

American foulbrood

Identification and control in New York

What is American foulbrood?

American foulbrood (AFB) is a destructive, worldwide bacterial disease that infects and kills larvae. Colonies inevitably die either because adults are no longer replaced or because there are too few of them to protect against robbing. The bacterium that causes this disease, *Paenibacillus larvae*, can infect colonies at any time of the year. Although incidence is relatively low in New York State, the chief problem with this disease is that the bacteria remain alive in the spore or resting stage for over 40 years. Research has not determined exactly how long beyond that time the spore remains viable, so caution should be considered when purchasing used equipment. The long-lived spore, which is largely resistant to changes in the weather, extreme temperatures, and bactericides poses a challenge to the beekeeper.

Sources of Infection

- Contaminated equipment
- Unwashed hands after working with an infected colony
- Contaminated colonies (alive or dead). Healthy bees robbing honey or drifting to an infected colony can bring back spores and pass them to young brood during feeding. Once present in the larvae, the spores will become vegetative and will begin rapidly multiplying. Each larvae may come to contain up to 2.5 billion spores
- Swarms of unknown origin. This is an unlikely source of infection.

Figure 1. Comparing healthy brood to AFB-infected brood



1. A healthy brood pattern. Pupae lie next to other pupae with larvae around the outside because the queen lays eggs in expanding concentric circles. Note the good color and convex shape of the cappings over the pupae.



2. Perforated and sunken cell cappings are often seen with AFB-infected larvae. Photo provided by Paul Kozak.



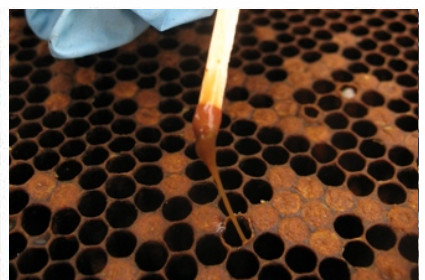
3. A spotty brood pattern indicating weakness or disease. The queen has not laid eggs in a compact manner.



4. Close up of an infected larva beginning to change color and sink to the lower cell wall. Photo provided by Paul Kozak.



5. In the later stages of AFB infection, larvae become a thin scale along the lower cell wall that cannot be scraped out with a toothpick. Photo provided by Paul Kozak.



6. A larvae dead from American foulbrood. The brown, ropy consistency of the dead larvae is typical of those that die from this disease. Photo provided by Paul Kozak.

Know healthy brood

Brood is the composite name given to the three development stages – eggs, larvae, and pupae – in the brood nest of a honey bee colony. In a normal colony, brood of the same age is found next to brood of a similar age, as the queen lays eggs in ever-expanding concentric circles. A strong brood pattern with light brown cappings and no perforations signals healthy pupae. Healthy eggs and larvae have a pure, glistening white appearance. Of the three development stages, only the larvae feed, and it is during feeding that they may take in the AFB spores and become infected. **We recommend beekeepers give their colonies at least three careful checks for AFB each year.** Shake bees off brood frames to give a thorough inspection. After finding and handling frames from an infected colony, hive tools, smokers, and hands should be disinfected before inspecting another colony of bees.

Symptoms of infected brood

It is often difficult to identify AFB as some symptoms are shared with other disorders, such as European foulbrood, idiopathic brood disease syndrome, and parasitic mite syndrome. It is best to always use an AFB Vita® Test Kit or send a sample of suspicious brood to the Beltsville Bee Lab to confirm the diagnosis.

Table 1. Symptoms of American Foulbrood

Early Stages	Late stages
<ul style="list-style-type: none">• Spotty brood pattern with sunken, concave, or perforated cappings• Beige or coffee-colored larvae• Larvae laying flat on the lower cell wall with a mucous-like consistency• Larvae will string out into about 1 inch ‘ropes’• Tongues of pupae stretched outward in some cases	<ul style="list-style-type: none">• Larvae become a thin dark scale along the lower cell wall. This scale does not pick out if you scrape it (unlike in other disorders such as European foulbrood or sacbrood)• Larvae at this stage will not be ‘ropy’• Distinctive foul odor in some cases• Toward the end of the colony’s life, there are few adult bees present

Diagnosing American foulbrood

If you see any of the symptoms described above, you can do a preliminary test for AFB if you wish before sending a sample for confirmation to Beltsville Bee Lab. Uncap a cell from the suspicious brood area and enter a small twig, flat-end toothpick, the end of a matchstick, or a Q-tip. If the larva appears coffee-colored and goopy, poke it with the stick, rotate it 360°, and pull outwards. If the larva forms a rope of about 1 inch, this is indicative of AFB. Do not throw this stick on the ground. Either embed it in the diseased comb so bees can’t drag it out, or include it in your sample to the Beltsville Bee lab. Next, perform a Vita® AFB test. These kits can be purchased from select bee supply stores, are easy to use, and generate results quickly.

What do you do if the ropy test and/or the Vita® Test Kit suggests you have AFB?

First, label the colony so you will easily be able to find it again, then contact a NYS bee inspector. Joan Mahoney can provide their contact information. In addition, send a brood sample to the Beltsville Bee Lab to 1) confirm the presence of AFB and 2) test for resistance against the current available antibiotics. Check out this website to see how and where to send your samples:

<http://www.ars.usda.gov/Main/docs.htm?docid=7472>

Quarantining colonies:

If you or an inspector suspects you have AFB, quarantine only those suspected colonies until the diagnosis is determined. If you receive a positive diagnosis of AFB, continue to quarantine those diseased colonies until they are destroyed. Colonies in quarantine cannot leave the apiary. Equipment (such as hive tools, gloves, feeders, etc.) cannot be interchanged between quarantined and healthy colonies without first being sterilized.

What do you once AFB is confirmed in your bee yard?

Report the outbreak

Upon discovery of AFB you must, by law, report it to the state apiculturist Joan Mahoney. Her contact information is at the end of this information sheet. An inspector may come to your apiary/apiaries to inspect all of your colonies and try to determine how long your bees have had the disease and possibly where it originated from. If, for example, the source is a nearby apiary or nuc producer, inspectors may visit those sites to determine the extent of infection spread. Though most bees forage no farther than two miles from the hive, some bees may forage over an area five to six miles or more in diameter, so tracking down a source of infection can be difficult. We recommend keeping detailed records of where bees were purchased, where colonies have traveled, and to keep in touch with neighboring beekeepers to make certain they are also watching their colonies for disease.

Destroy infected colonies and disinfect equipment

According to the New York State Law, all AFB needs to be burned or destroyed. Do not try to control the infection by removing affected frames – the entire colony must be destroyed with an inspector’s oversight. A hole is dug in the ground and the frames and poor or rotten hive bodies are burned in it. Close all entrance holes and kill the colony with insecticides prior to burning. After the burn is completed, the hole is covered up with enough dirt that an animal cannot uncover it. If the hole is in an agricultural field, it must be deep enough that it is below plow depth.

If the area is dry and fires are not permitted, the colonies can be buried deep in the ground on the beekeeper’s property or on a landfill. The county will issue a permit to bury it in a landfill. The inspector must be present during the procedure.

Not all equipment has to be burned. Outer covers, inner covers, and bottom boards that do not have deep cracks or rotten wood can be scorched with a blowtorch. Alternatively, hive tools and smokers can be washed with bleach water and scrubbed with a stainless steel wool pad. This washing will not destroy spores, but it will dilute them by removing materials like wax, honey, and propolis that may contain a lot of spores. Bee jackets and leather gloves can be washed in a similar manner, but if gloves appear to be worn out or the contamination cannot be eliminated, it is safer to destroy them.

Antibiotics

The three antibiotics that are available in New York are oxytetracycline hydrochloride (Terramycin), tylosin (Tylan, Pharmasin, Tylomed-WS), and lincomycin (Lincomix). Historically, beekeepers applied these treatments prophylactically to their colonies in spring, fall, or sometimes both to prevent an infection from starting. Because of increased documented resistance to oxytetracycline in both humans and *P. larvae*, **these treatments are now only available through a prescription or veterinary feed directive from a veterinarian.** These new regulations came into effect by the FDA in January 2016. Bee inspectors cannot write prescriptions for these medications. Visit the Honey Bee Veterinarian Consortium website (<https://www.hbvc.org>) for an up-to-date list of veterinarians that are knowledgeable on honey bee diseases.

Tips to preventing AFB in your bee yard

- Inspect hives for AFB 3 times a year: spring, fall, and right before removing the honey crop.
- Do not purchase bees or equipment from beekeepers who do not have an inspection certificate.
- Do not use someone else's old equipment. Always buy your equipment new or build it yourself.
- If possible, keep your colonies away from neighboring apiaries. Honey bees can fly between 2 and 9 miles.
- Always do a thorough inspection of the brood nest before transferring equipment, frames, or bees between colonies.
- Do not bring your gloves, hive tools, or other equipment to someone else's apiaries. If you must, sterilize them thoroughly after the visit.
- Swarms can carry AFB. When capturing a swarm of unknown origin, initially keep it separated from other colonies, use separate equipment, and monitor this colony closely. Swarms are less likely to develop the infection if they are introduced on new foundation instead of drawn comb; building the comb can give them time to purge the spores from their bodies before brood rearing begins.
- When possible, order hygienic stock bees.
- Do not feed colonies honey from another colony, under any circumstance.

Figure 2. Inspect your brood frames 3 times a year to monitor AFB. Shake off bees and hold the frame so that the sun is shining directly into the brood cells for best vision.



Figure 3. AFB-infected colonies must be destroyed through burning or deep burial. Hive tools and smokers can be sterilized with bleach water.



Contact Information

Roger Morse (Original Author)
Emma Mullen, Information Sheet Author
Dyce Lab, 203 Freese Road
Cornell University
Ithaca, NY 14850
607 319 0752
ekm75@cornell.edu

Joan Mahoney
NYS Department of Agriculture
and Markets, Information Sheet Resource
Division of Plant Industry, 10B Airline Drive
Albany, NY 12235
(518) 457-2087
Joan.Mahoney@agriculture.ny.gov