Department of Primary Industries
primefact

NSW DPI Primefact - Varroa mites

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Introduction

Varroa mites are the most serious pest of honey bees worldwide. Varroa infects honey bees in every major beekeeping area of the world, except Australia.

Although there is a combined government and industry effort to keep them out of Australia, it is generally accepted that it is inevitable that varroa mites will eventually establish in Australia. This will radically change beekeeping practices.

Varroa mites include a group of species, including *V. destructor, V. jacobsoni, V. underwoodi, V. rindereri* and un-named 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.

The varroa mites normally breed on Asian honey bee drone brood with minimal impact on the Asian honey bee colony.

Dr Denis Anderson (CSIRO, Canberra) in a 2000 publication, stated that some varroa were reproducing on honey bees, while other varroa were not.

He was able to identify specific varroa that could breed on honey bees and these were named by him as *V. destructor*.

This cross-species infestation of *V. destructor* on honey bees probably started around 60 years ago.

This mite is now widespread throughout Europe, North America and New Zealand. *V. jacobsoni* is a mite infesting Asian bees throughout Papua New Guinea and Indonesia.

The areas to the north of Australia were not seen as high risk for the introduction of varroa mites.

Unfortunately, there is now evidence that suggests *V. jacobsoni* is reproducing on honey bees.

Thus, any varroa incursion into Australia has the potential to create major management problems for beekeepers.

Importance

Why are these mites so important? Essentially, left untreated in a honey bee colony, they will kill it. 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. There is also the likelihood of the chemicals used for such purposes leaving residues of one form or another in the beeswax and honey.

The most significant impact will be the death of all untreated honey bee colonies across the landscape. This will seriously reduce the positive impact of honey bees in the environment of pollinating a range of horticultural, broadacre crop 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 will dramatically diminish.

Description

Unfortunately, when mites are in low numbers in a colony of honey bees they are difficult to detect. On its own individual mites are easily identifiable to the naked eye. They look like small brown sesame seeds with eight legs. 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 bodies, rather than hemolyph (as previously thought).

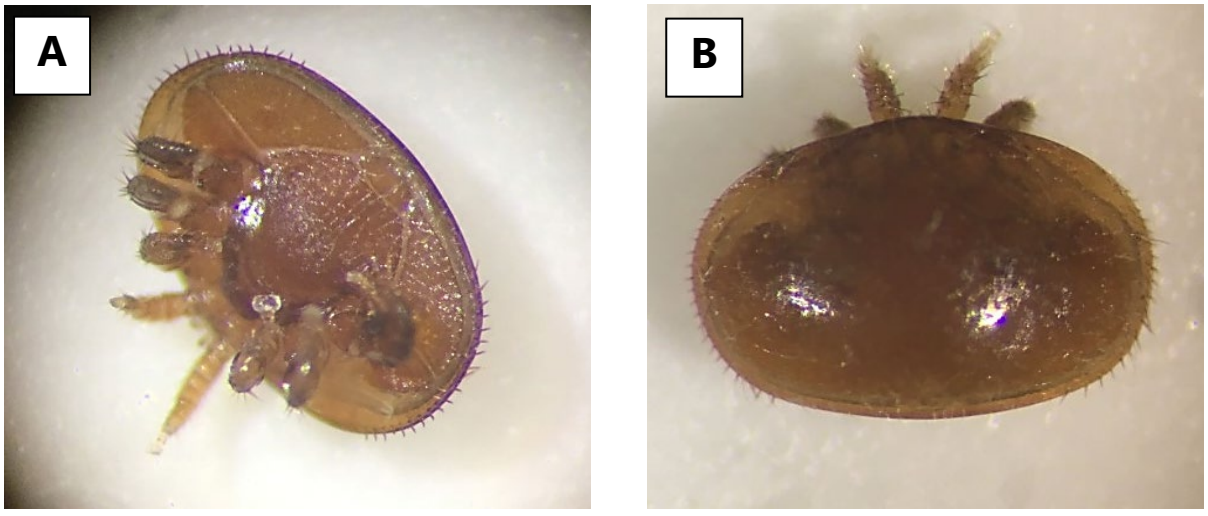

Figure 1. Varroa mite from underneath (A), varroa mite from top (B). *Photo credit: Madlen Kratz*

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.

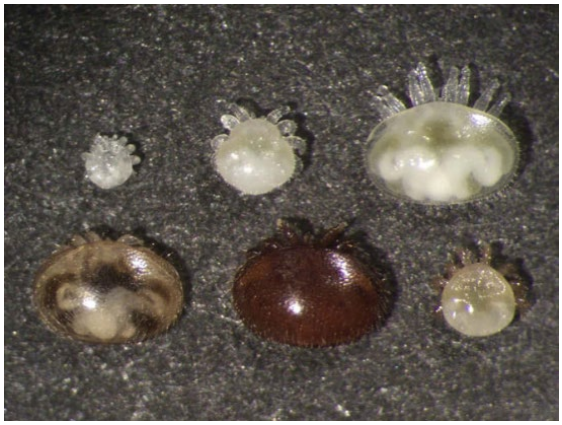

Figure 2. The normal composition of a ‘‘Varroa family” within a honey bee worker brood cell, approximately 11 days after the capping of the brood cell. Upper row from left to right: Protonymph, deutonymph, deutochrysalis. Lower row from left to right: freshly moulted young female, mother mite, adult male. – Figure adapted from Rosenkranz et al. 2010.

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 complete the reproduction life cycle again.

Once the population of mites has increased substantially, it is possible for several mites to be in 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/symptoms

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

Figure 3. Varroa mite hiding on the underside of a worker bee. *Photo credit: Madlen Kratz*

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

Figure 4. Drone brood infested with a varroa mite.

sesame seed-sized mite feeding on the white drone pupae is very distinct.

Other than this accidental 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 is irregular 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

The most effective way to determine if mites are present or if their population is reaching a critical level is to place miticide strips in a colony and insert a sticky mat on the bottom board.

The sticky mat should have a wire screen or protection over it to prevent the house bees from cleaning up any fallen mites and to prevent the bees from getting stuck.

Figure 5. Varroa mites attached to a sticky mat.

The miticide treatments should be in the hive for up to two weeks to maximise the opportunity to detect the presence of very low numbers of mites.

Currently miticides are only registered for use in official surveillance hives strategically located across Australia.

Testing for mite presence/ mite populations

Mites can be detected via three commonly used methods:

1. **Sugar shake**

Rolling of bees in icing sugar is an effective means of determining 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 (see Figure 6 below). The bees and icing sugar are rolled around for 2 minutes, ensuring

the bees are fully coated in sugar. Leave for 2 min and roll again. The fine powdered sugar irritates the mites, causing them to release from the adult bees.

A screen is inserted in the lid and the icing sugar plus mites are shaken out of the jar onto a white piece of paper or into a bucket of water, where the mites will float on top.

Return sugar coated bees 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.

See here for a demonstration.

2. Alcohol wash

Alcohol washing is a quick and effectively method for detecting the presence of Varroa mites, as well as monitoring colony mite levels.

The alcohol wash method can remove 70-80% of external Varroa mites present on adult honey bees. The disadvantage of this method is that it kills the bees that are sampled.

Similarly to the sugar shake collect about 300 bees. Transfer the bees into a container containing around 100ml of 25% rubbing alcohol or methylated spirits.

Shake the jar vigorously for 20 seconds, ensuring the honey bees are covered in alcohol. Drain the alcohol through a mash into a second jar to separate the suspended mites from the adult bees. View any mites that have been dislodged from the bees.

See here for a demonstration

How to make a washing jar.

3. Drone uncapping

Drone uncapping can be a particularly effective when drone brood is abundant as varroa prefer to breed in drone brood cells compared to worker brood cell due to

Figure 6. Put approximately 300 bees into a jar (A), add a tablespoon of icing sugar and roll bees around for two minutes (B), shake icing sugar and mites onto a white sheet of paper or into a bucket of water (C).

their prolonged development stage (drones ~24 days, workers ~21 days).

See here for further details

Spread

Adult mites are quite capable of living for more than 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.

They are certainly able to move varroa mites around. Foraging worker bees will come in contact with other bees when visiting blossom for nectar and pollen. Mites are very agile and quick in 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. The varroa will quickly infest these robber bees which will very effectively spread the mites.

Varroa mites and honey bee viruses

V. destructor is a vector for various honey bee viruses. So far, about 18 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 (KBV)
- Sacbrood virus (SBV)
- Acute bee paralysis virus (ABPV)
- Israeli acute paralysis virus (IAPV)
- Deformed wing virus (DWV)

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

What do you do?

Be vigilant – keep an eye out for the unusual.

- Become familiar with what varroa looks like.
- Practice a barrier system that restricts the interchanging of equipment.
- Keep good records – where have your bees been, how long for, movement of supers, etc.
- If you notice anything unusual, take a sample and record the details and contact the Emergency Disease Hotline on 1800 084 881. It is available 24hrs a day, 7 days a week.

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 is currently present in Tasmania. Pollen mites are sometimes found in hives but are not harmful to honey bees. Tropilaelaps mite are currently not found

in Australia. If any mites are observed on adult honey bees or in the brood, call the Exotic Plant Pest Hotline immediately on 1800 084 881.

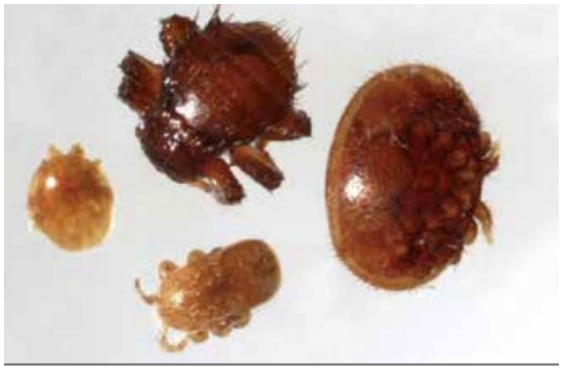

Figure 7. Braula fly (top), varroa mite (right), tropilaelaps mite (bottom) and pollen mite (left). Adapted from Plant Health Australia

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