

Honey bee pests and diseases



Best management practices

Bee Health Assurance Program
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Disclaimer

1. Best management practices are provided only as a guide for educational purposes. It is the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used.
2. The information given in this guide is supplied with the understanding that no discrimination is intended and no endorsement or exclusion of any registered products by the Bee Health Assurance Program, Alberta Agriculture and Forestry are implied.
3. The chemical recommendations are consistent with current federal and provincial pesticide regulations and labeling as of the date of publication. Use of common, trade or brand names in this publication is for clarity and information; it does not imply, nor does it guarantee or warrant the standard of the product or effectiveness of the product. Revisions in labels can occur at any time.
4. Due to the potential for changes to labels or registration status, some of the information given in this guide may no longer be legal by the time they are read. If any information in this guide disagrees with the label, the label instructions must be followed.
5. To protect people and the environment, pesticides should be used safely. Always read and follow label directions carefully before buying, mixing, applying, storing or disposal of a pesticide. Use the label recommended personal protective equipment when mixing and applying treatments.
6. The Pest Management Regulatory Agency (PMRA) is the federal agency that is responsible for the regulation of pest control products in Canada. As the federal authority under the *Pest Control Products Act* (PCPA), PMRA enforces compliance with the PCPA.
7. Read product labels before applying disease or mite control products. Always follow treatment withdrawal times. Do not use treatments when honey supers are on, unless specified on the product label. Some products may leave residues in honey.
8. The presence of multiple parasites/diseases may require treatment at levels below the recommended treatment threshold(s).
9. Treat all colonies that require treatment in the yard at the same time.
10. Monitor colonies to determine the severity of varroa infestation.
11. Always use temperature-dependent treatments like formic acid and thymol within recommended temperature thresholds.

Always Follow the Label

Product labels take precedence over information in this guide

American Foulbrood – AFB (*Paenibacillus larvae*)

AFB is a bacterial disease that kills developing brood. It is the most harmful of the honey bee brood diseases, and infected colonies, without treatment, will die. AFB is highly contagious and can easily spread to other colonies and apiaries in the area. AFB bacteria form spores that can survive on equipment for decades, and withstand boiling water and many chemical disinfectants.



Dead larvae with AFB will show ropiness over 1.5cm

Infected colonies must be dealt with **immediately** to prevent further spread of AFB.

Symptoms

Poor brood pattern with noticeably sunken and perforated capped cells. Dead larvae will be brown and ropy when pulled out with a twig or blade of grass. Hardened larvae will be present as a dark brown scale stuck to the side of the cell. A foul odour may be associated with affected brood. Please refer to the [Bee Health Assurance American Foulbrood Fact Sheet](#) for more information.

Monitoring

Examine a minimum of three brood frames every time you open your colony and have access to the brood chambers. To see all brood cells clearly, it is helpful to shake the bees off the frames and into the hive before inspecting the comb.

Prevention

- Re-queen colonies with queens from hygienic stocks
- Maintain healthy colonies
- Prevent robbing and remove unused equipment from the apiary
- Clean hive tools and gloves between apiaries
 - Hive tools can be cleaned by removing all wax and scorching with a torch.
- Irradiate any pollen fed to colonies, only feed honey sourced from healthy colonies
- Carefully inspect any comb before moving it among other colonies
- Any colonies or used equipment purchased should be inspected, isolated, and irradiated if possible.
- Replace 10 per cent of combs in the brood chamber every year with new drawn comb from honey supers or new foundation.

**Please report
suspected AFB
infections to the
provincial
apiculturist at
780-415-2309**

Cultural Management Options

1. Colonies with light AFB infection

Inspection of brood combs show that very few (1-2) capped cells are perforated, sunken or discolored in one or two frames. Very few brood cells (<5) contain decaying pupae from AFB infection.

Shaking method: Can only be done when there is enough time for a colony to build up prior to winter

- If you are not experienced with this practice, contact the [provincial apiculturist](#) for more information
- Shake all bees onto new or disinfected equipment with frames of foundation.
- Burn all infected combs and decontaminate empty hive boxes, bottom boards and inner covers using one of the following options:
 - [Irradiation](#)
 - Scorch insides with a torch
 - Disinfect with bleach (one part bleach to nine parts water) or Virkon®, following the label instructions. Rinse with water. Please note this will not eliminate all AFB spores but will reduce them to a level where clinical symptoms should not develop.

2. Colonies with medium to heavy AFB infection

Inspection of brood combs show capped brood cells that are perforated, sunken or discolored. Brood combs have cells that contain AFB scales and or decaying pupae.

- Burn all bees, frames, and bottom boards of heavily infected hives. Non-symptomatic comb can be disinfected by irradiation. **Honey should not be extracted** from these heavily infected bee hives. For more information on how to euthanize a colony contact your provincial apiculturist.
- Decontaminate empty hive boxes, inner covers and lids according to methods above.

Please contact the provincial apiculturist to have a sample tested for resistance to the antibiotic Oxytetracycline.

Chemical Management Options

In order to treat honey bee colonies with antibiotics, you must contact your local veterinarian. You will require a Veterinarian – Client – Patient – Relationship (VCPR) to ensure they can accommodate your request. A qualified veterinarian will establish a treatment plan for your operation that will maximize both bee health and human safety using products that are registered for apicultural use in Canada. It is illegal to purchase antibiotics from internet suppliers without a prescription. Never administer antibiotics while honey supers are on hives and follow the withdrawal period carefully to prevent contamination of honey.

Currently the only way to chemically manage AFB is with antibiotics. Antibiotics do not eliminate AFB, they only mask the symptoms.

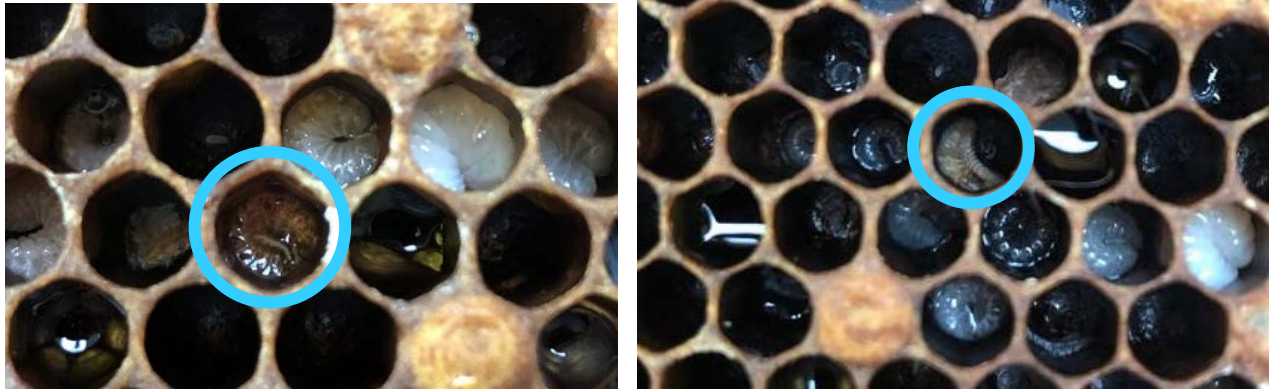
Oxytetracycline hydrochloride (Foul Brood Mix®, Oxytet-25®, Oxysol-62.5®, Terramycin) is the first choice of antibiotic prescribed for AFB infections. However, AFB resistant to oxytetracycline is present throughout Alberta. As a result, beekeepers with evidence of colonies with rAFB can apply Tylosin (Tylan®) or Lincomycin (Lincomix). Treatment with antibiotics in spring is associated with a higher risk of antibiotic residues in honey and should be avoided when possible. Please note that mixing antibiotics into Crisco and sugar is NOT recommended, as there is a risk of leaving residues. The treatment is also not as effective in this mixture and it increases the likelihood of developing resistance.



AFB scale

European Foulbrood – EFB (*Melissococcus plutonius*)

EFB is a bacterial brood disease typically associated with stress. EFB is most prevalent in spring and early summer due to poor nutrition in the colony. If the infection is minor, visible disease symptoms will disappear and colonies will become stronger as more food sources become available.



Larvae infected with EFB will start to turn yellowish-brown

Symptoms

Spotty brood pattern with yellowish-brown larvae. Tracheae and midgut of larvae will be visible. Larvae are rubbery when poked with a twig or blade of grass. Dead brood does not “rope” out. May see dead brood twisted in cell. Scale is rubbery and easy to remove from the cell. Some larvae die after capping, but most die before the brood cell is capped. Please refer to the [Bee Health Assurance European Foulbrood Fact Sheet](#) for more information.

Monitoring

Examine a minimum of three brood frames every time you open your colony and have access to the brood chambers. To see all brood cells clearly, it is helpful to shake the bees off the frames and into the hive before inspecting the comb.

Management options

Generally, symptoms of EFB will disappear as nutritional requirements such as pollen and nectar become more abundant. If symptoms persist, follow the same management options as AFB. Please note, Tylosin (Tylan®) and Lincomycin (Lincomix®) have not been shown to be effective at controlling EFB and are not registered for its control.

Chalkbrood (*Ascosphaera apis*)

Chalkbrood is a fungal brood disease of honey bees. It is most prevalent after cold springs and in early summer, especially when the population of adult bees is insufficient to keep the brood warm during spells of colder weather.



Chalkbrood-infected larvae



Commonly called 'mummy' larvae

Symptoms

Diseased larvae are evident as hard, white or grey mummies. Chalkbrood mummies are found in the comb, on the bottom board, and in front of the hive throughout the brood-rearing season.

Management options

- Replace comb of highly infected frames
- Replace queen with hygienic stock
- Hive colony in well ventilated sunny spring yards
- If colony is weak in spring, bring it down to a single brood chamber
- Face hive entrance to the sun
- Clean bottom board of mummies
- Control other diseases and pests
- Maintain strong colonies (do not remove too many bees if making spring splits)



Food and Environment Research Agency. (N.D). Chalkbrood disease [digital image]. Retrieved from <https://beeaware.org.au/archive-pest/chalkbrood/#ad-image-0>

Varroa Mites (*Varroa destructor*)

Varroa mites are an external parasite of honey bees that feed on bee fat bodies, and vector viruses. Varroa mites are a very serious pest of beekeeping, and infestations can cause irreversible damage to honey bee colonies and colony death. Colonies collapsing from Varroa easily spread this parasite to other colonies, and the viruses can be transmitted to native bees and other insects and arthropods.



Female varroa mite

Symptoms

Mites are sometimes visible as small, flattened, round, reddish-brown discs on the honey bee thorax or abdomen. Viruses transmitted from mites may present physically as bees with shriveled wings, or as trembling bees, among other symptoms.



Varroa mites on brood



Varroa mite on worker abdomen

Monitoring

Monitoring is important to prevent mite populations from reaching a level that will permanently damage bee colonies. Monitoring also helps to choose the best treatment option and will help evaluate the likelihood of treatment success. A minimum of six colonies per apiary, and four to 10 apiaries per operation should be monitored. Beekeepers should monitor colonies two to three times in spring and fall.

Varroa Hand Shaker (Varroa Mite Counter Jar, Varroa easy check)

The Varroa hand shaker is a simple, fast, and reliable method to monitor Varroa mite populations in the field. Follow these steps:

1. Sample approximately 300 worker bees from brood frames into a shaker jar filled 1/3 full with winter washer fluid, or 70 per cent alcohol. Three hundred bees will fill about one inch in the bottom of the jar when settled or quarter cup scoop of bees.
2. Screw the sample jar onto the hand shaker and shake vigorously up, down, and sideways for 40-60 seconds.
3. Turn the jar with the bees upside down. The bees will remain in the top, and the mites and liquid will pass through into the bottom jar. Count the number of mites collected in the fluid in the bottom jar.
4. To determine the percent infestation, divide the number of mites by three.
 - For example, assuming that you collected 300 bees, and counted nine mites in the bottom jar, the percentage infestation is equal to nine divided by 3 = 3%.

Note: a sample of 300 bees is required to produce results that accurately determine the Varroa mite infestation in bee colonies. It can be helpful to count the number of bees in five samples to standardize the method.



300 bees in a Varroa hand shaker

Sticky traps/boards:

This method is also reliable to monitor Varroa mite populations. It does not kill bees, however, it is harder to interpret and more time consuming than the Varroa hand shaker.

1. Make 12"x16" sticky traps by coating heavy paper with sticky materials such as Tanglefoot® or a mixture of 50 per cent Vaseline and 50 per cent shortening. Sticky traps/boards can also be bought commercially.
2. For hives without a screened bottom board, cover the sticky board with 8-mesh screen then place it on the bottom board of the hive. For hives with a screened bottom board, simply place the sticky trap in the bottom board drawer.
3. Leave the sticky board for three days to collect naturally dropped mites from the bee cluster.
4. Remove the sticky board and examine mite drop. Count the mites and calculate how many mites dropped per day.



Commercial sticky trap with dropped mites and debris



Varroa mite on honey bee thorax

Treatment thresholds

It is important to monitor mite levels in your colonies particularly in the spring and fall. If the Varroa mite infestation is higher than three per cent (3 mites/100 bees) using the Varroa hand shaker or higher than 10 mites/day natural drop on sticky boards, the colony must be treated.

Mite counts can dramatically change in the fall from one day to the next as brood levels decrease.

Cultural Management Options

1. Requeen colonies with resistant stock:

Requeen your colonies with queens from hygienic genetic stock, Varroa Sensitive Hygiene (VSH), or Russian bees that have demonstrated Varroa tolerance.

2. Trapping Varroa in drone brood:

Drone brood removal is a method to trap adult and immature developing mites in capped brood. Do not leave the drone brood in colonies for more than 20 days as the drones will emerge and consequently increase the population of mites. Timing for removing capped drone brood is vital for trapping and removing mites from infested colonies.

3. Screened Bottom Boards:

Screened bottom boards with 8 mesh screens can be placed onto bottom boards of hives. In cold climates, the buildup of bee colonies could slow when screened bottom boards are used. However, some models are modified to reduce the drift of cold air into the hives and minimize the negative impact on brood production. If you are not using the modified bottom board, be sure to switch to a traditional bottom board before overwintering your colonies



For Varroa management, do not rely on cultural management options alone. Use them as part of an integrated pest management strategy along with synthetic or organic chemical options.

Chemical Options for Management of Varroa mites

Always monitor before and after treatments to ensure they are needed and effective. Also always remember to use appropriate personal protective equipment when applying any pesticide.

Synthetic Miticides

The following synthetic miticides are registered in Canada for treatment of Varroa mites and may be applied in the spring or fall; according to label directions, they each may only be applied once per calendar year. They are applied at a rate of one strip per every 4-5 frames of bees. Resistance to Checkmite+™, Apistan® and Bayvarol® has been reported in Alberta. As such, perform a Pettis test to ensure suitable mite kill. For instructions on how to perform the Pettis test, please contact the [provincial apiculturist](#).

Treatment	Application requirements	Label Information
Apivar®	One application for 42-56 days. If strips lose contact with cluster reposition and leave for 56 days inside the brood chamber(s)	www.apivar.co.nz/FAQs.htm
Checkmite+™	One application for 42-45 days inside the brood chamber(s). Allow for a 14 day withdrawal period before adding honey supers	www.animalhealth.bayer.ca/en/bees/checkmite/
Apistan®	One application for 42 days inside the brood chamber(s)	www.vita-europe.com/beehealth/products/apistan/
Bayvarol®	One application for 42 days inside the brood chamber(s)	www.animalhealth.bayer.ca/en/bees/bayvarol/

Non-synthetic Options for Management of Varroa Mites

The following organic acids and essential oils are registered in Canada for the treatment of Varroa mites:

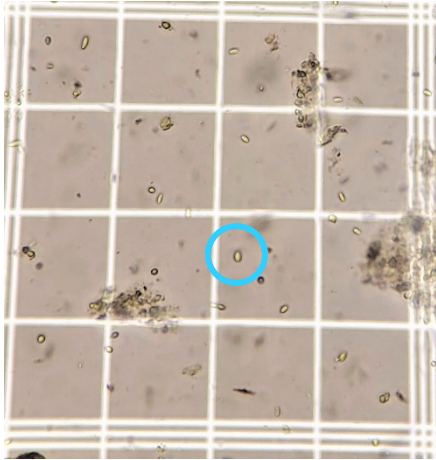
Treatment	Application requirements	# of applications per treatment period	Label Information
Formic acid 65% mite wipes	Apply between 12-24°C. Colony should be broodless	4-6	Health Canada
Mite Away Quick strip (MAQS) (Formic acid)	Apply between 10-29.5°C	1	Mite Away Quick Strips Label
MiteGone (Formic acid)	Apply when temperature is below 30°C. Colony should be broodless	1	Mite Gone Label
Oxalic Acid Sublimation	Colony should be broodless	2-3	Canadian Honey Council
Oxalic Acid Drip	Colony should be broodless	2-3	Canadian Honey Council
Thymovar	Apply between 12-30°C	2	Thymovar Label
HopGuard II	Apply when temperatures are between 10-33°C. Colony should be broodless	2	https://betatec.com/contact/

Nosema (*Nosema apis* and *Nosema ceranae*)

Nosema is a microsporidian fungal disease that infects and damages the intestinal tract of adult bees. It can be detrimental to colony development, queen performance, and honey production. It builds up within overwintering bees and declines naturally over summer in short-lived bees. Both *N. apis* and *N. ceranae* occur in Alberta, however *N. ceranae* is more common.

Symptoms

Colonies may appear weak and experience slow build up in the spring. Feces may or may not be apparent on hive equipment.



Nosema spores under light microscopy



Bee feces on the front of a hive can be an indication of a *Nosema* infection

Monitoring

1. Collect 30 to 50 older bees per hive in the spring and fall from frames of honey.
2. Homogenize the abdomens of 30 bees in 15 mL of water.
3. Examine with a compound microscope and count *Nosema* spores in five squares using a haemocytometer.
4. Calculate number of spores per bee by multiplying the total number of counted spores in the five squares by 25,000.

For more detailed information please contact the [provincial apiculturist](#)

To request analysis, you can contact the [National Bee Diagnostic Centre \(NBDC\)](#):

- 780-357-7737
- nbdc@gprc.ab.ca

Management Options

- Irradiate dead colonies and empty, used hive boxes
 - This can be done through [lotron](#)
- If the number of spores per bee exceeds one million, colonies can be treated with Fumagilin-B according to label directions. Please note that fumagillin is photosensitive. If the medication or medicated syrup is exposed to sunlight, it will no longer be effective managing *Nosema*.

Honey Bee Viruses

Honey bee viruses are frequently vectored by Varroa mites, and are usually associated with uncontrolled Varroa mite infestations. Many viruses affect honey bees including Sacbrood Virus, Black Queen Cell Virus, Deformed Wing Virus, Acute Bee Paralysis Virus, Israel Acute Paralysis Virus, Kashmir Bee Virus, and Chronic Bee Paralysis Virus.



Worker bee showing deformed wings caused by the mite-vectored Deformed Wing Virus



'Greasy' queen bee 1

Symptoms

Visible viral symptoms include:

- honey bees with shrivelled wings (deformed wing virus)
- bloated abdomens
- shaking bees
- bees with a greasy appearance
- weak colonies
- large piles of dead/dying bees in front of colonies.

Controlling Varroa mites is the only way to manage Honey bee viruses.

Sacbrood virus causes a brood disease that presents as dark punctured cappings similar to AFB. Larvae killed by Sacbrood virus will stay pointed like the end of a canoe. When a twig or blade of grass is inserted, the infected prepupae can be pulled out as a liquid-filled sac. There are no treatments registered to manage honey bee viruses; the best management practice is to manage Varroa mite populations.



Prepupae infected with Sacbrood virus



Larvae infected with Sacbrood virus

Tracheal Mites (*Acarapis woodi*)

The Honey Bee Tracheal Mite (HBTM) infects worker, drone and queen honey bees. If not treated, tracheal mites can lead to high colony losses over the winter. Although once common, tracheal mite infestations have become increasingly rare.

Symptoms

There are no outward symptoms of tracheal mites. Examination of a dissected honey bee tracheae is the only way to determine if bees are infected.

Monitoring

Samples of older bees should be collected from frames of honey in the early spring or early fall so that tracheal mites can be monitored and timely actions can be taken if required. If the bee samples have a tracheal mite infestation of ≥ 10 per cent, a treatment is required.

To request analysis, you can contact the [NBDC](#):

- 780-357-7737
- nbdc@gprc.ab.ca

Cultural Management Options

Requeen colonies with queens from known HBTM resistant stock once every two years.

Chemical Options for Management of Tracheal Mites

Treatment	Application requirements	# of applications per treatment period	Label Information
Formic acid 65%	Apply between 12-24°C	3	Health Canada
Mite Away Quick strip (MAQS) (Formic acid)	Apply between 10-29.5°C	1	Mite Away Quick Strips Label
Mite Gone (Formic acid)	Apply when temperature is below 30°C.	1	Mite Gone Label
Menthol	Apply when temperatures are between 20-30°C.	2	Mite-a-thol Label



Non-infected (left) versus infected (right) honey bee trachea

Small Hive Beetle - SHB (*Aethina tumida*)

SHB is a scavenger beetle and can be a major pest of weak honey bee colonies and honey houses. Larvae chew through the comb, feeding on brood, pollen and honey. Additionally, larvae defecate in combs causing honey to ferment and run out of the cells. Adult SHB are able to fly distances up to 10 km and can infest neighbouring apiaries.

The Small Hive Beetle is not an established pest in Alberta



Small hive beetle adult

Symptoms

SHB enter unaffected areas through interprovincial movements of hives, used equipment, and imports of queens. Identification of SHB and diagnosis of infestation is critical to prevent the establishment of the beetle in Alberta. When present, adult beetles can be found on inner covers, bottom boards, and top bars. Their club-like antennae and oblong body shape distinguish adults. The larvae will be on the surfaces of frames or pollen patties. Heavily infested hives will smell of fermented honey, which will drip from the frames.

Monitoring

A minor infestation can be difficult to detect. Adult beetles will avoid light and move quickly when the hive is opened. A quick look at the bottom board by tipping the hive forward can be done to monitor for SHB. Adult SHB can also be detected by placing corrugated plastic or cardboard on the bottom board to be checked after 24-48hrs. Beetles will hide in the tunnels of the cardboard or plastic to escape sunlight and honey bees. Beetle Blaster traps can be used for diagnoses and treatment if needed.

Cultural Management Options

Prevention

Eliminating movement of colonies, packages, and equipment from infested areas to Alberta will help prevent the spread of SHB to Alberta. [Interprovincial movement of colonies or used equipment requires an inspection and permit.](#)

Maintaining strong colonies, extracting honey immediately, and regular hive inspections are key steps in avoiding and detecting SHB.

Honey House

- Extract harvested honey combs within 1-2 days and check honey combs for damage caused by SHB before extraction. Damaged combs should not be extracted.
- Return brood combs brought to the honey house immediately back to the field or store at $\leq 10^{\circ}\text{C}$ for 24-48hrs before doing so.
- Store any comb suspected of SHB infestation at $\leq 10^{\circ}\text{C}$ for 24-48hrs or in the hot room with good circulation and $< 50\%$ humidity to kill all SHB stages
- Use a queen pheromone lure in a nuc box to collect flying SHB and depopulate them (can be done by washing in soapy water)
- Melt wax cappings each night or store them in tight drums in a cold room ($\leq 10^{\circ}\text{C}$)
- Clean the honey house immediately after every extraction.

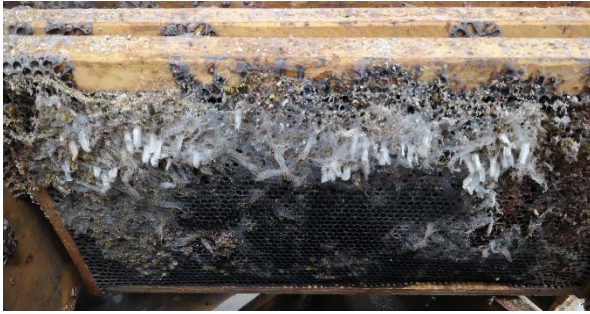
Field

- Eliminate weak colonies throughout the beekeeping season to reduce potential infestation sites. Remove all dead colonies from apiaries immediately.
- Use queen excluders to prevent bringing brood frames to the honey house.
- Unused equipment should be stored in a cold room ($\leq 10^{\circ}\text{C}$)
- Avoid throwing burr comb and broken comb in the bee yard. It should be stored in the cold room until melting.
- For pollen collection, harvest more often and store in a cold room for 24-48hrs

Please report suspected Small Hive Beetle findings to the provincial apiculturist at 780-415-2309

Greater Wax Moth (*Galleria mellonella*)

The greater wax moth is a pest that can damage combs and beekeeping equipment. Adult moths lay eggs in cells, cracks in hives, on the ground near a hive, or in stored equipment. The caterpillars chew through comb and feed on larval skins, pollen, honey, and wax. Older brood frames are most often affected and caterpillars will tunnel through frames leaving behind a silk web. Damage caused by the moth may destroy frames if infestation is high.



Wax moth cocoons

Symptoms

Masses of web, cocoons, and larvae can be found on frames of stored equipment. Caterpillars also chew on wood, damaging brood boxes.



Wax moth hive damage

Cultural management options

Proper storage of equipment is an effective preventative measure. Freezing or storing frames outdoors during winter months, free of honey and pollen, will limit the likelihood of infestation.

Chemical management options

Acetic acid has been used to treat stored equipment. Necessary precautions must be taken as acetic acid is harmful to humans, bees, and many other species.

Bee Louse/Bee fly (*Braula coeca*)

The bee louse is a wingless fly that can live in honey bee colonies, but is not considered a serious pest. They feed on nectar and pollen and or glandular secretions from host bee mouthparts. Occasionally, a number *Braula* can be seen on the back of a queen. However, the presence of *Braula* does not seem to disrupt the colony. Due to its similar size and colour, the bee louse is regularly confused with Varroa mites.



Bee louse adult

Management Options

There are currently no management options as they are not considered a serious pest of honey bees.

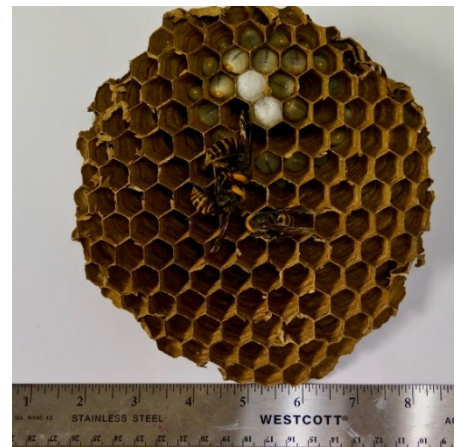


Multiple bee louse on the back of a queen

Asian Giant Hornet - AGH (*Vespa mandarinia*, *Vespa soror*)

Two different species of AGH were found in British Columbia (BC) in 2019. A single queen identified as *Vespa soror* was killed. There have been no sightings of *V. soror* since.

In fall of 2019, a single nest of *Vespa mandarinia* was found in Nanaimo and subsequently destroyed. In late November there was additional findings of *V. mandarinia* in White Rock BC and Washington State, close to the Canadian border. It is not yet known how the AGHs have gotten into Canada. AGH are known to predate on honey bees, and can cause the death of a honey bee colony in a short time. They can fly up to eight kilometers from their nest. The hornets are large; workers can measure up to 3.5 cm in length and queens 4-5 cm. Monitoring and control programs have been implemented in BC. There have been no reports of this pest in Alberta as of May 2020.



Asian giant hornet comb (picture taken by P. van Westendorp)



Vespa mandarinia (picture taken by P. van Westendorp)