

DPI Primefact

Varroa mite

November 2023, Primefact 861, 3rd edition
Madlen Kratz

Varroa mites are the most serious pest of honey bees worldwide. Varroa mite infests honey bee colonies in every major beekeeping area of the world.

Introduction

Varroa mites are a group of species including *Varroa destructor*, *V. jacobsoni*, *V. underwoodi*, *V. rindereri* and unnamed species. It was believed up until recently that only *V. destructor* posed a threat to managing honey bees. For the purposes of this Primefact, honey bees refers to *Apis mellifera*, European honey bee.

Varroa have evolved with *Apis cerana* (Asian honey bees). The impact of varroa on Asian honey bees is not lethal. Varroa mites normally breed on Asian honey bee drone brood with minimal impact on the Asian honey bee colony.

Subsequently it was found that some varroa were reproducing on *Apis mellifera* honey bees, while other varroa were not. The specific varroa that could breed on *Apis mellifera* honey bees were named *Varroa destructor*. This cross-species infestation of *V. destructor* on honey bees probably started in the 1960's. This mite is now widespread throughout Asia, much of Africa, Europe, the Americas and New Zealand. In Australia, in September 2023, it was Nationally agreed that eradication of Varroa (*Varroa destructor*) mite was no longer feasible and a transition to management commenced.

Varroa jacobsoni is a mite infesting *Apis cerana* honey bees throughout Papua New Guinea and Indonesia.



Figure 1 Magnified mites, showing top and underside.

Importance

If left untreated, varroa mite will kill a honey bee colony. All feral and untreated bee colonies will eventually die.

This necessitates very careful management from a beekeeper's perspective to detect and treat mites as and when their population increases to critical levels. There is a significant cost in materials and labour involved in varroa management. Common chemicals used for such purposes can leave residues of one form or another in the beeswax and honey.

The most significant impact of varroa establishing, as experienced in other countries, is the death of all untreated honey bee colonies across the landscape. This seriously reduces the positive impact of honey bees in the environment, pollinating a range of horticultural and broadacre crops and pastoral plants. The value of honey bees as pollinators is considered to be extremely important and, in some reports, without honey bees the range of food products may be considerably impacted.

Description

Mites in low numbers in a colony are impossible to detect with the naked eye. Varroa mites look like small brown sesame seeds with eight legs that extend outward from the front of their body. They are flat and about 1.1 mm long and 1.7 mm across.

Life cycle

Varroa can only reproduce on bee brood. No brood equals no mite breeding. Mites find drone honey bee brood significantly more attractive to breed in than worker brood. Approximately 4 out of 5 mites will enter drone brood if given a choice.

The female mite enters the brood cell of an advanced larva just before the cell is capped by nurse bees. The mite sinks itself into the larval food at the bottom of the cell and emerges once the brood cell is fully capped.

She will then move onto the developing bee larvae/pupae and feed on primarily fat body tissue (rather than hemolymph as previously thought).

The mother mite may lay up to six eggs at intervals of about 30 hours. The first egg develops into a male mite and the rest are female.

Mite development from egg to adult takes about 8–10 days. The first mite (male) mates with the female mites as they mature.

On average, 1.5 daughter mites emerge from a worker cell and 2.5 daughter mites emerge from a drone cell along with the mother mite. The male and undeveloped female mites die inside the cell. The mother mite and her daughters are then capable of crawling back into adjoining brood cells to begin the reproduction life cycle again. Once the population of mites has increased substantially, it is possible for several mites to infest the one brood cell.

There can be 24–30 breeding cycles for the mites in a year. It is believed that female mites will breed up to three times. Thus, as long as honey bee brood is present, the mites will breed and their numbers will increase exponentially. If drone brood is present, then the mite population will increase even faster.

Signs and symptoms

Unfortunately, mites are very good at concealing themselves on adult honey bees. It is generally agreed that to visually observe adult mites on adult honey bees is very difficult and unreliable as a diagnostic tool.



Figure 2 Varroa mite hiding on the underside of a worker bee.

In spring and summer when breeding conditions are ideal most colonies rear large numbers of drones. Occasionally drone brood comb is built between the top bars of combs and the queen excluder. When inspecting a colony and removing the queen excluder, developing brood pupae and larvae can be exposed. The presence of mites feeding on the drone brood is very obvious, as the brown sesame seed-sized mite feeding on the white drone pupae is very distinct.

Other than this incidental discovery, if you are not deliberately monitoring for mites, the colony is likely to collapse before you are aware of the presence of mites. A colony can appear to be populous with healthy looking brood one week and be all but extinct the following week. In this case the brood pattern may become irregular with sunken and chewed cappings and larvae slumped in the bottom or side of the cell and may look similar to that observed with brood diseases. However, a sample of 'infected' larvae sent to the laboratory for diagnosis is unlikely to be positive for European foulbrood or American foulbrood. This condition has been termed 'parasitic mite syndrome', or PMS.

Monitoring

All NSW beekeepers must complete a surveillance action on their hives at least once every 16 weeks. This is an important step in monitoring for Varroa and understanding how best to manage it. Varroa surveillance supports the broader beekeeping industry to understand the impact and spread of *Varroa destructor*.

There are three approved methods for testing for Varroa mite outlined in the Emergency Order –

1. Alcohol wash
2. Soapy water wash
3. Sugar shake.

Drone uncapping is another method of testing for mites, however, is not an approved surveillance method and does not allow the beekeeper to estimate the overall mite numbers in a colony.

Alcohol/soapy water wash

Alcohol/soapy water washing is a quick and effective method for monitoring colony mite levels. The disadvantage of this method is that it kills the bees that are sampled.

Like sugar shake, collect about 300 bees. Transfer the bees into a container filled with either:

- Alcohol: 150 ml of minimum 25% rubbing alcohol or methylated spirits
- OR
- Soapy water: 150ml of pre-mixed 2 tablespoons (40 millilitres) of dishwashing soap in 3.5 litres of water
 - Soapy water: 150 ml of non-sudsy soapy water made using as automotive windshield washer fluid as per the manufacturer's instructions.

Shake the jar vigorously for 15 seconds, ensuring all bees are covered in alcohol/soapy water. Drain the alcohol/soapy water through mesh into a second container to separate the suspended mites from the adult bees. View any mites that have been dislodged from the bees.

Return the alcohol/soapy water to the jar and rinse and strain two more times. The rinses are key to attaining a high level of confidence that varroa mites will be found if they are present.

Sugar shake

Rolling bees in icing sugar and shaking them dislodges mites from bees and is a method to determine mite populations in a colony. A sample of approximately 300 adult bees are removed from the brood area and placed in a jar with a tablespoon of icing sugar. The bees and icing sugar are rolled around for 60 seconds, ensuring the bees are fully coated in sugar. Leave for 3-5 minutes and roll again for 60 seconds. The fine powdered sugar irritates the mites, causing them to release from the adult bees.

Icing sugar plus mites are shaken through a mesh lid out of the jar onto a white piece of paper or into a bucket of water, where the mites will be visible. Sugar coated bees are returned to the hive.

Although this is an excellent nonlethal (to bees) method of monitoring mite population densities, you are only measuring the number of mites that are on the sample of bees tested. You will not detect mites in the brood cells with this method.

Drone uncapping

Drone uncapping can be particularly effective for mite detection when drone brood is abundant as varroa prefer to breed in drone brood cells compared to worker brood cell due to their prolonged development stage (drones ~24 days, workers ~21 days).

Push the comb of the scratcher through a patch of capped drone brood and pull the pupae out. Examine each pupa for reddish-brown mites, which can be clearly seen against the white bodies of the drone pupae. Mites are easier to see on pupae that have pink eyes rather than those that have taken on adult colouration. Pupae that are younger than the pink-eyed stage are often too soft and fall apart when the scratcher is pulled out.



Figure 3 Drone brood infested with a varroa mite.

Drone uncapping is suitable for mite detection, however, only alcohol/soapy water wash or sugar shake methods fulfill the surveillance requirements of the Emergency Order and will allow the beekeeper to estimate the overall mite levels in a colony.

Spread

Adult mites are quite capable of living for at least five days without the presence of honey bees. This means that they can be moved around on used beekeeping equipment, including extracted combs.

Drone bees drift from hive to hive and even between apiaries, spreading varroa mites around. Foraging worker bees will come in contact with other bees when foraging for nectar and pollen. Mites are very agile and quick-moving and can transfer between bees in passing. Mites can also travel with worker bees during swarming events.

Thus, mites have several means by which they can disperse across the countryside. A colony that is heavily infested and collapses will be robbed of its honey stores by other bees from nearby colonies. Varroa will quickly infest these robber bees which will very effectively spread the mites.

Varroa mites and honey bee viruses

Varroa destructor is a vector for various honey bee viruses. So far, over 23 different viruses have been isolated from honey bees and many of them can be vectored by varroa mites. Before the occurrence of varroa mites, bee viruses have been considered a minor problem to honey bee health. Viruses include:

- Kashmir bee virus
- Sacbrood virus
- Acute bee paralysis virus
- Israeli acute paralysis virus
- Deformed wing virus

Best known is the deformed wing virus infection causing the typical symptoms of crippled wings and shortened abdomen in heavily infested honey bee colonies.



Figure 4 Adult worker bee with deformed wings (circled in red).

What do you do?

In NSW, beekeepers are currently required to undertake a surveillance action (alcohol or soapy water wash, or sugar shake) every 16 weeks. See the [Varroa mite webpage](#) for more information and up to date requirements.

- Be vigilant – keep an eye out for the unusual.
- Alcohol wash, soapy water wash or sugar shake once every 16 weeks and report results within 7 days to www.dpi.nsw.gov.au/alcohol-wash
- Become familiar with what varroa looks like.
- Practice a barrier system that restricts the interchanging of equipment between apiaries.
- Keep good records – where have your bees been, how long for, movement of supers, purchase or sale of queens/nucs/hives etc.
- If you notice anything unusual, take a sample and a photo, record the details and contact the Emergency Plant Pest Hotline on 1800 084 881.

What could varroa mite be confused with?

Varroa mite could be confused with Braula fly (*Braula coeca*), tropilaelaps mite (*Tropilaelaps clareae* and *T. mercedesae*) and pollen mites (*Mellitiphis alvearius*).

Braula fly, or bee louse, is currently present in Tasmania and Victoria. Braula is reddish brown and feeds on nectar and pollen that bees collect. The legs protrude from the louse's sides.

Pollen mites (figure 5) are sometimes found in hives but are not harmful to honey bees.

Tropilaelaps mite are not known to be present in Australia.

If you suspect you have found any mites, call the Exotic Plant Pest Hotline immediately on 1800 084 881.



Figure 5 Clockwise from top: braula fly, varroa, tropilaelaps and pollen mite.

Acknowledgements

Thanks to Doug Somerville for authoring the first version of this Primefact.

Figure 3 courtesy of Harold Ayton.

Figure 5 Courtesy of The Animal and Plant Health Agency UK, Crown Copyright

All other images courtesy of NSW DPI.

© State of New South Wales through Regional NSW 2023. The information contained in this publication is based on knowledge and understanding at the time of writing September 2023. However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Regional NSW or the user's independent adviser.