Varroa Mite–Biology and Diagnosis

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Varroa mites, *Varroa destructor*, are the most serious threat to honey bees. Varroa were previously known by the species name *Varroa jacobsoni*. Varroa are relatively large external parasites that feed on the body fluids of adult and developing honey bees. Varroa cause physical damage, weaken bees and transmit a variety of pathogens, particularly viruses. In almost all cases, when varroa infestations are not effectively managed they will eventually result in the death of the entire honey bee colony. It is crucial that beekeepers manage the health of their honey bees by suppressing the population of varroa in all of their honey bee colonies throughout the beekeeping season.

Figure 1.

Figure 2.

Figure 3.

Figure 1. Varroa mite in honey bee brood cell. Figure 2. Varroa mite on a honey bee. Figure 3. Varroa mite under the microscope.

PREVALENCE

Varroa originally evolved in Asia, on a different species of honey bee, the Asian honey bee (*Apis cerana*), and has since spread to the western honey bee (*Apis mellifera*) throughout most of the world.

Varroa is now present in almost all honey bee colonies at levels of infestation that are always increasing unless treated. If you have honey bees, you will have varroa. Any feral colonies present in Ontario will also be infested with varroa. At present, the region of Thunder Bay in north western Ontario is not known to have varroa . This is likely due to the prolonged isolation of the area from other populations of honey bees.

Different populations of varroa have become resistant to multiple classes of chemical treatments (fluvalinate, coumaphos and amitraz). Some treatments that were once effective at treating varroa may have limited effectiveness. Although there have been documented cases of amitraz resistance in other countries, there has not been a documented case of amitraz resistance of varroa in Canada at the time of this publication. However, resistance to fluvalinate and coumaphos are common amongst populations of varroa in Canada, including Ontario.

LIFE CYCLE AND BIOLOGY

Varroa mites are arachnids. They belong to the same class of animals as spiders, ticks and other mites. The most commonly encountered life stage of the varroa is the mature female mite. Unless referred to otherwise in this document, all varroa are mature females.

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Varroa are relatively large parasites compared to their host. It would be like having a tick the size of a small plate feeding on your body! Varroa are darkish red, oval in shape, approximately 1 x 1.5 mm wide, with the body surface covered in fine hairs and eight legs located at the front of the body (figure 4). Varroa have well developed chelicerae (jaws) that are used to puncture and attach themselves to the body of their host. Although varroa mites do not have eyes, they detect honey bees by smell and movement. They move fast and can easily move from the body of one honey bee to another.

Figure 4. Adult female mites. Upperview (left), underview (right).

Varroa are completely dependent on honey bee colonies for survival and reproduction. Varroa cannot live separately from honey bees for more than a few days. Varroa will feed on the haemolymph (body fluid) of adult honey bees after piercing their soft membranes located between segments of the exoskeleton, usually between their lower abdominal plates.

To reproduce, the parent varroa enter the brood cell of the honey bee right before the cell is capped (figure 5). Once the cell is capped, the parent varroa lays eggs and pierces the developing bee brood, leaving a wound open in it. The eggs hatch, the offspring mate with each other and feed on the developing bee brood along with the parent mite.

The numbers of varroa offspring generated in a brood cell depends on the time the cell remains capped. This is why varroa are able to produce more offspring in drone brood (2 to 2.5 offspring in 14 to 15 days capped) rather than in worker brood (1.5 offspring in 12 days capped). Thus, varroa are adapted to seeking out drone brood. As the new adult bee emerges from the brood cell, the parent mite and the female mite offspring are released. The parasitized honey bee brood will emerge weakened with a shortened lifespan.

Figure 5. Varroa infested brood.

The pattern of varroa population growth follows that of the honey bee colony. When honey bee brood is present, the varroa population increases with a large proportion (2/3) of varroa are protected inside the brood cells from chemical treatments (~12 days for workers and 14 to 15 days for drone). If left unmanaged the varroa population in a honey bee colony will increase from spring and reach extremely high levels towards the end of summer when the winter population of bees are developing. After the honey bee colony stops rearing brood in late fall, all the varroa in the population become concentrated on the bodies of the adult bees.

IMPACT

In almost all situations varroa is highly virulent and will lead to the eventual death of a honey bee colony. Research demonstrates that inadequate varroa control is the primary cause of mortality in honey bee colonies in Ontario (Guzman *et al.*, 2010).

Figure 6. Worker bee infected with deformed wing virus (on left)

Figure 7. Worker bees in brood nest. Note the small red dots on the surface of the bees—Varroa mites.

Varroa mites weaken bees by damaging tissue and depleting body fluids during development and adulthood. They also transmit pathogens, such as viruses, to individual bees (figure 6). Varroa are always in honey bee colonies. Chemical treatments or cultural control are almost always necessary to manage infestations under damaging levels. However, even when chemical treatments are applied to reduce varroa infestations there are always some varroa left over. They are increase their population within a colony to the point where the colony becomes severely weakened and will die.

It is important for beekeepers to know the level of varroa infestation in a honey bee colony before it becomes too high. Thus, beekeepers must continuously monitor levels of infestation in their honey bee colonies and treat them at regular intervals to ensure levels of infestation are kept below damaging levels (figure 7).

Colonies with high levels of varroa infestation in a weakened state may have their honey stores robbed by foraging bees of stronger, healthier colonies. When this occurs varroa can transfer to the robbing bees which spreads the mite to a healthy colony. Therefore, it is just as important to keep varroa levels under control in neighbouring colonies within a beeyard.

Beekeepers must take particular care not to delay late summer or early fall treatments for varroa as the winter bees that are being produced during this time must be healthy as they will make up the winter population (cluster) of bees.

Detailed instructions are given in the documents:
Varroa—Sampling and Monitoring Infosheet on OMAFRA's web site
http://www.omafra.gov.on.ca/english/food/inspection/bees/apicultu.html
and
Treatment recommendations
http://www.omafra.gov.on.ca/english/food/inspection/bees/11-treatment-recomms.htm.

RESOURCES

- Apiculture infosheets on OMAFRA's web site
http://www.omafra.gov.on.ca/english/food/inspection/bees/apicultu.html
- Honey Bee Pests and Disease Images
http://www.omafra.gov.on.ca/english/food/inspection/bees/honeybeepestphotos.htm
- OMAFRA - 2012 Treatment Recommendations for Honey Bee Disease and Mite Control
- Ontario Beekeepers Association, Technology-Transfer Program – Ontario Beekeeping Manual with an Emphasis on Integrated Pest Management with workshops
- Canadian Association of Professional Apiculturists – Honey Bee Diseases and Pests

Technology Transfer Program (Ontario Beekeepers Association):
http://techtransfer.ontariobee.com/
Phone: (519) 836-3609
obatechtransfer@rogers.com
http://techtransfer.ontariobee.com/index.php?action=display&cat=52&v=76
Integrated Pest Management Workshops
http://techtransfer.ontariobee.com/index.php?action=display&cat=55&v=69

Apiculture Program (Ontario Ministry of Agriculture, Food and Rural Affairs):
http://www.omafra.gov.on.ca/english/food/inspection/bees/apicultu.html
Toll Free: 1-888-466-2372 ext 6-4230
Local: (519) 826-4230
E-mail: foodinspection@ontario.ca
Regional Apiary Inspectors:
http://www.omafra.gov.on.ca/english/food/inspection/bees/info_beeinspectors.htm

REFERENCES

Guzman-Novoa E., Eccles L., Calvete Y., McGowan J., Kelly P. and Correa-Benitez A. 2010. *Varroa destructor* is the main culprit for death and reduced populations of overwintered honey bees in Ontario, Canada. Apidologie. 4 (4) 443-451.

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