

HONEY BEE
DISEASES AND
PESTS

European fowlbrood
disease (EFB)

- EFB is an infectious and contagious disease affecting the uncapped brood of several honeybee species, namely *A. mellifera*, *A. cerena*, and *A. laboriosa*.
- It is caused by an anaerobic Gram-positive non-spore-forming bacterium: *Melissococcus plutonius*.
- Several bacteria associated with *M. plutonius* develop secondarily.

- Infected larvae usually die rapidly when they are 4-5 days old.
- Overt EFB infection can cause significant weakening sometimes followed by collapse of colonies.
- In many areas, the disease is endemic with occasional seasonal outbreaks.

Clinical signs

- EFB affects the uncapped brood, killing larvae usually when they are 4-5 days old, 1-2 days before capping, sometimes just after in the most severe case, but always before pupation.
- The affected larvae move and die displaced in their cells.
- They may appear twisted within the cells around the walls, or stretched out lengthways.

Clinical signs

- Infected larvae become soft and their color usually progresses from pearly white to yellow and then brown.
- Larvae may decay, forming dry and rubbery scales that can be easily removed.
- These dark scales are more malleable than those typically found in AFB.
- In the more severe cases, the larvae may die within the cell after capping and symptoms may resemble those of AFB with sunken and punctured capping.

Clinical signs

- The brood pattern appears patchy and erratic (scattered or mottled brood) when a high proportion of larvae are affected.
- The colony exudes a slightly sour to a foul and rotten smell when a high proportion of the larvae are affected.
- This smell is due to the action of the associated secondary bacteria.

Clinical signs

- At the colony level, infection can develop over a long period (months, years).
- EFB outbreaks with spontaneous recovery a few weeks later have been reported.
- EFB usually weakens but can on occasion kill the colony.
- Most larvae usually die within a brief period in the late spring or mid-summer.

- The prognosis of EFB may be:

- benign with spontaneous recovery if it occurs in strong colonies before the first honey flow
- mild if the capped brood is affected (failing of detection of diseased larvae and super-infection)- the colony will probably die
- severe in autumn if the brood presents a patchy pattern.

- *M. plutonius* may be found in samples of worker bees from affected colonies.
- Hence, adult worker bees can spread the disease within the colony but also between colonies and apiaries by robbing and drifting behaviors.
- Furthermore, beekeeping practices are considered to be heavily implicated in the spread of EFB.

Pathogenesis

- EFB infection begins with the asymptomatic colonization of the gut of a larva after ingestion of contaminated brood-food.
- Usually, contamination occurs in larvae that are 1-2 days old.
- A second phase of the infection leads to sepsis, tissue damage, and death of the larvae.

Pathogenesis

- The infected larvae experience different fates:
 - Some larvae die before capping and are removed from the colony by cleaners.
 - Some larvae die after capping and defecate their infected and intestinal content within the cell.
 - Some larvae do not die and succeed in pupating, forming undersized or normal adults.

Contributing factors

- The main causes of EFB outbreaks are reported to be related to colony stress conditions and in particular to protein deficiency.
- EFB is most often seen at the brood spike in the late spring which is critical time in the life cycle of the honeybee colony.
- Nursing the brood at this time can be disrupted by several factors:
 - A deficiency in pollen,
 - Confinement due to bad weather conditions,
 - An imbalance between the populations of nurses and larvae.
 - Infection of nurses by sacbrood bee virus.
 - Varroosis and a high level of *V. destructor* infestation.

Diagnosis

- The clinical diagnosis of EFB first takes into account clinical signs observed on the brood comb and by the detection of diseased larvae.
- The main characteristic of the diagnosis is that EFB is the only disease of the uncapped brood.
- Microscopic examination
- microbial cultivation
- immunological and PCR methods

EFB control

- Highly infected colonies should be destroyed.
- The shaking swarm method (shaking bees into a new hive with new combs and destroying the infected combs) is recommended for the control of EFB.
- The prophylaxis of EFB is achieved through the implementation of good sanitary beekeeping practices.

Other bacterial
diseases

- Some bacteria have been already described in adult diseased honeybees.
- However, they do not seem to endanger colonies significantly.
- Septicemia has been described in both brood and adults.
 - The main causal agent is *Pseudomonas aeruginosa* and the clinical signs are dead or dying bees with a putrid odour.
 - However, this bacterium, like some others found in dying bees or brood, is not specifically associated with honeybees, being common in water and soil.
 - Infections are believed to occur, for example, after *V. destructor* feeds on the hemolymph through the cuticle.

- Spiroplasmosis (*Spiroplasma apis* and *S. melliferum*) has been described in honeybees.
- *Spiroplasma* can be found in the hemolymph of suspect infected bees and is thought to invade it through a breach in the gut epithelium.
- However, the scientific literature on spiroplasmosis is deficient and clinical cases have poorly been described.