Northwest Territories Beekeeping

BEST MANAGEMENT PRACTICES

Photo credit: Kyle Thomas

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ECOLOGY NORTH

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Introduction

Beekeeping is the practice of managing and maintaining bee colonies by humans. Beekeeping has been part of human history for thousands of years, although it is relatively new in the Northwest Territories (NWT). This best management practices document for beekeeping in the NWT was developed by Ecology North, with support from the Departments of Environment and Natural Resources, and the Department of Industry, Tourism and Investment. This document is designed to act as a guide to bee husbandry for northern beekeepers.

If you are considering beekeeping, it is critical that you understand the time commitment and financial responsibility that it requires. If you've never kept bees, this document will introduce you to the information you need to get started. Consider environmental conditions and whether you have the space and adequate floral resources near you to support your colony. Consider costs of equipment and of the bees themselves. A nucleus of bees will cost you between $200 and $400 and sometimes beyond depending on the strain of bees (i.e. Italian, Russian, a hybrid etc.). Equipment can be another $200-$400 depending on quality. Last but not least, time and commitment. Beehives need to be inspected regularly and require feeding in the spring and in the fall. You can expect to spend large portions of your weekends and evenings cleaning equipment, inspecting hives, and preparing them for the long winter months.

Bees in the Northwest Territories

There are 110 species of bees found in the NWT including bumble bees, mason bees, honey bees, and more. Honey bees, the subject of this guide, are not native to the NWT. This first section will provide a brief overview of native bees in the NWT, in particular the bumble bee.

Native bees are important pollinators for many plant species and are present in all of the regions of the NWT; bee specimens have been collected as far north as Banks Island. Generally, the 22 species of bumble bees in the NWT have healthy population numbers. However, three species are currently considered to be at risk in the NWT as of January 2020:

1) Gypsy cuckoo bumble bee (*Bombus bohemicus*)
2) Western bumble bee (*Bombus occidentalis mckayi*)
3) Yellow-banded bumble bee *(Bombus terricola)*

Some of the most significant threats to these bumble bees are climate change, pesticide use, habitat degradation, and the introduction of pests and diseases from imported bees. When it comes to bee conservation, individuals, communities, and beekeepers in the NWT have an important role to play in ensuring the future of native bees in our environment and around the world. There are many ways to help NWT native bees:

Bees drinking at a bee bath.
Photo credit: Matt Vincent

1. Choose bee-friendly forage. Bees prefer simple flowers and non-ornamental plants. Showy ornamentals tend not to have much pollen or nectar for bees.
2. Foster the growth of native plants, even those that some may consider weeds. Fireweed, dandelion, common yarrow, wild mint, lamb's quarters, prickly wild rose, Labrador tea, Arctic poppy, and dogwood are some examples.
3. If you choose to plant non-native ornamentals, consider planting those that are preferred by bees and are not naturalized[1] in the NWT, such as sunflowers, geraniums, marigolds, asters, forget-me-nots, and calendula.
4. It is best to use seeds harvested from plants in the NWT as opposed to seeds brought up from other jurisdictions. Seeds sourced or bought from other jurisdictions could be contaminated with non-native species to our region.
5. Learn how to collect seeds from native, wild plants and have them ready to plant for next year. Usually seeds will be ripe for collecting when the parent plant shows signs of dying back in the fall (senescing). Senescing plants are usually hard, dry, and darker in color. Seeds can be collected by gently shaking or pulling the seedpod. Make sure to keep seeds dry in a paper bag or envelope and store in a dry dark place. Label the seed bags with the collection date and location. Be responsible when harvesting and aim to take no more than 10% of seeds off the plant.
6. Provide a clean water source in the yard. Make a "bee bath" by filling a shallow dish with clean water and several small rocks. Leave the rocks partially exposed to serve as perches for visiting bees.

[1] A plant or animal having become established and living wild in a region where it is not native.

7. Provide habitat for nesting. Many bumble bees nest in dead tree branches, soil, leaf debris, and on the forest floor. When gardening or cleaning the yard, allow for some areas to remain unkempt so that bees can build a nest. Additionally, there are many different designs available for artificial habitats that are easy to build.
8. Avoid using pesticides, herbicides, and fungicides wherever possible. If you must use pesticides, make sure to carefully follow the label instructions.
9. Document bee observations through photographs and field notes. Capture traits of bee species in the area (e.g. size, colour, shape etc.), record observations of bee behaviour and what plants bees frequently visit. This is important data to better understand and foster native bee populations. Photos can be posted on www.facebook.com/groups/NWTSpecies or on iNaturalist.

More information on native bee species in the NWT can be found at www.nwtspeciesatrisk.ca.

Beekeepers and Native Bees

Beekeepers in the north have a particularly important role to play in the stewardship of native bees. Steps must be taken to ensure that honey bee colonies are well managed and checked regularly for diseases and pests in order to minimize the risk of negatively impacting native bee populations through the spread of pathogens. The later sections on disease and pest management should be given special attention by new and prospective beekeepers. Additionally, adhering to the best practices for sourcing live bees outlined below will help to mitigate the risk of introducing harmful diseases or pests to susceptible native bee populations. It is also important to recognize that high-density beekeeping is a threat to native bees, as they will compete for resources. Before attempting beekeeping, consider how many honeybee apiaries are already present in your area and acknowledge that starting another operation may be detrimental to the native bee population. Consider joining a bee co-operative with a neighbour to reduce single apiary operations.

Honey Bee Biology

The honey bee is an insect that belongs to the order *Hymenoptera* and genus *Apis*. There are many different species and subspecies of honey bee, varying in size and colour. The general anatomical structure of the honey bee is as follows:

- **Body:** The honey bee body is divided into three parts: head, thorax, and abdomen. The head has six fused segments, and the thorax three segments. The abdomen has six visible segments. The other three invisible abdominal segments are modified into the stinger.
- **Eyes**: Bees have five eyes. Three of the eyes are called simple eyes (or ocelli) and are used to detect changes in light. The other two are called compound eyes and contain thousands of light sensitive cells that are used for detecting patterns. The compound eyes allow bees to see polarized light. This allows bees to see all colours on the visible light spectrum (except red), as well as ultraviolet. Bees can also respond to polarized light, allowing them to navigate using the sun even on cloudy days.
- **Proboscis**: This is the mouth of the bee. Certain mouthparts of the bee form a long tube that allows the bee to reach nectar that is deep in flowers. Bees also have mandibles to deliver food to larvae, to uncap brood cells to let adults out, manipulate wax, carry and process pollen, and to remove dead bees and detritus from the hive.
- **Thorax**: Bees have three segments to their thorax. The thorax is entirely filled with muscles that operate the legs and wings. It is the principal locomotory region of a bee's body. It aids in flight, walking, and specialized functions of the legs such as pollen collection. The thorax is also home to three pairs of spiracles, which are part of the breathing, or respiratory system. Spiracles are openings allowing oxygen in and carbon dioxide out, a function similar to that of the lungs in animals.
- **Wings**: Bees have four membranous wings on their middle and posterior thoracic segments. The four wings are divided into two pairs (forewing and hindwing), which are connected to each other by a series of hooks so that they work in unison.
- **Legs**: As with all insects, bees have six legs. The foreleg is used to clean dust and pollen from the head as well as the antennae. The middle legs are used to clean pollen off of the thorax and pass it onto the hind legs. The hind legs of the worker and queen bees are equipped with a structure called a corbicula or "pollen basket". This structure is highly specialized in the worker bee to collect and pack pollen to carry back to the hive.
- **Abdomen**: The abdomen contains important parts of the internal organs and glands that produce defense pheromones.
- **Stinger**: The stinger is part of the egg-laying structure of bees called the ovipositor. This structure is only found on female bees and is a one-time use defense mechanism. The queen is able to sting repeatedly with her stinger, but she reserves this action to fight competing queens.
- **Hairs**: Most bees are covered in tiny, branched hairs that help to trap pollen grains.

Honey Bee Castes

Honey bees are social creatures that have a highly organized community structure. This structure is characterized by cooperative brood[2] regimes, overlapping generations of adults and a clear division of labor. In the honey bee colony there are three types of members, or castes, each with different responsibilities. These three castes are worker bees, drones, and queens. Aside from drones, the colony is made up predominantly of females, with the only reproductive member being the queen.

The Queen

A queen bee (centre) surrounded by worker bees. Photo credit: Matt Vincent

Only one queen lives in a given colony and is the only member of the bee colony with fully developed ovaries. She can lay 1,500 to 2,000 eggs a day in optimal conditions. Her reproductive ability is dependent on multiple factors such as seasonality, disease and pest presence, bee population, food availability, and her age. Worker bees tend to the queen's most basic needs. They groom and feed the queen and remove her excrement from the hive. She hardly ever leaves the hive except at mating and at swarming[3] time. The queen bee is the largest bee in the hive. Her abdomen is pointed, allowing her to easily access cells in the comb in order to deposit eggs. The queen has a barbless stinger that allows her to repeatedly sting predators and competing queens.

[2] A term that refers to immature bees, in the various stages of development, before they have emerged from their cells (eggs, larvae, and pupae).

[3] A collection of bees and a queen that leave their hive in search of a new home. Usually due to overcrowding of the hive.

The Life of a Queen

A queen bee emerges from her cell after 16 days of development. The cells containing queen bees are noticeably different from the workers and drones. They are large and extend conically out from the comb pattern to make room for the larger queen. The early larval stages of the queen are identical to those of the worker bees. Both are developed from fertilized eggs.

Queen cells surrounded by worker bees.
Photo credit: Matt Vincent

What determines the development of a larva into a queen is the diet that she is fed. All larvae are fed royal jelly for the first two days of development. Royal jelly is produced from the glands of worker bees and is rich in vitamins, proteins, and amino acids. Worker bees and drones are then switched from royal jelly to a mixture of pollen, nectar, and honey. In contrast, queens are fed a diet of royal jelly throughout their larval development. Royal jelly supplies a diet rich in protein and necessary supplements to alter the development to produce a queen. This diet promotes the growth of ovaries within the larvae and speeds up the process of development.

Multiple queens can be produced within a colony. The first to emerge will seek out the other queen cells and kill them before they have a chance to complete their development. If two queens are present at one time, they will compete and fight to the death. After the adult queen emerges, another 7 to 10 days must pass before she is sexually mature. Then, the queen will leave the hive on a mating flight. She does this in order to reduce risks of mating with relative drones - inbreeding -, which would reduce the stock of genes in the colony over time. A queen generally mates with more than one drone on a single mating flight and an average of 7 to 17 drones during the few days or weeks of the mating period. Upon returning to the hive and within 2 to 3 days, she will begin laying eggs. The queen will generally live for 2 to 4 years actively laying eggs. When fertilization and production starts to wane, another more fertile queen will supersede the queen.

Workers

Worker bees are infertile females that oversee all non-reproductive aspects of the hive. Reproductive roles are reserved for the queen. The worker bee's roles include in-nest tasks, such as cleaning cells, rearing brood, building comb[4], and guarding the hive. Out of hive tasks include foraging for nectar, pollen, and water. The roles of the worker bee are age-dependent and research shows that in-nest tasks are performed by younger workers and outside jobs by older workers. A worker bee will cycle through many roles throughout her life and bees are flexible in the ages at which they do many jobs, as they will adjust their work schedules to fit the needs of the colony.

Capped brood cells containing workers will appear flush with the comb pattern. Worker bees emerge from their cells after 21 days of development. A lifespan of 45 days is common for summer bees that are active during the foraging season. Worker bee lifespan can double in overwintering bees.

Drones

Drones are the males in the colony, existing exclusively to mate with a virgin queen. Drones make up a relatively small percentage of the bee colony's total population. They will be tolerated in the colony while the colony is prospering and as long as honey is produced fast enough to feed the colony. The queen continues to lay drone eggs in case an old queen dies, and needs to be superseded[5], or in preparation for swarming. Near the end of the season when mating ceases and nectar flow stops, drones are forced from the hive by workers to help save honey stores to survive the winter months. The queen will begin to lay new drones again in the following spring in anticipation for the next mating season.

A drone (centre) surrounded by worker bees. Photo credit: Matt Vincent

Drones arise from unfertilized eggs with one set of chromosomes. In contrast, females (workers and queens) come from fertilized eggs with twice as many chromosomes. This reproduction system is called haplo-diploidy.

[4] A collection of hexagonal cells that are made of beeswax and used by the bees to store food and raise brood.

[5] The natural occurrence of a colony replacing an old or ailing queen with a new queen.

Drones are a similar size to the queen, but are characterized by a barrel-shaped abdomen with no stinger. During a drone's copulation with a queen bee, the drone's reproductive parts will burst from its body. This act takes with it parts of the drone's abdomen, leading to its death. Cells in the comb containing developing drone larvae are larger than the cells containing workers and appear rounded, protruding from the comb pattern in a bullet-like shape. Drones emerge from their cells after 24 days of development. The age of drones seldom reaches 4 months.

Communication

Pheromones

Pheromones are chemicals produced by animals as a communication system between members of the same species. Honey bees use pheromones to convey alarm, recruitment, swarming, maintenance, and brood recognition. A honey bee colony communicates with over 50 different pheromones. The three castes of bees produce various pheromones at various times to stimulate specific behaviours. In beekeeping, smoke is used to mask the alarm pheromones of a colony. This reduces stress and keeps bees calm as the beekeeper opens the hive.

Round dance

The round dance is a simple dance performed by honey bees to communicate the location of food sources. This dance does not communicate precise distance or direction, and therefore only performed to communicate food sources in the immediate vicinity of the hive. She performs the dance by walking in small circles on the comb being closely followed by attending bees. This can carry on for a few seconds to a minute. Foragers leave the hive to inspect the food source.

Waggle Dance

Honey bees use the waggle dance to communicate information about the distance, direction, and quality of resources at distances greater than about 100m from the hive. Foraging bees returning to the hive with news of nectar, pollen, and water repeatedly shake their abdomens in a characteristic figure-eight configuration. The direction of the dance indicates the direction of the food from the hive in relationship to the sun. The frequency of the abdomen waggle and the speed of the overall dance convey the distance of the food source. Long, slow dances indicate that the foraging source is far away; a short, fast dance shows a food source is close to the hive.

Introduction to Beekeeping

This section provides an overview of the most important aspects of beginning a beekeeping operation in the NWT. To improve their chances of success, new beekeepers should consult the resources in the back of this guide, as well as the information provided here.

Selecting Equipment

Selecting equipment is dependent on user preference. Used equipment should be avoided as it can transmit bee pathogens and create health problems for the colony. Although there are many different hive designs to choose from, Langstroth hives are the standard in North America. Top Bar Hives should not be used in the NWT because their horizontal hive design places even greater stress on the colony in the harsh NWT climate.

Hive frames can be made of plastic or wood. Wood frames with inserted plastic foundations are generally preferred because they are easier to handle. Plastic frames tend to bend or flex when handling. Wood frames are porous and need to be replaced after 5 years of continued use in order to reduce the risk of disease and pests. The discarded frames can serve as excellent kindling wood, and the plastic foundation can be cleaned and reused.

The following list covers the basic tools required for beekeeping and honey production.

1. All-in-one bee suit (washable).
2. Gloves (washable).
3. Smoker with wood shavings, pine needles, cotton, twigs, or other suitable fuel source that smokes (no animal products).
4. Hive tool.
5. Bee brush.
6. Uncapping tool.
7. Feeder (one per hive).
8. White granulated sugar and pollen patties for supplementary feeding.
9. Basic components of the modern Langstroth hive:
    - Outer cover, inner cover, shallow or standard honey super (only used during honey season), standard (deep) brood super (1 or more per hive), Langstroth frames (8 to 10 per super), bottom board, hive stand, entrance reducer (help control ventilation and temperature during the cooler months).
10. Bee hive winter wrap or other winter protection.
11. Optional: Foundation for combs (plastic or wax).
12. Optional: Queen excluder (separates brood from capped honey).
13. Optional: Honey extractor.

Purchasing Bees

Hives should be set up as soon as the weather starts to get warm. Given the short summer season in the NWT, it is especially important to start colonies early and give them the chance to grow/strengthen. This means beekeepers should place their order for bees several months ahead of the summer season, with a prescribed pick-up or delivery date of around June 1st.

Bees are available for purchase as packaged bees[6] or a nucleus[7], or "nuc". In the NWT, it is not advisable to purchase packaged bees. Packaged bees take too long to develop relative to the NWT's short summer season. Starting with a full-functioning nucleus gives the colony the advantage of having some brood, comb, and food reserves already established and ready for buildup at the start of the season. Beekeepers should purchase bees raised in the northern hemisphere, as they will be more adapted to the climatic conditions of the NWT.

It is important to buy bees from a reputable source in order to minimize the risk of disease that can spread from hive to hive as well as to other local invertebrates. There are several options for purchasing bees, including from beekeeping associations, websites, auctions, and local producers. There are supplier lists that are issued by provincial apiarists across the country, as well as honey bee regulating authorities. Always investigate the supplier prior to purchasing. Honey bees are defined as a regulated animal under the Canadian Health of Animals Regulations and imports from other countries must be approved by the Canadian Food Inspection Agency.

When speaking with the supplier keep in mind there is no absolute guarantee of a disease-free hive, but some questions to consider asking would be:

- Have their bees been inspected by the provincial authority for pests and diseases? If so, does the supplier have a copy of the inspection report available to share?
- Do they have mites? If so, what level? Suppliers should ensure that Varroa mite levels are extremely low or undetectable.
- Have they had any cases of disease in the past year? If so, what was it and how did they treat? See the "Honey Bee Diseases and Pests" section for more information on common diseases and treatments.
- Is there any history of American foulbrood disease that is resistant to the antibiotic oxytetracycline? This is a red flag.
- What breed of bees does the supplier have? If a special breed, what are they genetically bred for?

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[6] A package of bees shipped in a screened box containing a quantity of bees. The package includes 1 to 2 kg of worker bees, a few drones, and a queen. A package of bees does not come with frames. This is essentially starting from scratch.

[7] A small colony of bees consisting of 3 to 4 frames of brood covered with bees and 1 to 2 frames of honey with a queen.

Novice beekeepers will simply be interested in procuring a full-functioning nucleus of good, vigorous, productive bees that provide a nice honey crop. Beekeepers with more experience may use more detailed criteria when choosing bees.

There are four bee characteristics one might consider when assessing honey bees. One bee stock will likely not meet all of the criteria. It helps to research and select a stock according to the intended purpose (e.g. honey production, education, or pollination) and local environment. The four criteria are:

- Productivity
- Temperament
- Winter hardiness
- Disease resistance

Make sure to monitor the queen when she arrives to ensure she is not senescing[8]. Do this by keeping an eye on her brood pattern: she should be laying eggs in every cell (side by side). If she's laying eggs in a patchy pattern she may be aging, or not mated well, and will require replacement. When performing weekly or bi-weekly hive inspections make sure to pay attention to brood pattern.

Replacing a Queen

A hive can lose its queen for different reasons. If weekly or bi-weekly hive inspections reveal that the queen, or signs of queen activity, is not present, the hive will need to be re-queened. This can be done naturally or artificially.

New queen, boxed with several worker bees.
Photo credit: Matt Vincent

If left alone, a hive will naturally raise its own replacement queen. However, even if natural re-queening is successful, because of the short summer in the NWT, no honey crop can be expected and the colony population size will not be large enough to survive winter. NWT beekeepers should proactively purchase and introduce a newly mated queen instead of waiting for the re-queening process to occur naturally. Individual queen bees can usually be purchased and shipped from most honey bee suppliers. Try to purchase queens from the northern hemisphere as they are more likely to succeed in the NWT's harsh climate.

[8] Aging, meaning she has less reproductive ability.

Nutrition

Bees require diverse and abundant food sources that provide them with essential nutrients for survival. Healthy, properly fed colonies are better equipped to defend themselves from pests and diseases. A honey bee diet must consist of carbohydrates, vitamins, minerals, lipids, and protein for proper development. They acquire these nutrients from foraging for nectar and pollen. Water is essential to bee health as it helps bees maintain constant temperature and humidity within the hive and is used to liquefy crystallized honey.

Honey

Bees process nectar from flowers into honey so that they can store it as food. Nectar is primarily made up of sugar and water and is collected by the bee's proboscis. The proboscis is the long mouthpart that acts as a vacuum to reach deep into flowers. The nectar is transported back to the hive in the honey stomach of the bee, which acts as a temporary reservoir until it can be stored in comb cells. Once the bee has returned to the hive, its esophagus expands and contracts to regurgitate nectar from stomach to mouthparts where it is passed to another bee in the hive.

The bee that receives the nectar will regurgitate the nectar content repeatedly, allowing for water evaporation and condensing the nectar to honey. Through this process, the nectar is mixed with enzymes. Once the nectar is ready, the bee will regurgitate the contents into a cell where it will further evaporate until it reaches an approximate water content of 17% or less. The cell is then capped with wax to protect the honey from absorbing more water.

Nectar is the main source of carbohydrates for the bees. If honey stores are inadequate and there is no nectar available to forage, the honey bees will starve. Beekeepers use supplemental feeding, discussed later, to prevent starvation and ensure colony health.

Pollen

Pollen is the reproductive grain of the male parts of flowers. It is collected from flowering plants by the forager worker bees. Pollen is a powdery substance that can be seen on the hind legs of some bee species. When bees collect pollen while moving from flower to flower, they are aiding in flower pollination by helping the pollen reach the female reproductive parts of the female flowers. Bees use pollen as a food source. It is the main source of protein, lipids, vitamins, and trace elements important for bee development. If a colony does not have enough pollen stores, brood production will cease, causing a population decline.

Beeswax

Beeswax is the building block of the beehive structure. It forms the combs where immature bees develop, and it stores food and provides protection. Worker bees have four pairs of wax glands at the end of their abdomen. The glands produce tiny, thin sheets of wax that are moulded by bee mandibles into a putty and formed into the classic hexagonal comb structure. Neither the queen nor the drones develop wax glands. Beeswax is malleable in ambient temperatures, waterproof, and has a low melting point of 62° to 64° Celsius. Beeswax also has anti-pathogenic properties that help protect the colony from disease.

Supplemental Feed

Supplemental feeding can be used to maintain colony health and development when stored food is scarce or natural forage sources are low. Due to the short summer foraging season, beekeepers in the NWT will need to provide supplemental feed to their bees. Sugar syrup, fondant (candy board), granulated sugar, and pollen patties are the most common forms of supplemental feed. Pure white sugar in its various forms (syrup, fondant, granulated) provides carbohydrates for the bees in lieu of nectar. Pollen patties provide equivalent nutrients as naturally foraged pollen.

In the spring, when bees start to emerge from their winter cluster, natural forage sources will not be readily available and the bees' diet should be supplemented with sugar syrup and pollen patties. This addition of food will give the colony a boost and prompt the queen to start laying eggs again. Feed the bees as much sugar syrup as they will take. Replace pollen patties as they are used up. This spring feeding should begin as soon as the hives are opened up after the overwintering season. More information on when to open hives can be found in the "Overwintering" section.

Sugar syrup and pollen patties can be given again in the fall, to help the bees build up food stores for the winter. As long as the bees are consuming the supplemental feed, the beekeeper should continue to provide it. In the NWT, this means that supplemental feed will likely have to be provided from spring through fall continuously. Special attention should be given to supplemental feeding if colony food reserves are low due to swarming or if rainy weather has prevented bees from foraging.

Before closing up hives for the winter, select a feeder type that is contained within the hive (see list below) and fill it with granulated sugar. Fill with as much granulated sugar as the container will hold to avoid opening the hive again during the winter months. Place a pollen patty in the feeder as well. This extra reserve of food will be used by the bees in addition to any honey stores to help

them survive the winter. For more information on when to close up the hives, see the "Overwintering" section below.

For spring, a feeding ratio of 1:1 sugar to water is recommended. This ratio should be increased to 2:1 in the fall. Pure white refined sugar is the best type of sugar supplementation. Avoid using brown sugar or organic non-refined sugar as this can give the bees diarrhea. Heat the water and sugar mixture over the stove on medium-low to avoid boiling. Change the syrup once a week to discourage the growth of mold and pathogens. Feeding honey from other hives is discouraged as it may spread diseases.

There are multiple ways to provide supplemental feed to bee colonies. It is up to the beekeeper to select the method that best suits their operation. Here are a few options:

Inverted hive-top feeders: Easy and practical. Inverted hive-top feeders are a shallow box that sits on top of the uppermost deep brood super, but underneath the outer hive cover. It has a reservoir that can hold several gallons of sugar syrup (or granulated sugar) as well as pollen patties. The bees access the food through a screened bottom.

Re-sealable plastic bag: Cost effective. This method simply involves filling a gallon Ziplock bag with sugar syrup, using a knife to cut a few openings on top, and placing it on top of the hive.

Boardman feeders: For sugar syrup only. This feeder is an upside-down jar filled with sugar syrup that rests on a specialized base that allows bees access to the syrup. It is joined to the hive entrance.

Open feeding: This method involves leaving sugar syrup out in the open so the bees can access it as needed. There are numerous drawbacks to this method, including the possibility of feeding other insects (sugar is not cheap!), attracting pests, and inciting robbing[9].

Frame feeder: This feeder replaces a frame within the hive. It is a deep reservoir that can be filled with sugar syrup. Drawbacks include drowning bees and frequent replacement.

Swarming

Swarming is a natural process for bees. It is a reproductive strategy that allows for a new queen to take over the colony. The old queen will recruit about 50% of the colony population and will start a colony elsewhere while a new virgin queen takes over the old colony. The new virgin will mate and then lay eggs and lead the rest of the colony. Bees also take a large portion of honey by gorging themselves before swarming. Although this process may occur in nature, it is not a productive strategy for beekeeping. Produced swarms will fly away from the hive and may not be caught in time to rehouse in the apiary. It is considered

[9] When a bee colony is invaded by bees from another colony.

a loss of bees. Swarming colonies may produce less honey, as a production of brood will take longer into the season to develop and honey stores will have to be restocked. Swarming can also result in concern from some members of the public. It is best to take steps to prevent it from occurring if the hives are located in an urban environment or close to members of the public.

Image : Swarming bees
Photo credit: Matt Vincent

Signs of a swarm can be noticeable not long after an increase in colony population in the spring and early summer when the broods' nest is building up too fast. If the colony is preparing to swarm, or the swarm has already occurred then there may be developing or capped queen cells within the hive. If the bee population in a colony is congested and queen cells contain larvae, then a swarm should be anticipated.

Swarm Control

Queen cells are not always a sign that swarming is imminent; sometimes this is a sign that the colony is attempting to supersede a queen that may not be performing properly. A general rule of thumb is that if the bee population is overcrowded and there are six or more queen cells present, the hive is likely planning to swarm.

Supers should be added during peak season to provide more space for the workers and to allow the queen more space to lay eggs. Annual queen replacement with a younger queen is not required to prevent swarming, but it will provide less incentive for the hive to swarm. Don't use swarm queen cells to re-queen bee colonies. This process will build up more genetics for swarming in these re-queened colonies.

If the colony does leave the hive in a swarm, search the surrounding area to locate the bees. Collecting the swarmed bees is best left to experienced beekeepers. Ensure that the area is clear of human traffic before attempting to retrieve the swarmed hive.

Overwintering

The biggest challenge for northern beekeepers is the long, harsh winter season. Overwintering requires planning, preparing, and management on the part of the beekeeper. In nature, bees have two methods to maintain colony temperatures

over winter (thermoregulation): they find protected cavities and they cluster. When ambient temperatures decline for the winter, the workers will cluster in a ball around the queen. They vibrate their thoracic wing muscles and collectively generate enough heat through this “shivering” to maintain a core temperature of around 30°C. When the heat inside the winter cluster dips down to about 27°C, the cluster runs the risk of steadily dwindling in the spring and eventually dying.

Although the core temperature of the winter cluster is much warmer, colonies overwinter most efficiently at an ambient temperature of 5°C and with proper ventilation. Maintaining this temperature in the harsh NWT climate can be difficult, as several variables are involved. These include fluctuating outdoor temperatures, the efficiency of heat production through worker bee shivering, and the reliability of heating and insulation systems.

However, it is important to maintain an ambient temperature between 5°C and 10°C because it is where a bee’s metabolic rate is lowest. At temperatures above 10°C, the colony’s metabolic rate will increase, the winter cluster will begin to break, and the bees will consume all their food reserves and starve to death before the winter is over. At ambient temperatures lower than 5°C, bees on the outside of the winter cluster will die from the cold. Overwintering bees can be done by keeping hives indoors in an insulated shed or by properly insulating the hives outdoors. Ensuring that hives are insulated on all sides will allow the winter bee cluster to move from frame to frame within the hive and access the stored honey and/or supplemental feed. In addition to warmth, reducing moisture buildup in the hive is a critical concern for overwintering. Proper hive ventilation is necessary to remove moisture buildup and CO_2, which can kill the bees.

How to ventilate will depend on whether hives are being overwintered indoors or outdoors (see the following sections for further ventilation recommendations). A method for reducing moisture within the hive, regardless of overwintering location, is installing a moisture board. The moisture board sits on top of the inner cover and absorbs condensation.

Closing and Opening Hives

As soon as outside temperatures are below freezing for several consecutive days and the bees stop flying, close up the hive for the winter. Prior to closing the hive, ensure that the feeder is filled with granulated sugar and a pollen patty. Closing the hive means wrapping it in a winter wrap and securing the entrance (more information on winter wraps is given in the subsections below).

During the winter seasons the hive should not be reopened. Any disturbance or introduced cold from opening the hive in winter causes an unnecessary and

dangerous increase in metabolism for the bees. Bees will not be expected to break the cluster and leave the hive when temperatures are below-freezing outside the hive.

When springtime arrives, it is time to unwrap the hives so that the bees can begin foraging. As soon as daytime temperatures are on average above 10°C, and nighttime temperatures are no longer dropping below freezing, open the entrances to the hives. Observe the bees daily to see when they begin flying. When the bees begin to fly, unwrap the hives and begin supplemental feeding immediately. See the subsection "Supplemental Feed" above.

Overwintering Outdoors

Keep hives out of the wind in a sheltered area and wrap in black, wind-proof sleeves or felt. Hives can be wrapped individually or in groups of four. This layer of insulation helps to retain heat when temperatures are extremely low. Sleeves can be homemade from roofing felt or tar paper, or they can be purchased. R-30 to R-40 insulation is recommended to maintain ambient temperatures inside the hive around 5°C. However, the beekeeper will need to take into account factors specific to their hives' location and surroundings in order to determine the optimal level of insulation that is required.

Although bees will not leave the hive in below-freezing temperatures, hive entrances should not be completely covered by the wrap. This allows for ventilation. Two methods for providing ventilation are (1) tacking a piece of accordion-folded cardboard in front of the entrance to cut the incoming wind while still allowing air flow and (2) by fixing an elbow pipe to the opening of the hive.

Snow has great insulating potential. Allow snow to accumulate on and around hives. Simply make sure the entrances are not completely blocked. NWT beekeepers have had success with overwintering their bees outdoors.

Overwintering Indoors

Honey bee colonies can be housed indoors in an insulated shed. If the shed is adequately insulated, forced air heating is not necessary. To keep the air temperature around the winter cluster between 5°C to 10°C, use a winter wrap around the hives, as per the previous subsection. When overwintering indoors, the winter wrap does not need to be as warm as when overwintering outdoors. An insulation rating of around R-12 is recommended. Install a thermometer inside the shed and check at regular intervals to make sure the temperature stays around 5°C. It is also recommended that a device that reads relative humidity be installed inside the shed. Humidity levels should be kept between 50% and 60% by the shed's ventilation system. Ventilation is extremely

important when overwintering indoors. Air must be cycled through the building to remove CO_2 and moisture build-up. A common mistake made by northern beekeepers is overwintering hives indoors without ensuring adequate ventilation. Even if the ambient temperature is within the desired range of 5°C to 10°C, the moisture buildup will cause bee colony loss.

To ventilate the shed where the bees are overwintering, install intake and outtake vents. Passive airflow through these vents will remove moisture and CO_2 buildup. It is recommended the intake vent be installed on the side of the shed or building that faces the prevailing winds, and the outtake vent on the roof. If the shed or building is heated with forced air, make sure that the ventilation system can keep up with the airflow.

Overwintering Tips:

- Before the winter comes, make sure to examine hives and repair any damages.
- Keep overwintering hives off the ground by placing on an insulated palette.
- Colonies should go into the winter healthy and strong with adequate food stores. A colony may consume about 85-100 lbs of honey and/or sugar syrup over the winter months. This number can go even higher in our northern climate with its long winters.
- It's advised not to harvest honey from a colony during its first year. This helps to ensure that the bees have plenty of food for themselves over the winter. If honey will be harvested from a colony, ensure that the bees have plenty of food in the form of granulated sugar or fondant to use during the winter months.
- Examine colonies for Varroa, Nosema, and other pests prior to putting hives away for the winter. Treat if needed prior to overwintering the bee colonies.
- Have a ventilation system installed to prevent CO_2 and moisture build up.

Disease Management

Many different diseases, viruses, bacteria, and fungal infections can affect honey bees and could spillover and potentially harm native bees. It is up to the beekeeper to maintain a strong colony that will produce honey. Protecting honey bee colonies from disease and pests is a critical component of best management practices.

It is essential to be familiar with the development and appearance of a normal hive as well as healthy bee behaviour. Knowing what is normal for the colonies may help with early detection of disease that could save the colonies. A healthy colony should have a consistent brood pattern, tan- to brown-coloured capped brood cells, and an adequate amount of food (honey) stores in white-capped cells. Colour of capped brood cells will vary depending on the environment and what the bees are foraging on. Capped brood cells should have flat caps for workers and domed caps for drones. Healthy unsealed larvae appear white and shaped like a crescent moon centered within the comb. It is important for disease to be managed properly within the hive to reduce chances of disease transmission to other colonies or native species. If beekeepers encounter problems, they should take a sample for laboratory diagnosis right away.

It is advisable to have an integrated pest management (IPM) plan in place before beginning a beekeeping operation. Integrated pest management is a multi-dimensional approach to managing pests and diseases rather than simply attempting to eradicate them.

IPM involves (1) actively monitoring bee colonies and becoming familiar with what "normal" looks like, (2) early diagnosis of diseases and pests, (3) active monitoring of the diagnosed disease, and (4) once the disease markers reach a certain threshold level, taking action. What action(s) a beekeeper chooses to take will be based on what tools and resources are available. An IPM will help the beekeeper to choose the right combination of actions to give the desired results in a short amount of time.

The Canadian Honey Council (CHC) and the Canadian Association of Professional Apiculturists (CAPA) have advised IPM procedures for beekeepers that are referenced at the back of this manual. The Canadian Food Inspection Agency (CFIA) has also developed the *National Farm-Level Bee Biosecurity Standard* in collaboration with producers, industry associations, academia, and provincial governments. The CFIA has also developed a bee biosecurity standard for honey bees specifically, the *Honey Bee Producer Guide to the National Bee Farm-Level Biosecurity Standard*. Review these documents and create your own IPM system prior to importing bees. In addition, there is a new "Bee Health" app that has been developed by the Government of Alberta that is an easy tool to help identify bee pests and diseases and report to, or consult with, a specialist for confirmation and advice. These resources are not a replacement for laboratory diagnostics, but may provide useful information.

Disease and Pest Management Tips:

- Source bees from a reputable source and only purchase bees that have been inspected for pests and disease.
- Clean and sanitize hive tool(s) regularly.
- Wash coveralls regularly.
- Used equipment is not recommended due to the chance of contamination.
- If signs of disease or pests are present, do not share combs/frames between hives and be sure to always clean and sanitize the hive tool before inspecting other bee colonies.
- Keep weekly hive records to monitor bee health inside the hive.
- Use the same method of monitoring throughout the entire season.
- Carefully read the label prior to use of any chemicals. Treatments should not be applied to colonies for longer time periods than recommended on label or by a veterinarian.
- Keep a toothpick, Q-tip, or small stick handy to check brood and take a sample of any suspected diseased ones.
- Reliance on any single chemical for disease or pest control is likely to result in pathogen resistance.
- When using treatments, ensure that they are registered for use in bee colonies and are food safe.
- Early diagnosis will prevent the spread of diseases and pests.

Laboratory Diagnostics

At the first signs of disease in a bee colony, send a sample to a laboratory for testing. There are currently no laboratories in the NWT to send bee specimens to. One of the following laboratories in British Columbia or Alberta should be used instead for diagnostic support.

Contact the laboratory prior to sending specimens. It is important when sending samples that the necessary identifying information is present, including your name, address, contact information (phone and email), date collected, and hive sampled. Please consult the web pages below for further information on how to package and ship samples.

British Columbia: Ministry of Agriculture

https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-production/bees

Provincial Apiculturist
Animal & Plant Health Centre
BC Ministry of Agriculture
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3
Please mark the envelope/container:
"DEAD BEE SAMPLE"

Phone: 604-556-3003
Toll free: 1-800-661-9903
Fax: 604-556-3010
E-mail: PAHB@gov.bc.ca

Alberta: Grande Prairie Regional College (GPRC), National Bee Diagnostic Centre (NBDC)

https://www.gprc.ab.ca/research/nbdc/submitsamples.html

Canada Post Shipments:
National Bee Diagnostic Centre
P.O. Box 1118
Beaverlodge, AB T0H 0C0

Other Couriers:
National Bee Diagnostic Centre
100038 TWP RD 720
Beaverlodge, AB T0H 0C0

Mark your envelope/container with:
"DEAD BEE SAMPLE"

Honey Bee Diseases and Pests

The most significant pests and diseases of the honey bee in Canada are Varroa mite, American foulbrood, Nosema disease, and chalkbrood. They all have the ability to cause colony loss and can be very costly. It is important to be up to date on proper treatment protocols for these diseases. Contact a veterinarian before the use of any antibiotics, as new regulations under the federal *Health of Animals Act* require that antibiotics only be prescribed by a veterinarian (http://www.inspection.gc.ca). Do not use antibiotics preventatively (prophylactically) as this can lead to antibiotic resistance among bee species. There are a number of viruses that could cause disease in honeybees and native bees that are not covered in this document, but more information can be found in the resources referenced in the document and from the laboratories mentioned above.

*American Foulbrood (*Paenibacillus larvae*)*

American foulbrood (AFB) is a highly contagious bacterial infection that affects bee larvae. It is considered one of the most detrimental honey bee diseases in the world and is geographically widespread. Spores of this bacterium are resistant to heat, desiccation, and most disinfectants, and remain viable in beekeeping equipment for many years.

What to Look For:

Make sure to use good lighting (natural sunlight is preferable) when examining the frame. Hold the frame at an angle at about 30° from your line of sight so that all sides of cells can be seen. Look for the following signs of AFB:

- Greasy cappings.
- Dark brown, sunken cappings with chewed irregular holes.
- Irregular, spotty brood pattern.
- Coffee-coloured and ropey consistency of larvae within the comb.
- Dead larvae.
- Dried brown scales that tightly adhere to the cells.
- Occasionally pupal tongue of infected pupae remains upright.
- Strong fish-like odour.

Field Testing

The “ropiness test” is used to identify AFB within the combs. Use a toothpick or matchstick to dip into a suspected cell and stir the diseased tissues. If AFB is present, when the stick is withdrawn slowly from the cell, there will be a rope-like slime “string out” of about 2 cm that is attached to the stick.

Laboratory Diagnosis

AFB is easily diagnosed using laboratory techniques. Remove suspect brood with a toothpick, Q-tip, or small stick and place in a sealed jar for lab testing. Alternatively, sections of suspected combs can be wrapped in wax paper, packaged in appropriate packaging, and sent to the lab. It is highly recommended that suspect combs be sent out for laboratory diagnostic testing.

Prevention

Prevention of AFB can be controlled by proper apiary hygiene, early detection, and immediate action. Minimize disease spread by not interchanging contaminated equipment between hives. Remove and destroy any comb that shows signs of AFB. AFB disease can be effectively prevented and eradicated with regular and vigilant inspection, removal of infected combs, and appropriate actions as soon as diagnosed.

Treatment

As AFB spores can persist in the environment for many years and are highly resistant, the best practice is to burn combs, frames, tools, and equipment diagnosed with AFB. Sterilize any equipment that cannot be burned with a dilute bleach solution or paraffin wax.

*Varroa Mites (*Varroa destructor*)*

Varroa mites are a parasitic mite that have adapted to the life cycle of the honey bee. Varroa mites are common and virulent pests that the majority of beekeepers will likely experience at some point in their career.

Mites feed on the hemolymph (bee blood) and body fat of pupae, and damage developing bees. They feed on the bee hemolymph and fat body by piercing the body wall. While feeding, they transmit many viruses, which can cause a variety of diseases and deformities. They can be found in worker brood, but more readily on drone brood that take approximately 2 to 3 days longer to mature than workers, giving the mites more time to develop. Mites can move from colony to colony on drifting bees or bees robbing infested colonies. A high mite load can be a reflection of poor Varroa management practices on the part of the beekeeper.

What to Look For:

- Mites are approximately 1-1.8 mm long and 1.5-2 mm wide.
- Mites are visible to the naked eye and have a reddish-brown oval shaped body.
- Spotty brood pattern with killed/chewed brood in the cells, known as parasitic mite syndrome (PMS).
- Bees with deformed wings.
- High levels of other brood diseases may be present as mites suppress colony health.
- High mortality rates with high levels of infection.

Field Testing

Test for Varroa mites regularly (every 4 to 6 weeks) from spring to fall. If testing is started too late in the season, mite levels may already be high and the beekeeper will likely lose the colony within the next year. Begin testing for Varroa mites as soon as the hives are open and bees are flying in the spring. There are several methods for field testing:

1. Sticky board with screened bottom board: A screened bottom board allows for naturally dropped mites from bees to go through the screen and adhere to sticky board placed in the tray. The beekeeper can visualize and count the number of mites on the sticky board. The number of fallen mites is correlated to the number of mites infesting the colony. Leave the sticky board in place for only 3 days to collect the fallen mites. Then count all mites and divide by 3 to provide the daily mite mortality and determine if treatment is needed or not. The screen can be left in place to monitor mite populations from spring to fall. In winter, the screen can be removed. The sticky board is commercially available or can be homemade using heavy paper and Vaseline.

2. Alcohol wash of a sample of bees:
    a. Collect bees from the brood combs, making sure to avoid the queen.
    b. Place ½ cup (~300 bees) of live bees in a glass or Varroa hand shaker (VHS) with windshield washing fluid (winter rating -40°C) or alcohol.
    c. If using a glass jar, shake/swirl the sample for 10 to 20 minutes. Then pour the bees and alcohol through a small mesh wire screen on to a white cloth or into a white tub.
    d. If using the Varroa hand shaker, shake/swirl for 30 seconds to 2 minutes then upend the bottle so that the mites fall through the screen to the lower bottle.
    e. Count the Varroa mites and calculate the percentage of infestation by dividing the number of mites by the number of bees and multiplying by 100.

3. Uncap drone brood: Uncap 100 drone cells using forceps and remove the pupae/larvae. Examine each empty cell and drone pupae/larvae and count the number of cells infested with Varroa mites. The number of cells with Varroa is an indicator of the percentage of infestation.

4. Powdered sugar shake method: This method is not recommended as it does not dislodge all mites and is not as accurate as the alcohol wash.

Laboratory Diagnosis

Laboratory diagnosis is not necessary for Varroa mites, unless you are uncertain as to the species of mite within your colony. The field testing techniques described above are sufficient for diagnosis and determining infestation levels to trigger treatments.

Prevention

The implementation of good management practices can reduce the incidence and effect of Varroa mites on the colony. This means purchasing the bees from a reputable source and performing sampling of bees or fallen mites during colony inspections. It is highly recommended to monitor mite infestation at least 2 to 3 times in spring as well as 2 to 3 times in the fall (or once every 4 to 6 weeks).

Monitoring of mites is important so that the beekeeper can understand the dynamics of the bee population versus the mite population. During the spring season when the conditions are right and the bees have access to pollen, the growth rate of the bee population is exponential.

The mites will take advantage of bee population growth and increase population numbers as well. It is important that beekeepers follow the trends of these two dynamic populations, so that normal variations can be distinguished from unhealthy ones.

Treatment

With repeated use of synthetic chemical treatments, such as acaricides, mites can build resistance to the treatments. It is important to determine if treatment is needed prior to implementing. Treat colonies when the Varroa mite infestation is > 2% of bees in the spring and >3% of bees in the fall. There are several chemical control options, but only a few that are registered in Canada. There are two treatment methods:

1. Varroacides: Chemical treatments to kill or remove Varroa mites should be applied at certain times of the year. Follow the label instructions to achieve the desirable results and reduce any risks of contaminating honey with any residues. In most Canadian provinces, beekeepers use Apivar strips in the spring to reduce mite infestations and associated risks of viruses transmitted by mites that could impact bee health and survivorship. For a list of available registered miticides for use in Canada, please review the “Tools for Varroa Management” guide published by the Honey Bee Health Coalition. More information on this guide can be found in the “Resources for Beekeepers” at the end of this manual.

2. Interrupting reproduction: A comb that consists of drone cells can be inserted into colonies to trap mites. This creates gaps in the brood rearing cycle that can slow the growth of populations. Although this is an effective Varroa mite control method, it is not necessarily useful to NWT beekeepers due to the extremely short summer season.

It is important to continue monitoring mite levels after the application of a treatment to ensure that the treatment was effective.

*Nosema (*Nosema apis, Nosema ceranae*)*

Nosema disease is caused by a microsporidian parasite that can affect the cells lining the adult honey bee's gastrointestinal system, limiting their ability to digest their food. This disease can become serious if bees are confined for longer times, such as during overwintering. Infections can spread rapidly from bee to bee, especially during cold periods when cleansing flight opportunities are reduced. Overall, Nosema disease shortens bee life and weakens bees, making the bee colony more vulnerable to other diseases.

What to Look For:

- Fecal deposits inside the hive and the entrance of the hive (fecal matter for a healthy colony will not be visible inside the hive or at the hive entrance).
- Disjointed wings, known as K-wings.
- Distended abdomens.
- Inability to fly.
- Reduced egg laying of queens.
- Queen supersedure (replacement of old or diseased queen by the colony).
- Poor spring colony build up.
- Low honey production.

Laboratory Diagnosis

Observe for above clinical signs. Diagnosis of Nosema disease can only be made through laboratory testing. Collect 50 forager bees per colony from the hive entrance or from honey combs inside the hive. Collection should occur in March or April when Nosema spores are at their highest. Place them in alcohol and send to a laboratory for analysis. Fall samples can be taken to determine levels of infection prior to overwintering.

Prevention

Good husbandry is essential in order to prevent Nosema disease. Best practices include ensuring that hives and equipment are clean and that approximately 20% of brood combs are replaced annually. Make sure that the colony is strong and has proper food stores for the winter to help with winter survival. Overwintered hives should be well-insulated and south-facing to promote cleansing flights when weather permits.

Treatment

If familiar with the symptoms of Nosema disease, treat right away. If not, send to a laboratory for testing as soon as the above symptoms are observed. Fumagillin is an antifungal used to treat Nosema disease. Follow the label instructions and do not treat with antibiotics when honey supers are on a colony. Antibiotic residues in food are a serious concern to human health.

*Tracheal Mite (*Acarapis woodi*)*

In most cases, tracheal mites are not observable with the naked eye. This disease has become less of an issue during the last 30 years because of the widespread use of formic acid, which is used to control Varroa mites and can also control tracheal mites. The tracheal mite invades the trachea of honey bees and lays eggs that hatch and feed on hemolymph (bee blood). Eventually, the trachea breaks down and becomes lodged with a buildup of mites that can impair breathing for the bee. Tracheal mites are associated with the death of honey bee colonies in winter.

What to Look For:

- Tracheal mites are very small (approximately the size of a pollen grain) and are not visible to the naked eye.
- The only true determinant of a tracheal mite infestation is dissecting the bees and examining the trachea for brown spotting and tracheal mites at various stages of development, which can only be observed under the microscope.

Laboratory Diagnosis

Mite detection at a laboratory will provide the best diagnosis. Contact the laboratory for information on proper collection and preservation.

Prevention

Infestation during the year can be sporadic. Some factors that may lead to mite build-up are brood rearing, weather, queen status, and genetics. Good husbandry helps maintain colony health and reduces stress. Make sure that colony food stores are sufficient year-round to alleviate stress and maintain health. Trying to re-queen your hive with a genetically resistant bee may provide the colony with protection. Provide good insulation for overwintered bee colonies to improve infested bees' winter ability.

Treatment

If infestation is 10% or less and colonies are strong, then treatment may not be necessary. There are multiple treatments available from your veterinarian and all label directions should be followed diligently. Formic acid is a registered product for use by Canadian beekeepers and is very effective in mite control. It is a food-safe treatment in spring or fall.

*European Foulbrood (*Melissococcus plutonius*)*

European foulbrood (EFB) is a bacterial infection that mainly affects bee larvae less than three days old by invading the midgut and competing with the host for food passing through the gut. The bacterial infection is initiated when food is contaminated with bacteria on the cell walls. EFB may be noticed during the onset of a major nectar and pollen flow. If food sources are steady and the weather is ideal, EFB symptoms will often disappear. Disease can persist and worsen in non-ideal environments, such as when food sources are scarce, pollen is of poor quality, or the bee colony population is weak. Signs and symptoms may resemble AFB, but EFB is known to be less destructive to colony health and is linked strongly to nutrition and growth rate

What to Look For:

- Larvae that turn yellow or brown and appear slimy and misshapen.
- Larvae found twisted within comb in a “C” shape, not centrally placed.
- Dead, dried up larvae that become brown scales.
- Infected larvae rarely capped.
- Cappings with a watery texture (as opposed a ropey texture that is seen in AFB).
- When the ropiness test is performed there will be a rope-like slime “string out” of less than 1 cm, in comparison to the AFB “string out”, which stretches more than 2 cm.
- Scales that do not stick to the cell (scales are hard and dark with AFB).
- Sour odours in advanced stages of infection.

Laboratory Diagnosis

Collect live suspected infected larvae and scales to send to a laboratory for diagnosis.

Prevention

European foulbrood can be prevented by following best management practices. Use new equipment or non-infected used equipment; inspect and monitor bee colonies; and manage colonies by making sure that the bee colony population is strong and there is adequate feed available to bees.

Treatment

Replace infected combs with foundation and burn the infected combs. Generally, beekeepers should replace each comb in a healthy brood nest with new foundation every 3 to 4 years.

Do not use prophylactic (preventative) antibiotics, in accordance with the guidelines for responsible use of antibiotics. Speak with your veterinarian to get proper recommendations and prescriptions for antibiotics if needed.

*Chalkbrood (*Ascophaera apis*)*

Chalkbrood is a fungal disease that infects honey bee larvae and sometimes pupae. It is considered a minor disease in healthy colonies. Colder temperatures with high moisture can lead to proliferation of the disease and ultimately lead to colony failure and economic losses. It can be more common in northern climates due to high moisture in early spring but can affect any caste in any stage of life.

What to Look For:

- Black, grey, or white mummied bee larvae can be seen on the bottom board or in front of the hives.
- Perforated comb cappings.
- Pinholes on caps.
- Dead larvae and chalkbrood mummies found throughout the brood area.

Prevention

As chalkbrood infections are believed to be related to stress within the hive, it is best to follow best management practices and reduce stress levels. Keep strong bee colonies and replace queens with hygienic stock. Avoid excessive hive moisture by ensuring adequate ventilation and control other diseases if present.

Treatment

There is no proven effective treatment for chalkbrood. Prevention through the use of best management practices is typically recommended. Minimize the movement of materials between hives, especially comb. There are no registered chemical products for use against chalkbrood disease in Canada.

Challenges from other species

There are many insect and mammal species that can cause damage to honey bee colonies. It is important to know what local wildlife may be interested in the colonies in your region and protect your bees accordingly. If bee colonies are located around potential bear country, it is wise to invest in protective bear fences that will keep you and your bees safe from a bear encounter. Consider discussing bear safety recommendations with your regional ENR office.

Food Safety Regulations

Honey products are considered a food product in Canada. Information can be found through the Department of Health and Social Services for food safety regulations and guidelines.

In the NWT, food safety laws are set in place by the *Public Health Act* and enforced by the Department of Health and Social Services. The Food Establishment Safety Regulation (section 37) requires food businesses to employ staff that have obtained food handler certifications. Contact Health and Social Services regarding food safe practices and regulations, permits, and packaging requirements in the NWT.

Northwest Territories Health and Social Services – Environmental Health
Phone: 867-767-9066 ext. 49262
Fax: 867-669-7517
Email: environmental_health@gov.nt.ca

Honey Harvesting

Honey harvesting is an important part of beekeeping practice. It is a simple, satisfying process that is well worth the wait. With hard work from both the beekeeper and the bees, an assortment of products, such as beeswax candles, body butters, soaps, salves, ointments and, of course, honey, can be made. Honey should be harvested in a way that prevents contamination and reduces the spread of pests and diseases. When moving the frames, protect them from dust, dirt, small sticks, or any contamination that may occur during transport. Facilities and equipment should have cleaning

A frame of capped honey.
Photo credit: Matt Vincent

protocols in place to avoid contamination risks and to maintain consistency. When extracting honey from the comb, sterilize any work surfaces and equipment, and make sure that people nearby have proper protective equipment, such as an apron and hair net. Prior to harvesting honey, review the CFIA-approved *Canadian Bee Industry Safety Quality Traceability Producer Manual - Good Production Practices* that was published by the Canadian Honey Council.

Queen Excluder

A queen excluder confines the queen to the brood box of the hive. This will leave frames free for workers to build up honey stores in the other boxes. This minimizes disturbance of the brood nests and simplifies the honey extraction process.

Honey Supers

Consider providing a colony with additional supers during honey collection to help ensure that worker bees can continue building comb and storing honey while also ensuring that the queen does not run out of space in the brood boxes to lay eggs. This is an easy method to manage honey stores that helps the bees build reserves up to survive the winter, while providing a surplus of honey harvest for the beekeeper.

Honey Extracting Tips:

- Beekeepers should not extract honey from brood chambers.
- Store honey in a sealed jar. Honey has its own antibacterial and antifungal properties and will therefore store well at room temperature.
- Methods used for honey removal and processing must prevent contamination.
- Stainless steel equipment is ideal for easy disinfection and disease reduction.
- Colonies should have adequate food stores for winter before honey is extracted for consumption. At least 90 pounds of honey stores are needed to get a hive through winter. Experienced or commercial beekeepers often choose to weigh their hives to ensure the colony is able to access enough energetic resources. For novice beekeepers in the NWT, this is largely unnecessary. Instead, a good rule of thumb is to harvest no more than 10-20% of the honey in any given hive.
- Consider the health and status of the colony before removing honey stores.
- Prior to extracting honey, uncap sealed honey cells with an uncapping tool to make extraction easier.
- Make sure that extracted honey moisture is less than 17.8% by using a refractometer (excess moisture will cause harvested honey to spoil).

Records

Records are an important part of a beekeeping operation. Beekeeping operations of any scale benefit from record keeping as it helps to promote efficient, profitable operations and protocols. For more information on what details to record and how to record them, consult the *Honey Bee Producer Guide to the National Bee Farm-level Biosecurity Standard*, published by the CFIA. To access pre-made checklists, ready to print and fill out, see the *Canadian Beekeepers' Practical Handbook to Bee Biosecurity and Food Safety*, published by the Canadian Honey Council. For more information on these documents, including web addresses, see the "Resources for Beekeepers" section of this manual.

Seasonal Inspections

Beekeepers should be continually aware of colony health, food stores, and queen status. It is helpful to keep an inspection checklist to compare hive activity and health status weekly or every two weeks.

- **Early spring:** Inspections every 7 to 10 days are recommended. Ensure that the bees have enough food to continue building up the brood nest. Check that the brood nest is building up well after winter. Take note to see if the queen is laying enough eggs and if workers are bringing home food stores. Monitor for Varroa mites and nosema disease especially in early spring and late summer.
- **Spring to summer:** Inspection every one or two weeks is recommended in the spring and summer. Does the queen have enough space to lay eggs? Does another super need to be added? Is the colony preparing for a swarm? Are honey stores enough to get the colony through the winter?
- **Late summer to fall:** Start to prepare for winter. Feed the colony sugar syrup and monitor for the presence of disease prior to overwintering. Monitor for Varroa mites and nosema disease, especially in early spring and late summer.
- **Late fall to winter:** A small number of bee casualties may be observed around the hive in the late fall and early winter. Bees 'clean house' in the late fall/early winter and will 'kick out' most males and older bees. Bees may also go on cleansing flights, get disoriented due to cold temperatures, and drop dead. Find a sheltered location for the hives and wrap them for the winter.

Resources for Beekeepers

General Interest

1. Chadwick, F., *et al*. 2016. The Bee Book.
2. Gruzska, J. 1998. Beekeeping in Western Canada.
3. Canadian Association of Professional Apiculturists. "www.capabees.com."
4. Government of the Northwest Territories, Environment and Natural Resources. "Bees." www.enr.gov.nt.ca/en/services/insects-and-spiders/bees.
5. Government of British Columbia, Ministry of Agriculture. "Bees (Apiculture)." www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-production/bees.
6. Government of Alberta, Alberta Agriculture. "Bees and Apiculture." https://www.alberta.ca/bees-and-apiculture.aspx.

Best Management Practices & Integrated Pest Management

7. Canadian Food Inspection Agency. "Honey Bee Producer Guide to the National Bee Farm-level Biosecurity Standard." https://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/honey-bee-producer-guide/eng/1378390483360/1378390541968.
8. Canadian Honey Council. "Canadian Best Management Practices for Honey Bee Health." http://www.honeycouncil.ca/images2/pdfs/BMP_manual_-_Les_Eccles_Pub_22920_-_FINAL_-_low-res_web_-_English.pdf.
9. Honey Bee Health Coalition. "Tools for Varroa Management - A Guide To Effective Varroa Sampling & Control." https://honeybeehealthcoalition.org/wp-content/uploads/2018/06/HBHC-Guide_Varroa_Interactive_7thEdition_June2018.pdf.
10. Canadian Association of Professional Apiculturists. 2013. Honey Bee Diseases and Pests Third Edition. 3rd ed.

Pesticides

11. Government of the Northwest Territories, Department of Justice. NWT *Pesticide Act* and regulations. "Apply for Pesticide Permits." https://www.enr.gov.nt.ca/en/services/apply-pesticide-permits.
12. Health Canada. "Update on Neonicotinoid Pesticides and Bee Health." www.canada.ca/en/health-canada/services/consumer-product-

safety/reports-publications/pesticides-pest-management/fact-sheets-other-resources/neonicotinoid-pesticides-bee-health.html.

Honey Production and Food Safety

13. Canadian Honey Council. “Canadian Bee Industry Safety Quality Traceability Producer Manual – Good Production Practices.” http://honeycouncil.ca/wp-content/uploads/2016/04/CBISQT-PRODUCER-MANUAL-ver-1.0-16-July-2014-FINAL-distribution-copy-CFIA-approved.pdf.
14. Government of Canada, Canadian Food Inspection Agency, and Food Safety and Consumer Protection Directorate. “Preventive Controls for Food Businesses.” www.inspection.gc.ca/food/general-food-requirements-and-guidance/preventive-controls-food-businesses/eng/1526472289805/1526472290070.
15. Health Canada. “General Food Safety Tips.” www.canada.ca/en/health-canada/services/general-food-safety-tips.html.

Records

16. Canadian Honey Council. “Canadian Beekeepers’ Practical Handbook to Bee Biosecurity and Food Safety.” http://honeycouncil.ca/archive/handbook.php.

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