

3rd Honey bee pests, diseases and poisoning revision post: the lifecycle of Varroa destructor and monitoring & treatment techniques

Posted on [October 21, 2012](#) by [Emily Heath](#)

B3 a) describe the life cycle and natural history of Varroa destructor & b) how does it develop within the colony?

Varroa is the number one killer of colonies in the UK, so it's really worth studying. Whereas European/American foul broods are dreaded but fairly rare diseases, unless you live in Australia or a remote island, varroa mites will be in your hive – whether you notice them or not.

Varroa destructor was originally a parasite of the Asian honey bee, *Apis cerana*. Through the movements of humans it has spread in recent decades to the Western honey bee, *Apis mellifera*, which unlike *Apis cerana* has not yet evolved any natural defences against it.



A female varroa mite – © Crown copyright 2010 "Courtesy The Food and Environment Research Agency (Fera), Crown Copyright"

The life cycle of varroa mites has two stages: a reproductive stage inside sealed brood cells and a phoretic stage as a parasite on adult bees.

An egg-carrying female mite will enter an uncapped cell with a larva inside and bury herself under the larval food, where the bees (and beekeepers) can't detect her whilst inspecting. She uses specialised tubes to breathe during this time. A smell is given off by larva ready to be capped; female mites sense this earlier than adult bees and receive a cue to enter cells just before they are ready for capping (mites enter day 8 after the egg is laid, while worker & drone cells are capped on day 9).



Immature mites on pupa. Courtesy The Food and Environment Research Agency (Fera), Crown Copyright.

About four hours after the cell is capped, the female mite will emerge from under the larval food and begin feeding on the developing honey bee larva, creating a lesion which her offspring can feed from as they develop. She then lays a series of eggs – first a male egg, then 4-5 female eggs, laid at regular 30-hour intervals. It takes about 6-7 days for a female egg to reach adulthood. The young mites hatch and mate with each other within the cell, obtaining energy to do so by feeding on the developing honey bee larvae. You'll be pleased to find out that mites mate on their own faeces, which give off a pheromone smell enabling them to find each other in the dark of the cell.

The male mites cannot survive outside the cell, and they die after copulation since their mouthparts are modified for sperm transfer rather than feeding. Therefore the females must be fertilised before the bee emerges from the cell. The success rate of producing new mature fertilised female mites is about 1.7 to 2 in worker brood, but increases to 2-3 in drone brood as drones take 3 days longer to develop.

Once the honeybee larvae emerges, the young female mites crawl out too and spend some time feeding phoretically on the backs of adult honeybees, before they can carry out the cycle again by hiding within an uncapped cell. Their flat shape allows them to squeeze between overlapping segments of a bee's abdomen to feed and helps them avoid removal by grooming bees. During the summer female mites live for about 2-3 months, during which time, if brood is available, they can complete 3-4 breeding cycles.



Varroa damage: normal bee on left, bee carrying several phoretic mites in the centre, deformed bee on the right. Courtesy The Food and Environment Research Agency (Fera), Crown Copyright.

c) How is it spread to other colonies?

- Foragers carrying mites drifting into, or robbing from, other colonies
- Drones carrying mites visiting other colonies
- The beekeeper moving brood frames between hives or transporting infected colonies to new areas
- Varroa mites have been found on flower-feeding insects such as certain species of bumble-bees, scarab beetles and flower-flies. Although the *Varroa* mite cannot reproduce on these insects, its presence on them may be a means by which it spreads short distances and finds new honey bee hosts.

B4. a) describe the various methods which beekeepers can use to detect the presence of the Varroa mite (and pyrethroid resistant Varroa) in their colonies and monitor the degree of infestation.

Looking out for deformed wings and adult bees carrying mites, and waiting to treat until you see these signs, is not enough. Colony collapse due to a severe varroa infestation can take only a few weeks, and may affect even strong colonies, so do not assume that levels will remain low because so far no mites have been spotted.

Testing for pyrethroid resistance

Varroa in some areas (most places in the UK) have developed resistance to pyrethroids, which are the active ingredients of the widely used varroacides Apistan and Bayvarol. The presence of such mites can be identified by resistance testing, but the first obvious sign is likely to be the collapse of colonies after pyrethroid treatment fails to control mite infestation.

It is quite straightforward to test for pyrethroid resistance. A sample of live bees should be removed and put in a jar with a strip of Apistan fixed in the lid and mesh at the bottom. The jar is left in the dark for some hours over a piece of card and then the number of mites that have fallen through the mesh are counted – this represents the susceptible population of mites. The bees in the jar are then killed by shaking vigorously in soapy water and the washings filtered through a strainer. Any more mites coming off in the rinsing water are the resistant ones. A percentage resistance can then be calculated, e.g. if 60 fall down initially and another 40 subsequently, the population is 40% resistant. (Info from my correspondence course tutor, Pam Hunter).

In a severe infestation, there will be a poor brood pattern, and some larvae will die, while many of those that survive will have stunted growth and deformed wings.

Below are a couple of monitoring methods beekeepers can use to help monitor how bad infestation is.

• Drone trapping

- Varroa mites prefer to breed in drone brood. Drones take 24 days to develop whereas workers take 21, so drones give the mites time to fit in more breeding cycles. The mites identify the drone brood by its different smell, which is a result of the more protein rich diet fed to drones.
- In England drone trapping can be used as a method of varroa monitoring and/or control during April, May and possibly June. To do this put a drawn super frame into the brood box, to encourage them to build drone comb in the gap underneath, or a frame with drone foundation or drawn drone comb, depending on the size and strength of the colony. Put the super frame at the side of the brood nest, not the

middle.

- Once the drone comb is sealed, cut it off the super frame. You can do this 2-3 times during the summer. Before you destroy the drone brood you can uncap some to see how many mites are inside.



Uncapping drone brood to check for varroa. Courtesy The Food and Environment Research Agency (Fera), Crown Copyright

Put your uncapping fork in deep, right into the neck of the drones. Fork out a hundred drones and count how many larvae have mites to get an idea of mite numbers in the hive: 5% infestation is light; between 5-10% light control techniques like drone trapping can be used; at over 25% infestation is severe and high-efficiency methods like Apiguard will be needed. Note that younger varroa mites are pale coloured and the mites move rapidly away from the light, so rotate the uncapping fork to ensure that you see all mites present.

- **Varroa board monitoring**

Draw a grid with several squares on your monitoring board and smear it with vaseline, then put it under your open mesh floor for a week. The grid pattern makes it easier to count mites and the vaseline ensures the mites stick to the vaseline and aren't blown off when you inspect the board. A week later, count the number of mites and work out an average daily drop count. If there is a lot of debris which makes it hard to count mite numbers, put the debris in a jar with a lid before mixing with methylated spirits and shaking vigorously: once the debris settles, the wax, propolis and other debris will sink, the mites will float.

To assess how bad the problem is based on the daily drop count, the season and the type of hive must be taken into account – UK colony collapse thresholds would be a daily drop of 6 in May, 10 in June, 16 in July and 20 in August. The [Beebase varroa calculator](#) is a helpful tool which can tell you how bad the problem is based on the time of year.



Varroa damaged brood. Courtesy The Food and Environment Research Agency (Fera), Crown Copyright.

b) give a detailed account of Integrated Pest Management

An integrated pest management strategy should be used throughout the year – this means using monitoring mite levels at regular intervals and using a variety of control techniques. Using several different control methods during the year makes it harder for the mite population to reach harmful levels. Good husbandry techniques, such as regular brood inspections, laying out apiaries to minimise the effects of drifting, and making sure your feeding techniques do not encourage robbing, are a starting point to help ensure healthy bees.

c) what treatments for Varroosis is permitted in the UK. Give a detailed account of how to carry out four forms of treatment.

- **Shook-swarm**

I have a blog post explaining how a shook-swarm works, '[A successful shook swarming](#)'. Ideally this is carried out in early spring, in late March – early April. The bees are shaken onto new foundation frames and all the old brood comb, containing lots of mites taking advantage of the new spring brood to breed, is burned. Sugar syrup is fed so the workers can draw out new comb quickly. This is a helpful non-chemical anti-varroa treatment because a large percentage of the mites are destroyed, followed by a short break in the queen laying while new comb is drawn out, which further cuts down on mite reproductive cycles.

- **Icing sugar**

The advantages of this method are that it's cheap and easy to do. It can also be done with supers on, unlike thymol based treatments like Apiguard which might taint the honey with their smell. The icing sugar works in two ways – by reducing the electrostatic charge by which the varroa cling to adult bees and by inducing the bees to groom. A flour dredger or a honey jar with holes punched in a lid work well. Work in pairs to do the treatment, with one person holding out each frame horizontally and another person dusting the sugar over each side.

As the treatment doesn't kill mites, but only knocks them off, it is only any good in a hive with an open-mesh rather than a solid floor. Since it only affects phoretic mites clinging onto adult bees, which only make up about 30-40% of the mite population, it is a low efficiency treatment and generally only reduces mites by about 20-30%. This may sound good, and is better than nothing, but really an 80% effective treatment (such as Apiguard or oxalic at the appropriate times of the year) is needed to have any real effect on mite numbers.

You cannot rely on sugar dusting alone to keep varroa levels down; if you do your colonies are likely to die. This is true generally of varroa control: you cannot rely on one treatment alone, but should use several different methods throughout the year.

- [Apiguard](#)

Apiguard, a natural thymol based treatment, can be given in August once your supers have been removed (otherwise your honey will stink of thyme). Starting Apiguard in August allows the hive to produce several generations of healthy bees before going into the winter. Two 50g treatment packs are given, one initially and the second 10-15 days later. Small colonies or nucleuses can be given a half dose.



The treatment works because the worker bees dislike the heavy thymol scent. They start removing the gel to clean the hive and remove the foreign smell, distributing it round the colony and killing off varroa mites in the process. Both adult mites and developing mites inside capped cells are affected, but honey bee larvae are safe. Tape up your varroa monitoring board whilst treating so the fumes stay in the hive. Apiguard should be done while the weather is still warm, as it is most effective – 90-95% effective – in the optimum conditions of an external ambient temperature of more than 15°C and active bees. This is because distribution of the Apiguard gel depends on the bees transporting it round the hive during the process of hive cleaning, and this activity increases as the external temperature rises.

- **Oxalic acid**

This treatment can be carried out once either in December or January whilst brood levels are either non-existent or low. It works by damaging the proboscis of the varroa mites, preventing them from sucking haemolymph from the host bees. Oxalic acid can be purchased pre-mixed in a sugar solution, which is the safest method.

Choose a bright and warm winter's day when the bees are loosely clustered, so that as they move inside the cluster they distribute the chemical onto the mites. Put a varroa monitoring board over the mesh-floor, as it feels good to count the number of dead mites dropped onto it over the next few days; sometimes I've counted over a hundred in a week. Warm the product slightly until it's lukewarm, remove the hive roof and crown-board, and trickle 5ml over each seam of bees. Do this very quickly to avoid chilling the bees too much. If the colony has been treated before and still has the same queen, it is unwise to use it again as it may harm the queen.