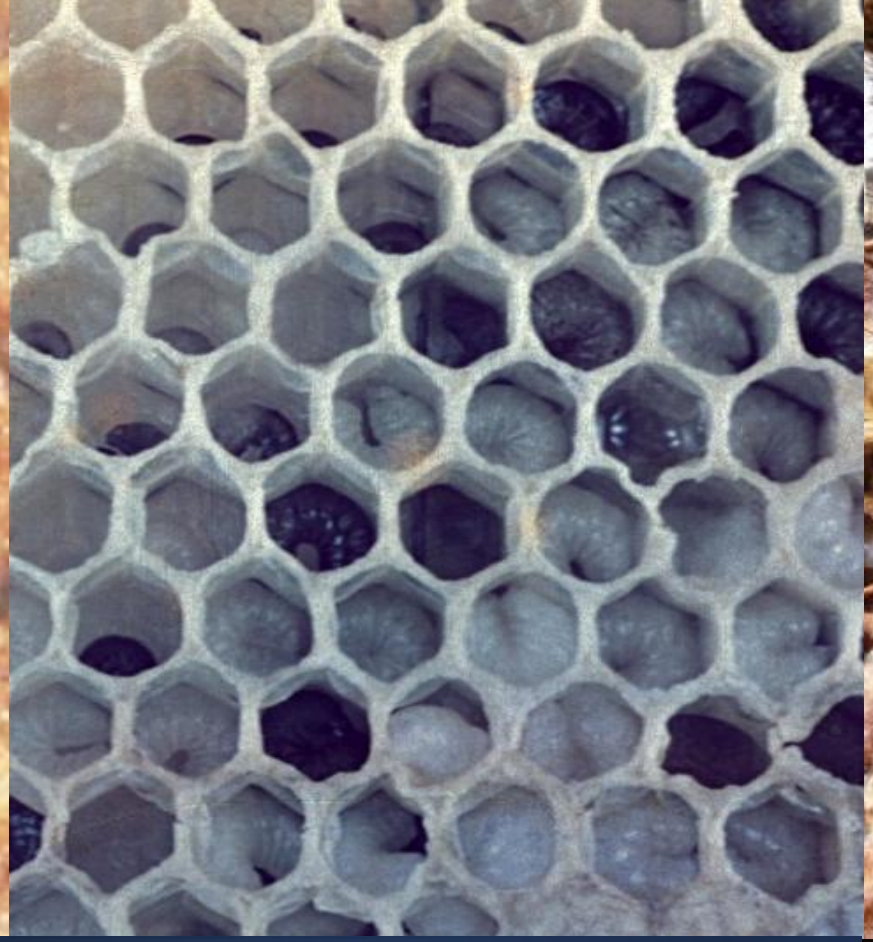
- Loss of segmentation
- Mass and changes colour from a healthy pearly white to a yellow then brown colour.
- The dead larvae slowly dry out becoming a ‘rubbery’ scale that adheres loosely to the cell.

Nurse bees attempt to remove the dead or dying larvae.

- While removing infected larvae the mouth parts of nurse bees become contaminated with the bacteria.
- EFB is subsequently spread by the nurse bees to larvae while feeding.

Occasionally some infected larvae will survive infection as larvae and become adults, which spread the bacteria in their faeces, further infecting the colony.

Holding frame for EFB inspection

Other brood diseases

Other brood diseases

Chalk brood

Sac Brood

Chilled Brood

Bald Brood

Others

- Stone brood, detrimental to human health, looks like chalk brood
  - Aspergillus flavus (yellowish green)
  - Aspergillus fumigatus (greyish green)
- Addled brood, catchall for anything unclear, larvae to pupae

Chalk brood - fungus

Causes

- Chalkbrood is caused by the fungus *Ascosphaera apis*.
- Conditions such as damp and cold weather will promote fungal spores
- However, in smaller colonies or those under stress it can become a problem
- Chalkbrood is not usually a serious disease among strong healthy colonies.

Disease cycle

- When ingested by the larva it penetrates the gut wall to absorb nutrients.
- As the spores germinate and multiply, the larva eventually dies of starvation.
- After a few days of growth, the larva and fungus swells and fills the brood cell where it will eventually harden after a few days to its distinctive 'mummified' appearance.
- Here it adopts a mottled white and black colour,
- Each chalkbrood mummy will produce millions of infective spores which stick to the cells, hive components and adult bees.

Symptoms

- Initially the dead larvae will be covered with a white cotton wool-like growth and may swell to fill the cell taking on its shape;
- After a time these will dry out and shrink to give the characteristic ‘mummies’ that are chalk-like at first turning to a greyish black colour as the fungal fruiting bodies develop;
- Worker bees uncap the cells of dead larvae so the mummies will be clearly visible;
- Shrunken chalk-like mummies in the brood and in and around the hive entrance.
- As the condition worsens, infected hives will also show a pepper pot brood pattern;
- If mummies are still contained in capped cells, when a comb is shaken gently the mummies may be heard rattling in the cells.

Spread

- A. apis is highly infectious and can be easily spread between hives through robbing and drifting of drones and worker bees. Spores can be transferred between apiaries on contaminated equipment and through the intervention of the beekeeper.

Treatment

- The best method for keeping chalkbrood to a minimum is the maintenance of good strong stocks which appear better able to resist the fungus.
- Those colonies which are susceptible can be re-queened.
- Avoiding damp apiary sites will also help to minimise the effect of chalkbrood in colonies.

Sac brood - virus

Causes

- Sacbrood is a viral infection of the brood caused by the *Iflavirus* genus and occurs when a diseased larva fails to pupate after being sealed in its cell.
- Fluid then accumulates between the body of the larva and the unshed skin, forming a sac.
- Larva is unable to split the sac and dies
- It does not usually cause severe colony loss.

Disease cycle

- It is a relatively common disease during the first half of the brood-rearing season and can often go unnoticed, affecting only a small percentage of the brood.
- initially during an infection, the virus particles replicate in the developing larva, which appear to develop normally until after being capped over.
- The infected larva then turns from its usual pearly white to a pale-yellow colour;
- The larva will eventually die and begin to dry out, turning a dark brown to black colour, The skin of the dead larva also changes into a tough plastic-like sac, which is filled with fluid. It is this stage of infection that gives the virus its name. The sac can be carefully removed by using a pair of tweezers.

Symptoms

- As the larvae die, the workers will uncap the cells to expose them,
- creating an uneven brood pattern with discoloured, sunken or perforated cappings scattered through the brood cells;
- the characteristic 'Chinese slippers' or 'gondola shaped' scales; giving rise to the characteristic 'Chinese slippers' or 'gondola shaped' scales;

Spread

- Varroa destructor is able to vector Sacbrood virus and will spread it when feeding off of honey bee larvae.
- The virus can also spread through the intervention of the beekeeper by transferring material from infected colonies to a healthy colony.
- In addition, the virus can spread through the feeding behaviour of nurse bees and bees robbing infected colonies.

Treatment

- re-queening the colony can help to alleviate the symptoms of sacbrood
- Controlling Varroa mite populations will help to control the spread of the virus.

Bald brood – wax moth or genetic

Causes

- the most usual cause of bald brood is wax moth larvae (both the lesser (*Achroia grisella*) and greater (*Galleria mellonella*)) tunnelling below the surface of the comb.
- Genetic trait not to cap cells

Disease cycle

- The moth larvae tunnel under the brood cappings.
- The bees will tear down the cell cappings to clean out the cells leaving perforated and exposed cells with brood in
- sometimes these partial cappings have a raised lip protruding from the comb surface.

Symptoms

- The condition also occurs over multiple cells in a linear pattern
- the developing pupae are usually sealed in their cells under wax cappings 8-9 days after laying. Bald brood may be seen as small patches of normal developing larvae with uncapped or partially capped cells.
- These uncapped larvae will usually emerge as fully developed adults, although a few malformed adults may result from contaminants becoming deposited on the developing larvae.
- Wax moth damage is also apparent as a white linear line among the biscuit coloured cappings.
- Uncapped cells in patches rather than lines for genetic variant

Spread

- *Wax moth*

Treatment

- strong colonies of bees will reduce the effects of wax moth,
- in the case of the genetic form of bald brood re-queening of the colony will usually resolve the problem

Chilled/neglected brood – non infectious disorder

Neglected brood

- Under normal conditions nurse bees feed sufficient food to the larvae and maintain the temperature and humidity in the area of the brood nest suitable for brood survival and growth.
- When this system fails, for example when there is a sudden loss of adult bees, there are fewer adult bees to feed the larvae and maintain temperature and humidity control.
- These situations often result in larvae and pupae becoming neglected and dying from chilling, starvation or overheating.

Chilled brood

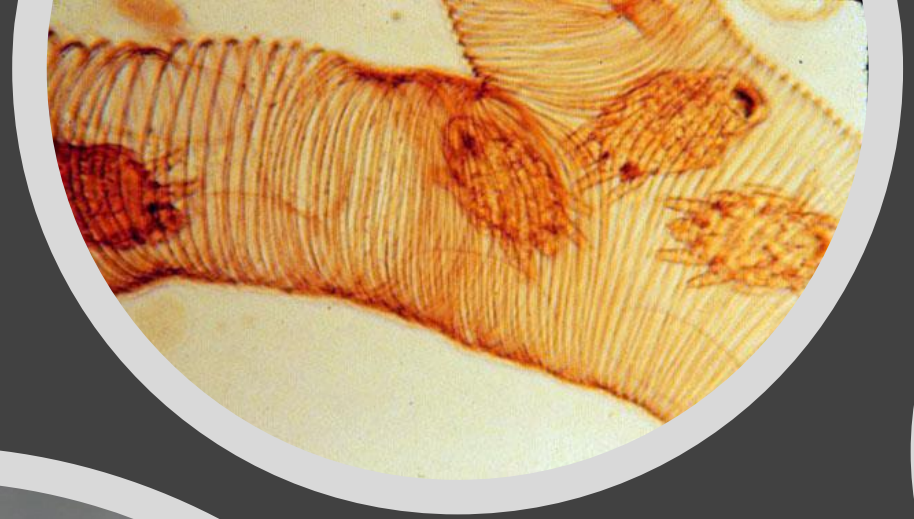
- Chilled brood is often observed in early spring once the queen has commenced expanding the brood area to a size where the number of adult bees present is not able to cover it adequately.
- Unexpectedly cold 'false spring' weather results in the adult bees contracting to cover and warm the central core of brood, leaving the outer edges of the brood unprotected and becoming chilled.
- The management practice of spreading brood frames and introducing empty frames into the brood area in early spring in order to stimulate brood nest expansion may contribute to the outer frames of brood becoming chilled if the temperature cools, because there may be insufficient bees to cover the outer brood combs.

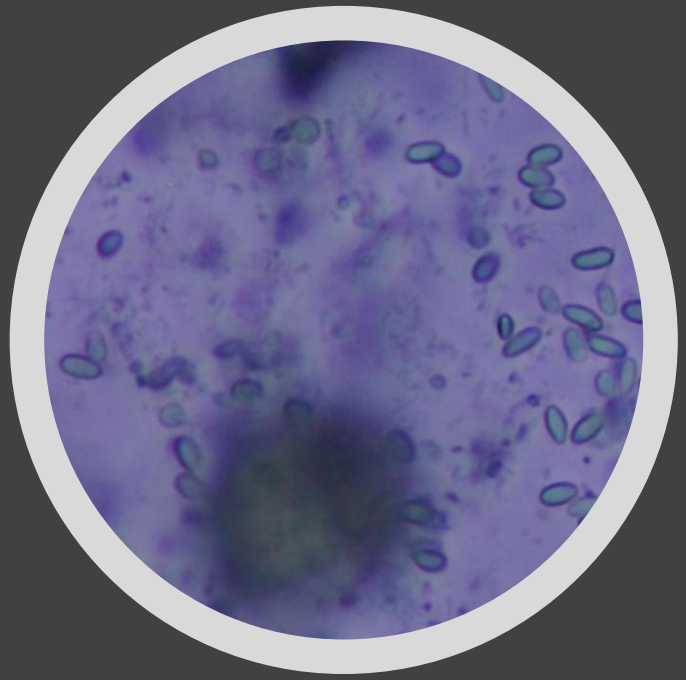
Symptoms

- Chilled brood may result following brood inspections in cold weather when frames are left exposed outside the hive for extended periods of time during inspection.
- Chilled larvae and pupae are yellow, tinged with black on their margins, or they are dull white with black or brown patches.
- The remains are pasty or watery. In extreme cases where sealed brood has been affected, brood cells may be punctured or uncapped.
- Usually, affected brood is at the outer edges of the nest area, with healthy brood remaining in the centre.

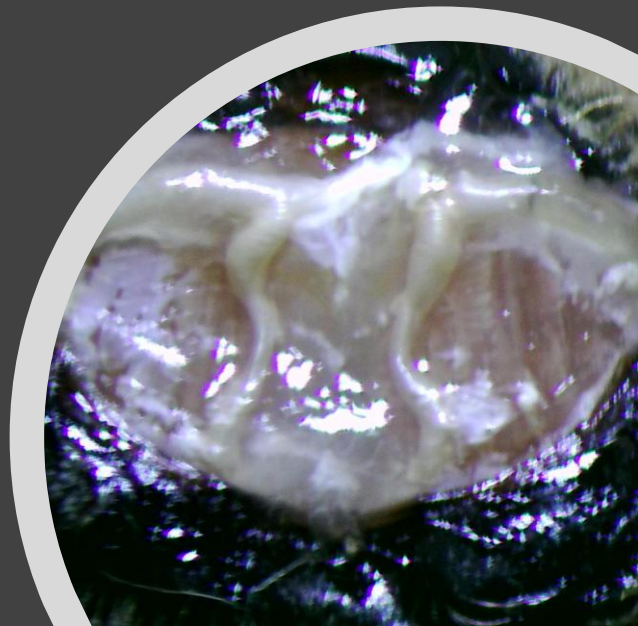
Treatment

- Treatment: Remove excess supers and feed sugar syrup if required.





Adult bee diseases



Adult Bee Diseases

- Acarine
- Nosema apis and ceranae
- Amoeba

Acarine – *Acarapis woodi, Arachnida* family

Life Cycle

- Mite enters an adult bee 0-5 days old via the 1st thoracic spiracle
- Pierces trachea and feeds on the haemolymph of bee
- Lays up to 14 eggs (male and female)
- Hatch and mate, creating feeding sites within trachea
- 14th/15th day mites leave bee
- Hang on hairs of adult bee an attach to new you bee

Affect on the colony

- Symptoms are noticed in early spring, when the colony slowly begins to dwindle.
- Summer no major effect as bees die away from the colony
- Bad infestation could expose colony to robbing

Symptoms

- No outward signs of infestation
- Infestations shorten the life of adult bees and symptoms vary, depending on the number of mites infecting a bee.
- Adult bees infested with tracheal mites will cluster on the ground in front of the hive, appearing disorientated and unable to return to the colony.
- Large numbers of bees may also be seen crawling up stems of grass in front of the hive,
- however, these symptoms are also associated with other paralysis viruses.

Diagnosis

- Through removing the head and foreleg of bee to expose trachea
- Need to remove collar to expose full length of trachea
- Examine under low powered microscope, trachea pearly white no infection, stained and brown infection
- Confirmation by making slide of trachea section and examine under x40/x100 magnification

Nosema apis/ceranae – single celled parasite *Microsporidia*

Life Cycle

- Spore consumed by house bee
- Spore enters Ventriculus of adult bee
- Enters vegetive state in ventriculus
- Contents of cell enters epithelial cell and multiples
- As cell dies sporulates
- Dead cell erupts releasing spores
- Some spores remain in ventriculus others are defecated

Affect on the colony

- *Nosema apis*
  - Spring dwindle
  - Adult bees do not feed young
  - Become foragers younger
  - Do not forage pollen
- *Nosema ceranae*
  - Systemic disease within bee
  - Highly infectious
  - Colony collapses and dies Summer/Autumn

Symptoms

- Excreta on comb of colonies in winter is a sign not a symptom
- Declining bee population in Spring for *Nosema apis*
- Sudden collapse of strong colony later summer *Nosema ceranae*

Diagnosis

- Remove the abdomens of 30 adult bees, collect from outer frames or entrance
- Crush in 15ml water
- Place drop on microscope slide with a coverslip
- Examine under x400 magnification for what looks like rice grains 5-8µm long
- *N. ceranae* smaller and rounder

Amoeba is caused by a protozoan (single cell) amoeba *Malpighamoeba mellificae*

Life Cycle

- Cysts are ingested with food and germinate in the gut
- Amoeba with flagellum emerge from the cyst
- They migrate to the Malpighian tubules (the 'kidneys')
- Feed on the linings of the tubules
- After 3-4 weeks to form cysts that then accumulate in the rectum and are excreted.

Affect on the colony

- No known effect

Symptoms

- No known symptoms

Diagnosis

- Remove the abdomens of 30 adult bees, collect from outer frames or entrance
- Crush in 15ml water
- Place drop on microscope slide with a coverslip
- Examine under x400 magnification for what looks like rice grains 5-8µm long
- Associated with *Nosema apis*

Viruses

Varroa related impact

- Deformed wing
- Chronic bee paralysis
- Acute paralysis
- Slow paralysis
- Cloudy wing (little studied)

Other viruses and associates

- Black queen cell - Nosema
- Filamentous - Nosema
- Bee virus Y - Nosema
- Bee virus X - Amoeba

Two most visible

Deformed Wing Virus (DWV)

Overview

- DWV persists at low levels in infected colonies without causing any signs of infection
- Where mite populations begin to increase and where an immune system is weakened it becomes an issue

Symptoms and Diagnosis

- DWV can cause pupal death
- Newly emerged bees from affected colonies will exhibit deformed or poorly developed wings
- Can also have bloated, shortened abdomens

Methods of Transmission

- the mating activities between a healthy virgin queen and an infected drone
- an infected queen laying an infected egg
- the bees feeding activities
- Varroa mites feeding activities
- At a colony level through swarming and increases made by the beekeeper.

Treatment and Control of DWV

- Treatments used to control the Varroa mite

Chronic Bee Paralysis Virus (CBPV)

Overview

- CBPV exits at low levels throughout the year
- Outbreaks can occur in Spring and Summer
- Usually associated with periods of confinement
- Virus accumulates around the brain, hence paralysis
- Two types, but this may be due different genetics of bees

- **Colony**
  - Infected individuals die within a few days following the start of symptoms
  - Heavily infected colonies may collapse, particularly seen at the height of the season
  - Collapsed colonies may be found to contain only a few adult bees and the queen

- **Similar viruses**
  - Acute Bee Paralysis, faster acting
  - Slow Bee Paralysis, affects forelegs and slower to die (approx. 12 days)

Symptoms and diagnosis

- Abnormal trembling motion of adult bees' wings
- Wings may be spread or dislocated, K-wing
- Adult bees are unable to fly and so are often found crawling in large numbers on the ground
- Adult bees often have bloated abdomens due to swelling of the honey stomach
- "Dysentery" like symptoms
- Adults take on a shiny, "greasy" appearance in bright light;
- Infected bees are subject to "nibbling" attacks by other healthy members of their colony
- Infected bees barred entry to the hive, making them appear to be robber bees.
- Adults appear hairless, looking very darkly coloured and almost black;

Method of transmission

- Open wounds from loss of hair
- Feeding
- Varroa feeding
- Faeces

Treatment

- Give colony more space
  - Add extra super
- Manage varroa

Other Viruses

Nosema related

- Black queen cell virus, kills developing queen in cell
- Filamentous virus, invades fat body, ovarian tissue and haemolymph
- Bee virus Y found in dead bees
- Common factor all gut related viruses
- Proliferate in weakened gut from Nosema
- No visible signs or symptoms

Malpighamoeba related

- Bee virus X, not related to bee virus Y
- Found in dead bees with amoeba


Any Questions?