European Foulbrood (EFB)

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Summary

The European Foulbrood (EFB) is a bacterial disease that affects the honey bee brood. The genetic resistance of some species of bees to this disease may allow, especially in favourable environmental conditions, to overcome the infection without suffering serious damage. However, it should be noted that, even if characterised by a better prognosis than the American Foulbrood, in some areas the EFB has a more malignant manifestation, seriously damaging even very strong bee colonies. This practice describes the causes and symptoms of EFB, how the disease spreads, and how to address and prevent the disease.

Description

1. Causes

EFB is caused by the *streptococcus bacterium Melissococcus pluton* (*M. pluton*), often associated with other bacterial agents, including: *Bacillus alvei*, *Streptococcus faecalis*, *Achromobacter eurydice*, *Paenibacillus alvei* and *Bacillus laterosporus*. Depending on the type of bacteria associated with the *bacterium M. pluton*, the EFB can occur with different symptoms (e.g. the presence / absence of an unpleasant acid smell). *M. pluton* is a germ that is quite resistant to adverse environmental conditions (e.g. it remains viable for several months in pollen).

2. Symptoms

The transmission of EFB from the adult bee to the larva takes place orally. After the infection, the larvae die in a few days, regardless of whether the larvae are working bees, drones or queens. Unlike the American Foulbrood, M. pluton kills the larvae before the cells' capping. The death of the larvae occurs with open cells and this is one of the features that allows to differentiate the EFB from the AFB (Figure 1). Only in the case of serious infection with EFB, the larvae can die in capped cells.

Another important feature useful to recognise this disease, is that the affected larvae instead of being horizontally positioned on one side in a C-shape, adhering to the back of the cells, they often change position. The infected larvae initially lose their pearly white colour to become first opaque, then yellowish and finally yellowish-brown (Figure 2). After death, the larva becomes darker and decomposes, turning into a soft brown mass which is neither viscous nor stringy, unlike the larvae infested with AFB (Figure 3). This mass

dries up forming a dark rust flake similar to that of AFB but, unlike the latter, it is easily removable from the cell.

Figure 1. Larval death with open cells

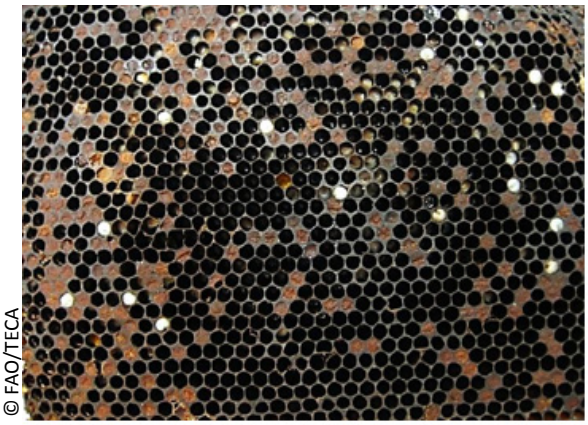

Figure 2. The infected larvae initially lose their pearly white colour to become first opaque, then yellowish and finally yellowish-brown

Figure 3. After death, the larva becomes darker and decomposes, turning into a soft brown mass which is neither viscous nor stringy

The brood appears scattered, with cells containing yellowed dead larvae. Depending on the bacteria present the dead larvae may give off smells of different intensity. The *Melissococcus* pluton leads to a sour smell, with flabby, but intact larvae. If, however, it is associated with Bacillus alvei, the brood has a putrid smell with molten larvae (but not ropey as with AFB). There are also intermediate forms in which the combs do not give off any smell. When the disease is not well developed, especially if you replace the queen and you are in a favourable time of the year (with the presence of abundant flowers providing nectar and pollen), bees may be able to clean up all the affected cells and the disease can disappear spontaneously, thus preventing the infection from spreading to the rest of the apiary.

3. Transmission

The bacterium develops inside the hive at the brood level. This disease spreads orally inside the hive by the nurse bees that, in an attempt to clean up the cells by the dead larvae, get contaminated with the spores and they transmit them to the brood when they go to feed it. The disease can be spread from hive to hive or apiary to apiary. This can be done by the bees, especially when bees rob a diseased hive. It can also be spread by the beekeeper with the use of infected honey to feed healthy colonies, moving diseased colonies during migratory beekeeping, trade of infected tools, using contaminated equipment, and moving of combs from one hive to another.

The disease, while being able to occur throughout the year, is more common in spring when there is more brood. The bacterium can spread through honey with infected combs through pollen, honey, brood, etc. The development of EFB could

be favoured by an imbalance between the number of larvae and that of the nurse bees. In addition, the EFB would seem to be more common in cold and rainy springs, where there may be food shortages, particularly of protein for the brood (lack of pollen). It has also been observed that the quality and quantity of the sources of nectar and pollen are able to influence the course of the disease.

The health status of the colony is very important for the development of the disease inside the colony. Wak colonies or colonies that are stressed for any reason (food shortage, migratory beekeeping, pesticides, etc.), as well as genetically more sensitive colonies, are especially prone to this disease. Healthy and strong colonies will be able to recover from the disease by themselves if the season guarantees adequate food sources (pollen, nectars and flowers).

Table 1: Summary of the main differences between EFB and AFB.

Main differences between European and American foulbrood	
European Foulbrood (EFB)	**American foulbrood (AFB)**
Dead larva in uncapped cell	Dead larva in capped cell
Sour smell	Smell of fish gelatin
Absence of blackening of honeycombs	Dark honeycombs, deep-set and perforated cappings
Non-ropey larva	Ropey larva
Removable flake	No removable flake

Source: FAO 2015

4. Diagnosis and prognosis

For the field diagnosis it is sufficient to examine the brood and to look for the symptoms described above (scattered brood, yellowed dead larvae in open cells, sour smell, etc.), which can be combined with the use of a rapid diagnostic kit, easily available on the market (Figure 4).

For disease confirmation, you can send a sample of the dead larvae to specialised laboratories where the pathogens responsible for the disease can be isolated (Figure 5).

Figure 4. Rapid diagnostic kit (positive result above, negative below).

5. Control

Take the appropriate actions as soon as possible to control the infection.

- Destruction by incineration of the infected colonies (honeycombs and honey bees; the hives, if in good state, could be disinfected). This action is suggested in case of advanced stage of the disease, weak colonies or low prevalence of the disease in the apiary.
- Accurate disinfection of all objects used for the manipulation of infected hives, including equipment used for operations by the beekeeper (e.g. the hive tool, the gloves, the suit, the honey extractor, etc.).

- Shook swarm method, consisting in shaking the hives from the infected combs into a clean hive with new foundation.

Figure 5. Sample of dead larvae taken to be sent to specialised laboratories for the diagnosis

6. Prevention

- Ensure that colonies have always available stocks of food (pollen and honey).
- Do not use honeys suspected of being infected to feed the bees.
- Do not move combs from a hive to another without checking their healthy conditions.
- Renew the combs every two to three years (about 30 percent of the combs per year).
- Remove the queen from the infected colonies.

7. Further reading

- Ferrari C. La Peste Europea. In “Aspetti igienico-sanitari in apicoltura” published by Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana “M. Aleandri”, Italy. August 2007: 19-21

8. Objectives fulfilled by the project

8.1 Women-friendly

The technology is easy to use, it is affordable, it is light and manageable, it supports tasks specifically assigned to women; advisory services target women’s needs and time availability.

8.2 Resource use efficiency

This technology allows for improved management of beekeeping and ensures better colony health.

8.3 Pro-poor technology

With improved management and improved bee colony health, this technology provides beekeepers with additional income and a source of food through improved quality of products such as honey.