

Chalkbrood and stonebrood

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Summary

Chalkbrood and stonebrood are fungal diseases of honeybees (*Apis mellifera*) that occur worldwide. Chalkbrood is caused by *Ascosphaera apis* and affects the brood. Stonebrood is caused by *Aspergillus flavus* and *Aspergillus fumigatus* and affects both the brood and adult bees.

This practice describes the causes and symptoms of chalkbrood and stonebrood, how they spread, how to address them and how to prevent these diseases.

Description

1. Chalkbrood

1.1 Cause

Bee larvae become infected by ingesting spores of *Ascosphaera apis* with food. The spores germinate in the intestines leading to the death of the larvae. Each dead larva of chalkbrood produces billions of spores and, if not removed by the worker bees, they can remain infectious for several years within the hive. *Ascosphaera apis* grows better in larvae situated more externally in the brood because it is colder.

This phenomenon may occur especially during the colony spring growth, when the number of adult bees is not enough to allow an adequate nest temperature control to cover the whole brood area. Less populated and weaker colonies are more

susceptible as the bees are not able to keep all brood warm. Drone larvae are usually the most affected because of their location on the margins of the brood chamber.

1.2 Symptoms and diagnosis

The larvae may be affected in different life stages, more frequently on the third or fourth day of larval life. They then die in the first two days after capping, so bees must uncap the cells to remove the dead larvae. Chalkbrood produces a mummification and/ or calcification of the larvae (Figure 1).

Figure 1. Calcification of the larvae



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Firstly, larvae appear soft, assuming the hexagonal shape of the cell, then they dry out and become hard. Most of the affected larvae become white, but some become grey or black (Figure 2). They may not present any symptoms if



the infection is less than 12 percent. The presence of little stones (chalkbrood) on the bottom or at the entrance of the hive is typical.

Figure 2. Some larvae become grey or black



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1.3 Predisposing causes

The disease is influenced by the genetics of the queen, like hygienic behaviour that is able to prevent or contain the disease by removal of affected larvae. Moreover, low temperatures, high humidity in the apiary and poor ventilation of the hives all contribute to the disease being more severe.

Avoiding any practice that causes heat loss in the colonies can help prevent chalkbrood disease. Some practices include too many or too long hive inspections during the winter time or during cold days, colony splits for artificial swarming or nest enlargement with interposition of wax combs between brood combs (especially during unfavourable periods for wax comb construction such as early spring, autumn or winter, when the bees do not find enough food resources).

Chalkbrood and stonebrood may even appear in the hives after antibiotic treatment due to a lack of microbial competition.

1.4 Control

Many drugs have been tested, but the persistence of spores makes the disease eradication impossible. The best solution seems to be the administration of sucrose syrup (1:1) acidified with lemon juice or vinegar or ascorbic acid powder until pH4, and prevention with the application of good management practices in the apiary, such as the selection of appropriate locations, selection of resistant queens and ensuring enough food reserves in the hive (also feeding artificially when necessary).

Chalkbrood and stonebrood frequently cause constant spring losses but the evolution of the diseases are usually benign. Affected colonies can recover by themselves especially if they increase their population. This is usually the case under favourable environmental conditions as in sunny days of spring-early summer with the presence of abundant nutritional resources.

2. Stonebrood

2.1 Cause

Stonebrood is a disease present worldwide and caused by the fungus *Aspergillus flavus* or, less frequently, *Aspergillus fumigatus*, both commonly disseminated in the soil. The temperature limits for its development are between 7° C and 40° C; with an ideal range around 33° C to 37° C. Stonebrood can affect larvae as well as adult bees.

The infection is oral by feeding (from one bee to another by passing nectar) or cleaning the hive. The fungus are also able to develop at the surface of the bees' body, causing the damage from the outside. It affects capped and uncapped broods. At the beginning the larvae appear white and fluffy, then they become yellow (*A. flavus*) or greenish brown (*A. fumigatus*),



mummified and with a hard consistency. The appearance is very similar to the chalkbrood affected larvae (Figures 1 and 2). Behavioural changes are observed in adult bees which include agitation, weakness, paralysis, inability to fly away from the hive and morphological alterations with distended abdomen and subsequent mummification.

2.2 Control

There are no treatments to eradicate the disease. It is transitional and disappears spontaneously. However the correct apiary location (avoidance of wetlands and good exposure), proper management (preventing water infiltration inside the hives) and the regular disinfection of beekeeping equipment (for example sterilising by torch flames) are effective prevention measures.

Although death of entire colonies affected by the fungus may occur, the disease is usually transitional and subsides spontaneously, especially if the previous measures are applied.

3. Contact

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4. Objectives fulfilled by the project

4.1 Resource use efficiency

Location choice and disease prevention measures lead to improved efficiency of bee colonies.

4.2 Pro-poor technology

The technology enables improved management of beekeeping through disease prevention. This allows for increased yields (e.g. honey production) thanks to stronger colonies. Increased yields can provide additional sources of income and livelihood.