Varroa destructor – A summary

Varroa destructor is an external parasite of the honeybee Apis mellifera and feeds on the bees haemolymph (blood). Its natural host is the Asian honeybee Apis cerana which has evolved with the mite to develop a natural resistance. It has spread to the European honeybee by beekeepers taking colonies to the Far East to improve honey production. There was a natural transfer of the mite and beekeepers then moved the infested colonies around the world.

The Mite

The adult female mite is a reddish brown in colour, oval in shape and measures about 1.1mm x 1.6mm. It has 8 legs. It is a member of the arachnidae – a group containing spiders and other mites.

Life Cycle

Adult female Varroa mites enter a brood cell just before it is capped. Drone cells are preferred and the drone brood produces a kairomone (smell) which is more attractive to the mite than that produced by the worker brood.
The mite squeezes past the larva and becomes immobile, immersed in the larval food at the bottom of the cell. Only the breathing tubes (peritremes) are exposed. Once the cell has been sealed and the brood food consumed by the larva, the mite is released and then pierces the exoskeleton of the larva to feed on its haemolymph.

Egg laying begins about 60 hours after the cell has been sealed.
The first egg to be laid is haploid (7 chromosomes) and develops into a male. Subsequent eggs laid at about 24 hour intervals are diploid (14 chromosomes) and develop into females. The actual timing may vary due to external effects.
A 6 legged larva develops in the egg and hatches into an 8 legged protonymph. This then moults into a deutonymph and finally to the adult form.
Average numbers of female mites developing are as follows
Worker cell 2.2
Drone cell 4.2
Recent work at the Central Science Laboratory (CSL) indicates an average of 1.45 viable female mites from a worker cell.
The male mite does not eat and its sole purpose is to mate with its sisters and it then dies and remains in the cell.
The mated females live on the young host bee until they enter cells to reproduce.
In the summer mites live about 2-3 months but much longer in the winter. When they are on the adult bee they are described as phoretic. In summer mites can manage 2 reproductive cycles producing ~ 8 daughters if using drone brood.

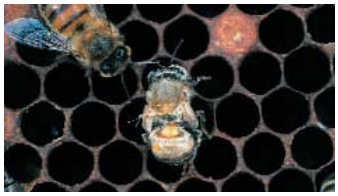
The effect on the colony

The number of mites per cell has a marked effect on the protein levels in the haemolymph and can reduce it by up to 50%. This causes a marked reduction in the final weight of the bee and its life span. If more than 5 mites are present the bee may not survive. If it does there will be marked damage to the wings legs and abdomen.
It takes about 3 to 5 years before the colony is weakened to a critical stage when there is a rapid decline in the adult population and severe brood damage. Death of the colony soon follows.
In heavily infested colonies the weakening of the bees and reduced life span disrupts normal hive routine leading to poor hygiene. At this stage bacterial and viral diseases can thrive and may be the cause of the terminal collapse.

Signs in the colony

It is unlikely that any signs will be noticed until the colony has been affected for about 3 years. It is very difficult to see the mite on the adult bee as it lives in the intersegmental region of the lower abdomen. As it breeds in the sealed cell it cannot be seen unless the cell is opened and the contents examined.
As the infestation progresses small malformed bees begin to appear and brood patterns are affected.

Signs of colony collapse



- A sudden decrease in adult bees
- Bees with deformed wings and abdomens
- Numerous mites on the remaining bees and in brood cells
- Abnormalities of brood
  - Bald brood
  - Poor brood pattern
  - Neglected and dead brood
  - Discoloured and partly removed brood

Please note that these changes are also seen in foul brood and need to be checked by a bee inspector.

Spread of Varroa

Robbing When a colony is severely affected it becomes a target for robbers. Not only do they take any stores but also pick up large numbers of mites.

Drifting Poor apiary design will allow young bees to ‘drift’ into neighbouring colonies. This is particularly important with drones are they are accepted into any colony.

Migration Bees from collapsing colonies abscond from their own hive with the robbers and increase the mite load in the robbers hive.

Swarming A swarm from an infested colony will always carry mites with it. It is essential to test any swarm for the mite and treat it before introducing it to the apiary. Swarms from feral colonies are no more likely to be free than those from managed colonies but can spread the mite naturally by 3-5km per year.

Beekeepers manipulative management by the beekeeper can transfer affected bees to other colonies in the apiary and to other apiaries. Migratory beekeeping can cause a rapid spread throughout a country.

Detection

1. Examination of the floorboard/hive debris

This method is not very reliable particularly when infestation is light. The small number of mites which drop are easily missed.

2. Uncapping brood

This is done on the drone brood during a normal colony inspection. Note that if the mites are very young they will not be as dark as the adults and easily missed. A frame of drone foundation can be used in the brood chamber to make examination easier and can also be used as a method of control

3. Bayvarol/Apistan test

With a sticky paper insert on the floor one strip of Bayvarol/Apistan is placed in the brood chamber and left for 24-48 hours. The strip can then be used on other colonies being aware that it could spread other diseases. Examine the insert carefully for the presence of the mites. This is an ideal method for testing swarms and if positive can be used as a treatment.

Monitoring

Once the mites have been detected the use of a Varroa floor can be used to determine natural mite drop.
Regular examination of drone brood can also be used.
Monitor more than 1 colony in the apiary to make sure you have a representative result.
The benefits of monitoring are to show if your control methods are working

Control

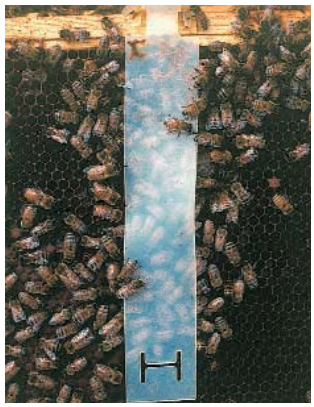
Biotechnical

Comb Trapping The queen is caged for 9 days on three combs in succession. These are left in the hive for a further 9 days to allow the mites to enter. The combs with the mites trapped in the sealed brood are removed and destroyed. To reuse the combs place them in a deep freeze for a couple of days to kill the brood and mites. Then uncap and wash the contents out of the cells.

Drone Brood using sheets of drone foundation in the brood chamber or qa super frame to allow drone comb to be drawn underneath it cause the queen to lay drone brood. This is more attractive to the mite and once capped can be removed and the contents disposed of.

Like the method above there is a danger that if you are unable to remove the sealed comb and it hatches you will have increased the mite population rather than reduced it.

Hard Chemical



Bayvarol (flumethrin) and Apistan (fluvalinate) are synthetic pyrethroids which act as a nerve poison. When used according to the manufacturers instructions they are more toxic to the mites than the bees. Both chemicals act on the same metabolic pathway so that resistance to one will mean resistance to the other.

It is important to remove the strips after the 6 week treatment to reduce the risk of resistance developing.

Soft Chemical

The only licensed soft chemical is `Apiguard which contains thymol. Used as per manufacturers instructions can obtain a 90-95% efficiency. It would be particularly useful used alternatively with the hard chemicals.

Organic acids (formic acid,oxalic acid and lactic acid) have shown efficiencies of up to 90% but are best used in broodless conditions as they can cause brood loss and even the loss of the queen.

Essential oils the effective chemical here is a terpene but is unreliable as a sole treatment and can be irritant.

Combination Therapy

Many of the methods described above can be used in conjunction with one another. Particularly using a biotechnical and chemical combination.

Great care must be taken if chemical treatments are combined as the combined effect may well be toxic

Resistance

This is when the mite will not respond to the treatment. To reduce the risk

- Apply treatments only when needed
- Always use the full recommended dose
- Always remove varroacide strips at the end of treatment
- Do not re-use strips (except as a diagnostic aid)
- Alternate treatments using unrelated authorised products whenever possible

Remember
If you use a product which is not licenced (or is used inappropriately) you could damage your bees and contaminate your honey and wax.
Honey samples are regularly taken from beekeepers to test for residues and if found could lead to a hefty fine.

Integrated pest Management
This is a well tried practice throughout agriculture and uses a variety of controls applied throughout the season. The benefits are

- Control at several points makes it harder for the mites to reach harmful levels Including a biotechnical method can slow mite reproduction and reduce the need for varroacides
- Using 2 or more unrelated varroacides will delay the development of resistance
- Control strategy can readily be adjusted to reflect changing infestation levels
- The table below sets out some examples

Treatment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
mesh floor												
drone brood trapping												
artificial swarm												
comb trapping												
Apiguard/formic acid												
Bayvarol/Apistan												
lactic/oxalic acid												

Pictures and table taken from CSL leaflet ‘Managing varroa’