Early detection of European foulbrood using quantitative PCR

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Introduction

In Switzerland, the bee disease European foulbrood (EFB) was under control during the last 30 years. From 1970 until 1998 20 to 50 disease cases were reported each year, and were sanitized by the veterinary authorities. Since 1999 the number of cases increased dramatically. In 2008 more than 500 apiaries were reported as affected, representing an incidence rate of 3.6% (Fig. 1).
The actual control method against EFB implies the destruction of the colonies showing clinical symptoms and disinfection of the equipment. In the present situation, these sanitation measures seem to be insufficient.
The clinical symptoms appear at a late stage of the disease development and they are often not recognized early enough by the beekeepers, with the consequence that the bacteria causing the disease, *Melissococcus plutonius,* has already spread to the surrounding colonies.

Goal

➢ avoid the spread of the disease

- by locating the infected colonies before they show clinical symptoms (early diagnosis).
- by initiating control measures as early as possible

Material

We investigated the apiaries reported as affected by EFB (n=5) as well as 4 to 5 apiaries surrounding each case:
- presence of clinical EFB symptoms (OIE, 2004) was noted
- worker bees samples from the brood nests of each colony were collected
- colonies were analyzed individually with a quantitative real-time PCR method for the presence of *M. plutonius* (1).

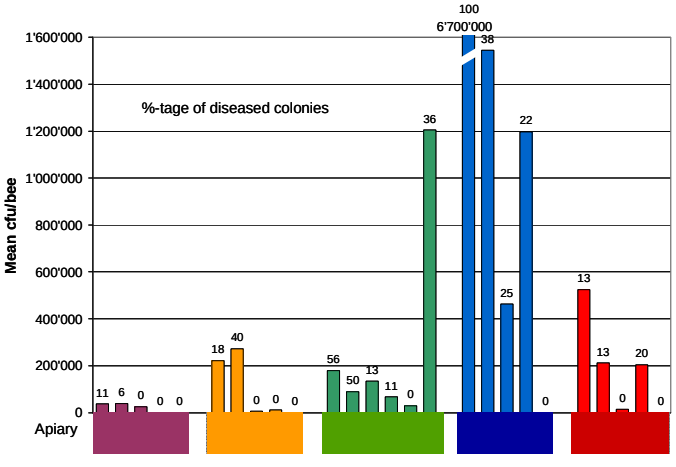

Fig. 2: Mean infection of the apiaries. Apiary 1 is the apiary in which the outbreak was reported.

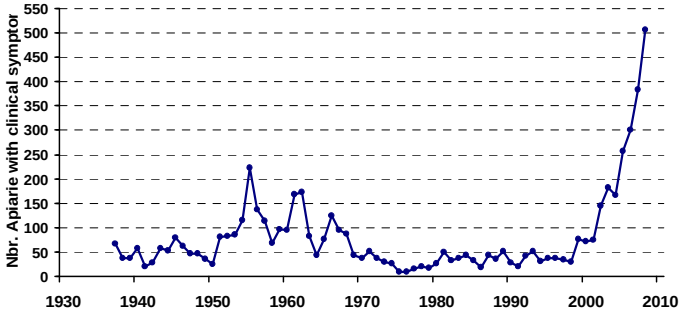

Fig. 1: Number of apiaries reported having clinical EFB symptoms per year in Switzerland

Results

We observed large differences in the infection rate between the different cases. This is probably due to the fact that the disease was recognized at various stages of development.
Apiaries without diseased colonies had no or only a low infection rate (Fig. 2 and 3).
A threshold seems to be set at about 30'000 cfu/bee (log 4,5), under witch no symptomatic colony can be found in the apiary.

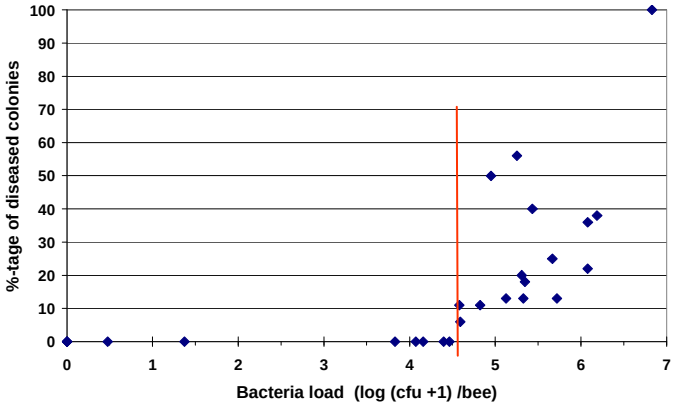

Fig. 2: Relation between the mean bacterial load of the bees on an apiary and the %-tage of diseased colonies on this apiary

Conclusions

Our results show that it is possible to locate with a good accuracy the infected apiaries at an early stage of infection using quantitative PCR. This methodology allows a rapid setting of apicultural measures to reduce the spread of the bacterial pathogen. Based on the results of such analysis, the veterinary authorities have the possibility to focus their inspections on infected apiaries and to omit the apiaries where clinical symptoms are not suspected. More trials to confirm this finding are planed.

(1) Roetschi,A.; Berthoud,H.; Kuhn,R.; Imdorf,A., 2008, Infection rate based on quantitative real-time PCR of *Melissococcus plutonius*, the causal agent of European foulbrood, in honeybee colonies before and after apiary sanitation. Apidologie 39 (3), 362-371

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