European Foulbrood

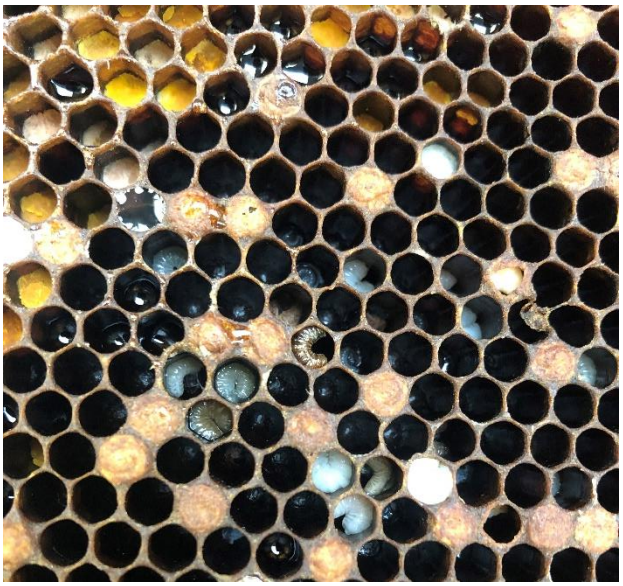

Photo credit Alexandra Panasiuk

Prescription Only

As of December 1 2018, all Medically Important Antimicrobials for veterinary use are sold by prescription only as they have been added to the Prescription Drug List. This includes antibiotics used in apiculture, such as oxytetracycline.

It is imperative that the use of all medically important antibiotics are controlled to limit the development of resistance in human and animal pathogens, so that effective treatments remain available when required. Antibiotics for the treatment of all animals including honey bees are no longer available “off-the-shelf” in Canada, and a prescription from a veterinarian is required to access these drugs.

Beekeepers are encouraged to contact a veterinarian to discuss establishing a Veterinarian–Client–Patient–Relationship (VCPR) — don’t wait until you have a problem to establish a relationship with a veterinarian.

For more information, e-mail bee@gov.ab.ca

Alberta

Background Information

European foulbrood (*Melissococcus plutonius*) is a contagious brood disease of honey bees (*Apis mellifera)*, with near-global distribution. In Alberta, European foulbrood (EFB) is listed as a bee disease under the Alberta Bee Regulation. Typically symptoms of EFB arise early in the season when food sources are limited. Historically, EFB has spontaneously resolved with a strong nectar flow. However, in recent years infection has persisted throughout the summer. It can have devastating effects on an apiary and can spread to neighbouring operations if not managed properly.

Unlike American Foulbrood (AFB), EFB is a disease caused by non-spore-forming bacteria that infect the digestive tract of honey bee larvae. Larvae younger than three days old are most susceptible to EFB infection and infected larvae usually die at four or five days of age, before the cell is capped. When the larvae die before the cell is capped, the worker bees may remove the larvae from the colony and eliminate the majority of the bacteria contained within the cadaver, helping to minimize the spread of the disease. However, death of infected larvae can also occur after the cell is sealed. It is important to note that not all larvae infected with EFB will die from the disease, but the ones that do survive often emerge as underweight adults due to competition for nutrients with the bacteria. EFB is spread within a colony by nurse bees feeding larvae contaminated food, or bacteria present in the cells after an infected pre-pupa defecates in a cell.

What makes this disease unique and difficult to visually diagnose is its association with secondary bacteria that colonize the dying larvae. In addition, diagnosis can be complicated by uncharacteristic visible symptoms caused by different EFB bacterial strains. The specific mechanism through which EFB kills larvae remains inconclusive, but the leading theory is that the bacteria outcompete the young larvae for nutrients, leading to starvation. There is also some recent evidence that in some cases, secondary infections or damage to vital tissues may be the cause of larval death

Figure 1- Spotty brood pattern from EFB infection. Photo credit: Emily Noordyke, Graduate Assistant, University of Florida

Cause of Outbreaks

The cause of EFB outbreaks are believed to be caused by a number of factors interacting at once. Nutritional deficiencies caused by weather, poor forage (specifically pollen quality or quantity), and/or a lack of nurse bees able to feed developing larvae can contribute to EFB outbreaks in a colony. Visible symptoms are often observed when a period of poor forage is followed by the onset of a strong flow. Before the strong flow, the small amount of brood is well-fed and the infected bees survive, spreading the bacteria throughout the colony. When brood rearing suddenly increases at the onset of a strong flow, there can be a shortage of food and nurse bees. As a result, infected larvae do not survive to pupation. EFB symptoms can persist when honey and pollen flows are variable. Historically, EFB would clear up when the flows are continued and strong, and weather is conducive to foraging, but in recent years beekeepers have reported persistent EFB infections that are not clearing up with the onset of idea conditions.

Other factors that may contribute to EFB outbreaks, as it is often considered a stress-associated disease, include:

- Lack of water
- Transportation
- Larval immune response
- Genetics
- Other environmental factors

It is also important to look at the biosecurity practices in your operation to ensure equipment is cleaned or sanitized regularly, and disease-prevention management practices are employed.

Symptoms

***Note**: Visibility and appearance of symptoms depends on disease stage, infection level, and colonisation by secondary bacteria.*

- A spotty brood pattern
- Dead and dying larvae
- Larvae will begin to change from pearly white to yellow in colour, then to grey and eventually a brownish-black colour. Segmentation may not be visible.
- The midgut of infected larvae may appear chalky white, compared to a healthy midgut, which is yellow-orange. The tracheae may also be visible in each segment of the bee.
- Larvae may become twisted or stretched in the cell and will move away from the characteristic “c” shape of healthy larvae at the “bottom” of the cell.
- If the cell is capped, the capping may look sunken or perforated, similar to AFB. However EFB infected larvae are watery and will only rope less than 1.5 cm when drawn out with a toothpick.
- Once an infected larva dries out, it can form a scale or plaque on the cell walls. This plaque is easy to remove, unlike AFB, and lighter in colour than typical AFB scale.
- The detection of a foul odour is not a reliable diagnostic feature of EFB. The presence of an odour would be dependent on colonisation by secondary bacteria.

- In addition to typical EFB, there has been increased incidences of: 1) ‘melted’ or ‘deflated larvae; 2) larvae infected with EFB at a later stages of development; and 3) higher than average number of EFB-infected larvae per colony.

EFB is a complex disease, and its symptoms can be confused with other common honey bee diseases including: sacbrood (a virus), AFB (a bacteria), Parasitic Mite Syndrome, or even early-stage chalkbrood (a fungus). EFB bacteria can be present in a colony that shows no visible symptoms, particularly if antibiotics were used as a routine part of colony management. Looking for EFB infected larvae may be challenging if the colony is strong, as worker bees may have removed the larvae, leaving behind an empty cell. Diseased colonies that are starving can display the same behaviours of ejecting infected larvae. Distinguishing EFB from the diseases listed above is further complicated by the presence of secondary bacteria that colonise the cadaver, and the type of EFB strain that infects the larvae. Both of these factors may lead to atypical symptoms that make it harder to identify EFB in your colony (see list of symptoms below). For this reason, frequent monitoring of brood frames in late spring is important when EFB outbreaks are most common. This will also help to familiarize yourself with the range of symptoms associated with this disease.

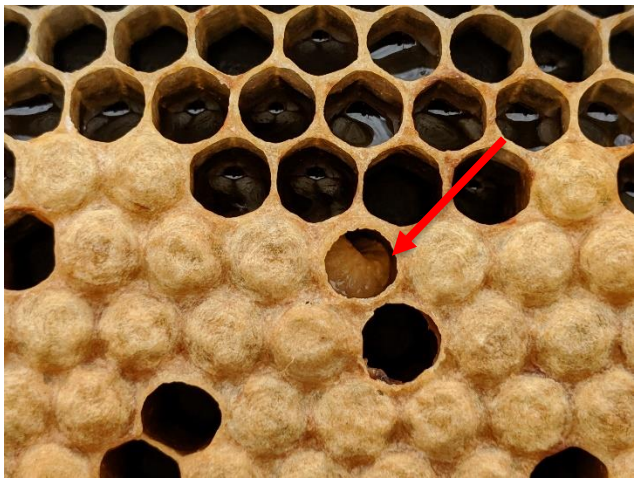

Figure 2 - Larvae twisted in cell. Photo credit: Andony Melathopoulos

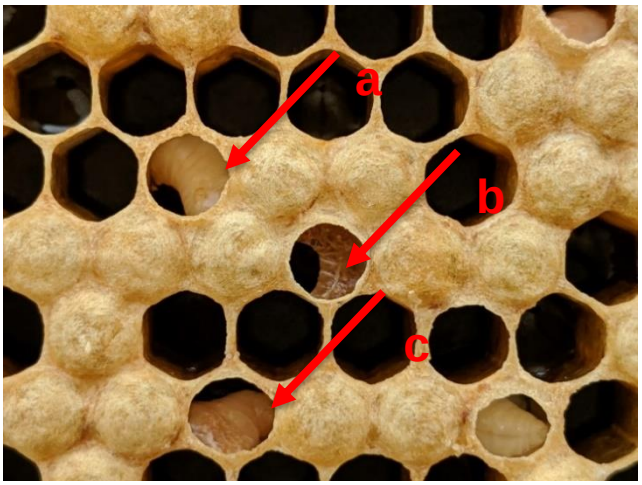

Figure 3 - a) larvae twisted in cell, b) larvae twisted and in the process of drying out, tracheal lines are visible, c) deflated larvae twisted in cell. Photo credit: Andony Melathopoulos

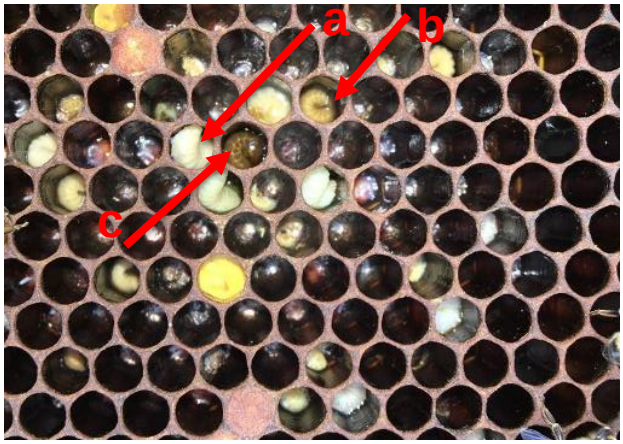

Figure 4 - a) twisted larvae b) discoloured larvae c) discoloured larvae, trachea visible. Photo credit: Emily Noordyke

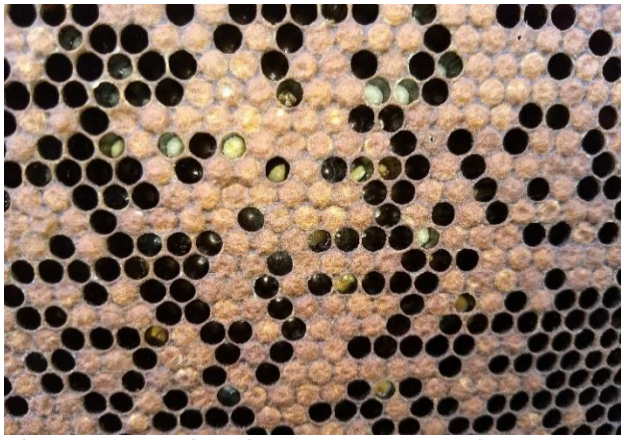

Figure 5 - Spotty brood pattern, greasy cappings, discoloured and twisted larvae. Photo credit: Emily Noordyke

Figure 6 - Spotty brood pattern, discoloured larvae. Photo credit: Emily Noordyke

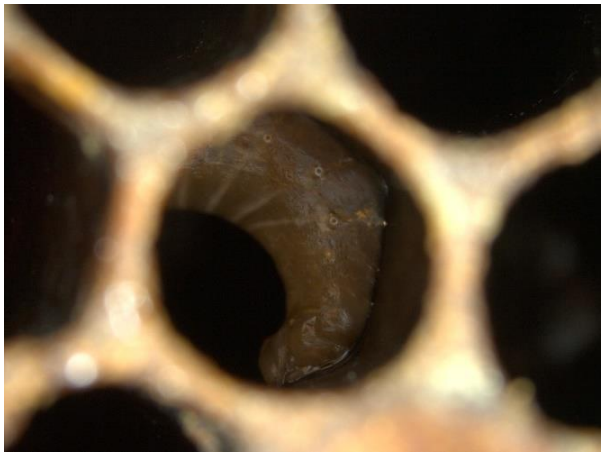

Figure 7 – Close up photo of EFB infected larvae. Larvae is discoloured, and tracheal are lines visible Photo credit: Rassol Bahreini

Integrated Pest Management Strategies for European Foulbrood

Prevention

- Frequently monitor colonies for diseases and practice good sanitary management practices by regularly cleaning and sanitizing equipment (smoker, hive tool, gloves, extractor, hive parts, supers) to prevent the spread of EFB between colonies.
- Select bees from stocks that exhibit hygienic behaviour.
- Supplement colonies with protein when the weather is unpredictable, during a dearth, and when moving apiaries
- Ensure there are adequate food reserves and nurse bees to care for the amount of open brood in the colony.
- Cycle out old brood frames every three to four years. Although EFB is not spore-forming, it can remain viable in the comb for a number of years. Getting rid of old frames can reduce the bacterial load in the colony, even when visible symptoms are not apparent.
- Be cautious when transferring equipment and combs between hives, specifically if colonies were historically treated with antibiotics. Colonies might not show clinical signs of EFB, but you might be unknowingly spreading the disease.
- Employ management practices to prevent drifting and robbing between colonies during a dearth.
- Queens, package bees, and infected feed (syrup, honey, pollen, and supplements) can be a source of EFB bacteria.
- Remove symptomatic colonies, dead-outs, and equipment from apiaries to reduce robbing and transmission of EFB and other diseases.
- Ensure equipment and frames are properly disposed of by burning to reduce disease transmission. Cold temperatures will not kill EFB bacteria.
- Quarantine swarms to ensure they are disease-free before placing them in an apiary.

Control

- Remove frames with clinical signs of EFB and dispose of them by burning to reduce transfer of diseases.
- If EFB infection is severe, burn your infected colonies.
- Irradiate your comb (min. 15 kGy of radiation, compared to 10 kGy for AFB).
- Use the “Shook Swarm” method for light infections. Keep in mind this method is only available as a control method until mid July. After mid July the colony will likely not recover because the bees won’t have enough time to build up their population before winter and will have insufficient honey storage.
- The use of registered antibiotics should be restricted and only used on **strong colonies under the direction of your veterinarian.**

Treatment with Antibiotics

Antibiotics can treat EFB bacteria, however antibiotics will not kill EFB it will only prevent the reproduction of the bacteria in developing larvae. EFB bacteria will still remain viable in the colony after treatment with antibiotics. Historically, some beekeepers in Alberta and other jurisdictions have prophylactically applied antibiotics to their colonies to prevent outbreaks of EFB. Always carefully follow antimicrobial labels and apply the correct dose, mixed in the correct application material as prescribed by your veterinarian. Please note that tylosin (Tylan®) or lincomycin (Lincomix®) are not registered for treatment of EFB.

Proactively contact your local veterinarian to discuss establishing a Veterinarian-Client-Patient-Relationship (VCPR) — don’t wait until you have a problem to establish a relationship with a veterinarian. A qualified registered veterinarian will work with you to understand your operation and establish a treatment plan that will maximize both bee health and human safety using products that are registered for apicultural use in Canada.

Recommended Resources

- Bees and Apiculture
  - Apiculture - Publications and resources
- Alberta Bee Health App
  - Available on both the App Store and the Google Play Store
- Honey Bee Diseases and Pests 3rd Edition, Canadian Association of Professional Apiculturists, Stephen Pernal ed.
  - Available in French, English and Spanish
- Purchasing Honey Bees or Equipment in Alberta
  - Questions to ask and things to consider
- Iotron Industries Canada, Inc
  - Irradiation Services

If you suspect your colony has an EFB infection, you can contact the Bee Health Assurance Team for help: 780-644-8746, bee@gov.ab.ca

For more information, e-mail bee@gov.ab.ca

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