Department of Agriculture and Food
Farmnote
Note: 298
March 2008
Replaces Bulletin 4227

Preventing the spread of American foulbrood disease

Revised by Kate Ambrose and Bill Trend, South Perth

What is American foulbrood?

American foulbrood (AFB) is a disease of honeybee larvae caused by the bacterium *Paenibacillus larvae*. Beekeepers should ensure their apiaries are free of AFB to prevent reduced production and dead beehives.

AFB is transmitted through spores. Very young larvae are highly susceptible to infection; as few as 10 spores can infect a larva less than a day old.

Infected larvae are killed by the bacteria before pupation and at this stage as many as 2.5 billion spores per larva may be released. These spores may survive at least 40 years. They are resistant to drying and boiling in hot water.

How do beehives get infected?

The spores may be introduced through contaminated equipment from other hives or from another bee colony by contaminated 'robber' or drifting bees. Unsterilised tools may also be a source of contamination.

How does AFB affect the beehives?

Young larvae swallow the bacterial spores in infected food from nurse bees. The bacteria multiplies in the larval tissue causing rapid death and the spores are spread to other larval cells as well as the honey cells by worker bees attempting to remove the dead larvae. Eventually, there is a decline in adult bees and the hive becomes weak and dies out. Bee colonies usually abscond (swarm). This dead hive may attract 'robber' bees from neighbouring hives which can spread the disease further.

What are the signs of AFB infection

The first signs of AFB are sunken and damaged cappings on the sealed brood (Figure 1).

The dead larvae turn yellow at first and then chocolate brown and are drawn down into the cells. On stirring with a probe, such as a matchstick, the contents of the cell may rope out forming a characteristic fine elastic thread up to 30 mm long (Figure 2).

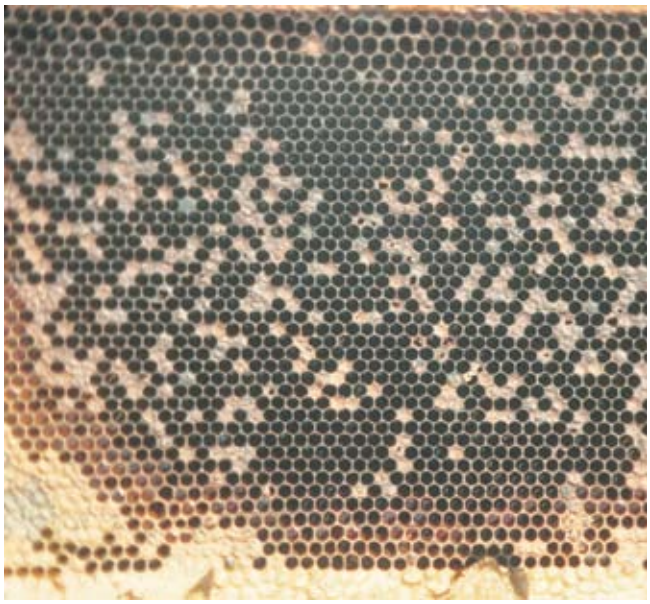

Figure 1 Classic signs of AFB are sunken and damaged cappings on the sealed brood

Figure 2 Contents of the cell rope out to form a characteristic fine elastic thread

In the more advanced stages of the disease, the larval remains become tacky and gradually dry out to a dark brown scale. Good lighting is required to observe these scales, as they are similar in colour to dark brood combs (Figure 3).

Figure 3 Larval remains become tacky and dry out to a dark brown scale

What do I do if I see signs of AFB?

Whenever a colony dies out or an irregular pattern of brood is observed the combs should be examined for sunken and perforated cappings or dried larval scales. If anything resembling them is found, a sample of comb and larvae should be submitted immediately to the Department of Agriculture and Food for laboratory examination.

The remaining combs should be left in the hive. The hive should be physically identified and made bee-tight until a report on the condition of the sample has been received.

Note: An apiary inspector must be notified within 48 hours of suspecting AFB.

If AFB is identified, the beekeeper and an apiary inspector will agree on a management plan to eradicate the disease from the apiary. All brood will be inspected and diseased hives removed before honey extraction and movement of hives. Hives can still be moved to their normal honey or pollen sites with the permission of the inspector.

Diseased hives can be either decontaminated by irradiation or wax dipping, or destroyed. Some hive components can be decontaminated by using sodium hypochlorite.

Preparing beehives for decontamination

All boxes, including frames and lids, should be thoroughly cleaned—that is, free of honey, bees, brood, propolis and wax—before any decontamination is attempted. This initial cleaning does not decontaminate the equipment.

Note: All honey, dead bees, scrapings and brood frames (as well as hive components that are not to be decontaminated) removed during the cleaning process need to be disposed of so robbing does not occur. Burning at night is a good choice. Use a hole big enough so the remains can be covered

Equipment can be cleaned by:

- hand scraping
- a hot air brush or blowlamp (used for paint stripping) to melt the wax build-up
- caustic soda in boiling water
- boiling water.

When boiling water is used, the boxes need to be placed in the container of boiling water so the wax and residue floats to the surface and can be skimmed off.

Turn boxes upside-down to assist in the removal of the debris when heat treatment is used. Remember to scrape out the rebated edges.

Extract the honey

- Honey can be salvaged from infected hives. However, if only a few hives are infected, the honey should be burnt with the frames and the infected brood.
- Immediately clean the extraction shed or van and equipment when extraction is completed. Pay particular attention to the extractor baskets. Soak them overnight prior to final cleaning and then use high-pressure wash-down equipment. If using a van, wash-down water should be led to a drainage hole in the ground near the van to trap the waste water. The hole should be immediately covered after cleaning has been completed.

Destroy bees from the infected hives

- At night the entrances to infected hives should be sealed with wads of newspaper or masking tape, and an insecticide introduced into the hive to kill the bees. Wait for 48 hours after extraction before killing the bees in the hive. Bees often congregate around the entrance of the hive rather than enter it on the first night following extraction.

Transport infected equipment safely

- Place all boxes, frames and equipment (including lids and bottoms) from infected hives in plastic bags before they are taken from the site for decontamination. Where practical, scrape bottom board debris and any excess burr-comb off the boxes before the equipment is put into the bags. It is recommended that 200 L drum liners (1.1 kg) be used.

Ensure infected equipment is stored so it is 'bee-proof'

- Seal the plastic bags and store them in a bee-proof shed. If a bee-proof shed is not available, an undercover storage area could be used provided the bags are covered with a tarpaulin and secured at the edges so it provides a bee-proof barrier.

Points to note

Frames

While frames can be sent for irradiation, brood and wooden frames are difficult to clean properly so they should be burnt. Wax dipping frames is not an effective method of decontamination.

Hive lids

Lids should be irradiated or burnt. The wax-dipping process increases their weight because the masonite component of the lids absorbs the paraffin wax. In addition, when wax-dipped lids are re-used, the trapped wax can melt and run down the outside of the hive in hot weather.

Hive bottoms

High-rise bottom boards, bottom boards and internal grates made of masonite or wood should be irradiated or burnt.

Metal bottom boards can be decontaminated by irradiation, wax dipping or steam cleaning or by being dipped in 5 per cent sodium hypochlorite and placed in boiling water for more than 10 minutes. Any metal contact with hypochlorite needs thorough rinsing otherwise it will corrode.

Pallets

Where a pallet is used to form the entrance of a hive it should be decontaminated using a blowlamp/torch.

Queen excluders

Plastic queen excluders cannot be effectively cleaned and these should be irradiated or burnt. Metal queen excluders can be cleaned and decontaminated by irradiation, steam cleaning or the use of sodium hypochlorite as per metal bottom boards.

Decontamination by irradiation

Gamma irradiation is an effective treatment for killing AFB spores. The gamma rays penetrate cells and break down DNA strands so bacterial growth cannot occur. It leaves no residues and the bee equipment can be reused immediately.

The hive boxes must be thoroughly cleaned on the outside (use a high-pressure hose) prior to being stacked into doubles or triples with the lid and base. The unit must be double-bagged or shrink-wrapped so that it is sealed, then strapped tightly together. Each unit should not weigh more than 25 kg. The units can then be stacked onto a 1200 mm x 1240 mm pallet. The height should be less than 2 m and the whole thing not more than 1000 kg. Beekeepers should clearly label each box for easy identification.

The pallets must be transported to the irradiation facility in a bee-proof container. Contact Steritech (**www.steritech.com.au),** the company providing the sterilisation service, for more information.

Wax dipping

If hive components are not thoroughly cleaned before wax dipping, the wax quickly becomes soiled and contaminated with paint and debris, shortening its useful life.

The boxes should be dipped in a mixture of 50 per cent micro-crystalline wax and 50 per cent paraffin wax. The equipment must be submerged in the molten wax for a minimum of 10 minutes at 160 °C to kill the AFB spores. Use a timer and thermometer to ensure that decontamination is effective.

Caution: Wax heated above 150 °C can cause severe burns to exposed skin.

However, wax under 160 °C results in ineffective decontamination. Lower temperatures also result in an increase in the amount of surface wax retained by the timber which subsequently decreases the holding power of any paint later applied to the timber surface.

Do not overheat the wax as it will give a highly flammable vapour above 175 °C and reaches flashpoint at about 230 °C. Boxes to be dipped must be dry, since moisture will cause the molten wax to froth and boil over the vat.

Identify the paraffin and crystalline wax so that it will not be mistaken for beeswax when the wax dipping unit is not in use.

Draining boxes

Remove the boxes from the molten paraffin and allow them to cool for one to two minutes. As soon as the excess paraffin on the surface of the box has been absorbed by the timber and the box is 'dry', but still hot, it can be painted inside and out with an acrylic paint or sealer. Painting the inside of the box is not necessary but it can help to keep the boxes free from burr-comb. Boxes should not touch each other while drying.

Wax dipping vat

Follow the manufacturer's instructions when using a wax dipping vat. In cool weather, it is advisable to dry and warm the boxes in a warm room as this will help to reduce frothing from moisture retained in the timber and assist in maintaining the temperature of the wax during dipping.

Dispose of any debris in the bottom of the vat so bees do not have access to the wax residue. Wax dipping vats may be available for hire from beekeeping equipment suppliers.

Storage of clean boxes

Identify all boxes with the date they were wax dipped or irradiated. This will prove helpful in the future should any outbreaks of disease be found elsewhere in the apiary.

Further reading

Keeping your beehives free of disease

Sending beehive samples for identification

082118-03/08-ID9106

ISSN 0726-934X