Sacbrood Virus

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Although not a particularly serious condition in Europe, sacbrood is a viral disease which, can lead to death of brood. Kirsty Stainton describes what to look out for and what to do if you find sacbrood in one of your hives.

Background

In 1913, the bacteriologist, GF White, published an article for the US Department of Agriculture on his investigations of a honey bee brood disease where 'larvae die here and there throughout the brood comb' but lacked the ropiness and glue-pot odour that makes foulbrood distinctive, and upon microscopic examination was found to be 'practically free from micro-organisms'.[1] White comments that across Canada, the USA and the UK, beekeepers were finding this mysterious condition, which he referred to as 'so-called pickled brood'. 'Pickled brood' was used to describe brood suffering from a fungal disease, but White was certain that the causative agent was not fungus. He observed the symptoms of the disease: '*Many larvae of this disease can be removed from the cell without rupturing the body wall. When thus removed they have the appearance of a small closed sac*' and he coined the term 'sacbrood'. He was the first to suggest that this disease was caused by a virus, but it was not until 1964, when the virus that causes sacbrood was first isolated and described by Leslie Bailey.[2] Although only relatively recently described, White reminds us '*to think of sacbrood as a disease which has affected bees longer than history records the keeping of bees by man*'.

Symptoms of sacbrood

Larvae that have become infected with sacbrood fail to pupate and die just after capping. The body wall of the larva becomes thick and the larva can easily be removed from the cell intact (Figure 1A).

It is common to find uncapped cells containing larvae that have died from sacbrood as the bees will uncap the cells and attempt to remove the diseased larvae. Often, in capped cells where the larva has died from sacbrood, the cappings will be punctured by the bees. The infected larvae will be upturned in their cells (Figure 1B),[3] lose their pearly white colour and turn yellow during the first stages of decomposition (see Figure 2, i and ii on page 274).[3] As decomposition progresses the larva turns brown, the skin toughens up and the sac becomes filled with fluid and, during the later stages of decomposition, the larval remains begin to dry out (Figure 2 iii and iv).[3] At the final stage of decomposition the larva has rotted down into a dry, dark scale (Figure 2 v).[3] If you rupture the sac you will find the contents to be a granular, brownish liquid and more-or-less watery depending on the state of decomposition of the larva.

Transmission and prevention of sacbrood

Larvae become infected with sacbrood virus when they ingest brood food fed to them by infected nurse bees. The virus prevents them from shedding their cuticle (skin) and their bodies fill up with fluid containing millions of new viruses.

While it is the larvae that suffer obvious symptoms of sacbrood virus, adult bees can become infected too.[4] The virus can shorten the lifespan of adult bees and it accumulates in their hypopharyngeal glands which allows them to spread the virus to more larvae; they can also spread

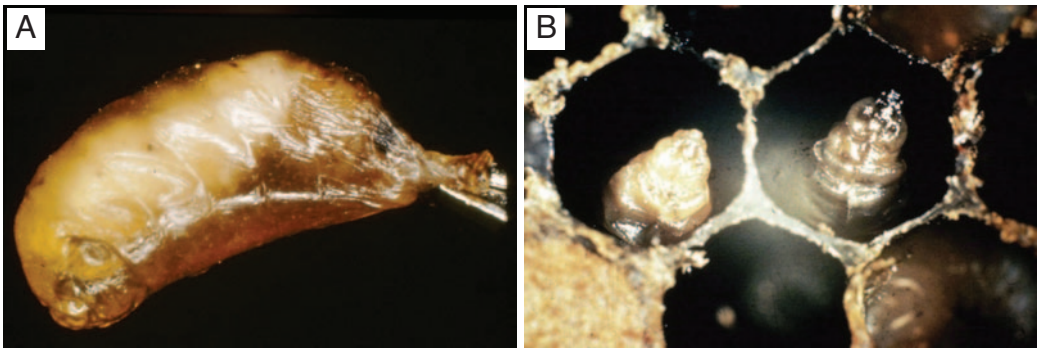

Figure 1: Symptoms of sacbrood. Larvae develop into a thick, leathery fluid-filled sac which can easily be removed from the cells (A). Larvae often appear upturned in their cells and turn yellow or brown during decomposition (B). Images courtesy crown copyright.

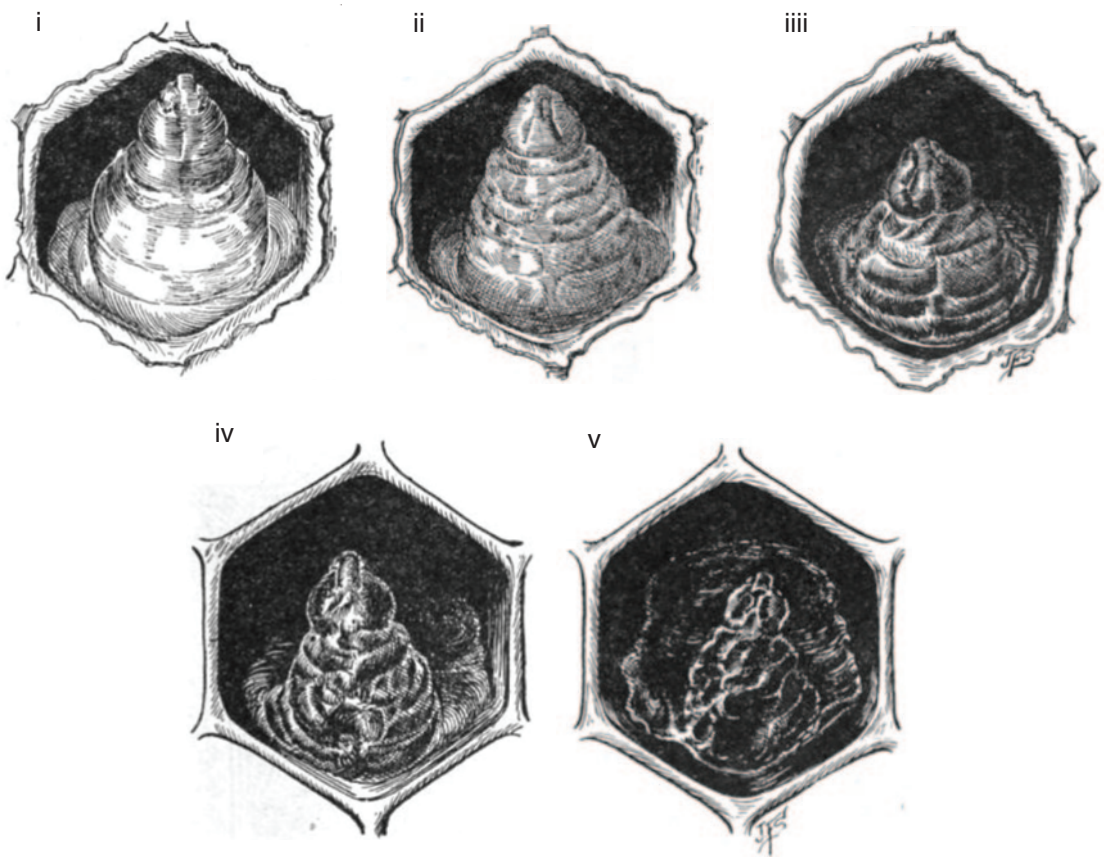

Figure 2. Stages of decomposition of sacbrood infected larva. Illustrations taken from GF White from the US Department of Agriculture, *Bulletin* 431 (1917).[3]

the virus to other colonies through robbing or drifting.[4] The virus can remain viable in honey, pollen and old comb for up to four weeks at room temperature[4] but exposure to sunlight and heat can destroy the virus. As far back as 1913, GF White discovered that heating honey to a minimum of 70°C for ten minutes was sufficient to inactivate sacbrood virus, as was direct exposure to full sunlight for five to six hours at room temperature.[3] Interestingly, GF White notes that putrefaction speeds up the rate of virus destruction, so virus present in decomposing larvae will be destroyed seven to ten days into the decomposition process.[3]

Bees will attempt to remove diseased larvae from the brood nest. Most often, the virus is well managed by the bees and, in *Apis mellifera* at least, does not lead to serious colony losses. Good hygiene on the part of the beekeeper will help prevent spreading of the virus between the hives but colonies with persistent sacbrood infections may benefit from requeening with a less-susceptible stock. Honey and frames from an infected colony should not be transferred to other colonies.

Treatments?

Viruses are very different to bacteria and the diseases they cause are much more difficult to treat. While antibiotics do not work against viruses, there are a number of antiviral compounds that treat viral diseases by preventing viruses from replicating. However, only recently have researchers investigated the use of antivirals in bees. In 2016, the Veterinary Medicines Directorate funded a study at Fera investigating the use of antivirals against deformed wing virus (DWV) and chronic bee paralysis virus (CBPV). Although this work demonstrated that some antivirals can be used to reduce replication of these bee viruses, they have not been tested on sacbrood and most importantly, they have not been tested in the field. There is a lot more work to be done before we know if antivirals are a feasible route in terms of efficacy and as sacbrood is not a serious disease in Europe, good husbandry is preferable to an application of a pharmaceutical treatment.

In European honey bees, *Apis mellifera*, sacbrood does not normally cause colony losses, so there is no strong motivation to fund research into finding a treatment. However, in Asian honey bees, *Apis cerana*, a very similar virus causes severe colony losses across Asia, especially in China, Thailand and Korea. Researchers are working to find treatments as a matter of urgency. At its worst, it caused 95% *Apis cerana* colony losses across the Himalayas, Nepal and India and nearly collapsed the *Apis cerana* beekeeping industry in Korea in 2009.[5] This *Apis cerana* strain of sacbrood does not seem particularly compatible with *Apis mellifera* and does not cause disease symptoms, so is unlikely to cause a problem for European beekeeping.

References

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