FRIEDRICH-LOEFFLER-INSTITUT
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Federal Research Institute for Animal Health

American foulbrood (AFB)

Susceptible species

So far, the bacterial disease has only been detected in honey bees, *Apis mellifera*. Only the brood of the honey bee is affected, as only larvae are susceptible to infection; adult bees are resistant to the pathogen. Economic damage is however considerable, as the disease leads to the loss of entire bee colonies and has a high potential to spread due to its highly resistant spores. AFB does not represent a human health risk.

Distribution area

American foulbrood occurs worldwide.

Causative agent

The causative agent of AFB is the spore-forming Gram-positive bacterium *Paenibacillus larvae*. Only the spores are infectious and remain so for decades, as they are highly resistant. Five different ERIC genotypes of *P. larvae* have been described (ERIC I – ERIC V), which are all pathogenic but have different grades of virulence. While ERIC III´, ERIC IV and ERIC V usually only exist in strain collections, the two genotypes ERIC I and ERIC II are isolated regularly worldwide from AFB-infected bee colonies. On the colony level ERIC I is more virulent than ERIC II, which often leads to late detection of infections with *P. larvae* of the genotype ERIC II.

Transmission

Bee larvae can become infected by ingesting *P. larvae* spores with the food. By „robbing“ of infected bee colonies or infected drifting bees spores can be introduced into the bee colony. Within the colony, the spores are spread rapidly by body contact and exchange of food. If infected colonies are moved and if spore-contaminated food or contaminated equipment is used in a beekeeping operation, the pathogen is transmitted by humans.

Clinical picture

The pathogen kills the majority of larvae generally before capping of the brood cells. If the larvae die after capping, the nurse bees usually will not notice it (mostly in case of infection with ERIC I) and *P. larvae* will decompose the bee larvae within the brood cells. Cell capping’s then often appear sunken or have holes, as the larvae transform to a pasty, coffee-brown, semi-fluid glue-like colloid usually known as ropy mass (matchstick test). This viscous mass then attaches to the cell wall, dries out and forms a hard scale that is hard to remove. In case of infection with *P. larvae* ERIC II the bee larvae usually die before capping and are removed by nurse bees, which causes a spotty brood pattern. Depending on the infection dose and the genotype, the incubation period ranges between a few weeks and several months. Furthermore, the condition of the bee colony and the hygienic behavior of the bees play an important role.

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Diagnostics

AFB diagnostics in the bee colony can be done based on the clinical symptoms described above. Suspicious larvae, pieces of brood cells, entire broodcombs or food samples can be sent in for laboratory diagnosis. For pathogen detection microscopic, microbiological, and molecular biological detection methods can be used.

For more detailed information please refer to the "Amtliche Methodensammlung" (in German language only).

Similar disease pictures

The clinical picture of AFB is very similar to that of European Foulbrood (EFB). Brood killed by AFB, usually forms a slimy thin thread with the matchstick test and a hard scale tightly attached to the cell wall, while EFB does not produce such a ropy thread and the scale is loosely attached. If mixed infection with *Melissococcus plutonius*, the causative agent of EFB, Acute Bee Paralysis Virus or Sacbrood virus is suspected, differential diagnosis is recommended.

Control

AFB is a notifiable animal disease. Control measures are defined in the German "Bienenseuchen-Verordnung" (= bee diseases act). As the spores of the causative agent of AFB are particularly resistant and long-lived, all equipment, the bee hive and the entire bee colony must be regarded as infectious. If the disease is suspected, no modifications must be made to the apiary until the case has been clarified. In addition to the most effective method for AFB control, burning of diseased bee colonies, the „shook swarm" method can be applied, i.e. the entire honeycomb material is destroyed and the bees are transferred to new or disinfected hives.

Further information: National Reference Laboratory for Bee Diseases

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