Varroa mites (*Varroatosis* or *Varroosis*)

Source Apimondia, IZSLT - Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "Mariano Aleandri"
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Summary

Varroa destructor (Figure 1) is the mite responsible of *Varroatosis* (or *Varroosis*), an external parasitic disease that attacks honeybee colonies (adult bees and especially the brood). The varroa destructor causes major economic losses to the beekeeping sector because it is widespread and it has a strong adaptability to the treatments. This mite affects both the brood and the adult bees. It weakens the adult bees by sucking their hemolymph. The weakened bees are more susceptible to other diseases, especially viral pathologies. The first to suffer are the stronger colonies with more brood because of the higher possibility of the mite to replicate at the brood level.

Description

1. Morphology

The varroa destructor has a remarkably different morphology between the two sexes. Only varroa females cause the depriving parasitic action on bees. The adult female is reddish-brown with elliptical shape and it is on average 1.1 mm long and 1.5 mm wide. It has four pairs of legs that enable the mite to move very quickly inside the hive (Figure 1). The male of V. destructor has only a reproductive role and features a spherical body shape and whitish colour. It is smaller than the female (about 0.8 mm in diameter). It has a soft body, very similar to the immature stage of the varroa female (Figure 2). Males have a very short life. They are not able to survive outside of the capped brood, in fact they die within a few days and cannot feed themselves because their mouthparts are delegated exclusively to the transfer of sperm into the genital tracts of female varroa.

Figure 1. Dorsal and ventral view of a V. destructor female

The parasite at all developmental stages feeds of the adult honeybee hemolymph for sustenance, leaving open wounds on the bees. The quantity of hemolymph ingested by the mites varies depending on the time of year. The compromised adult bees are more prone to infections. Varroa can live up to five

days out of the hive if the environment is favourable for its survival (temperature, humidity). The life of the varroa female varies on average from two months in summer to up to five months in winter.

The number of mites that naturally fall every day on the hive bottom board (or diagnostic board) is a good indicator for the infestation rate in the hive. For counting the mites it is important to keep the diagnostic bottom tray clean. Females of varroa are easily detectable on the diagnostic board, especially after anti-varroa treatments as they provide a fair approximation of the actual level of infestation. In case of severe infestation, the mite could be visible directly on adult bees (Figure 3).

Figure 2. Male and female mating

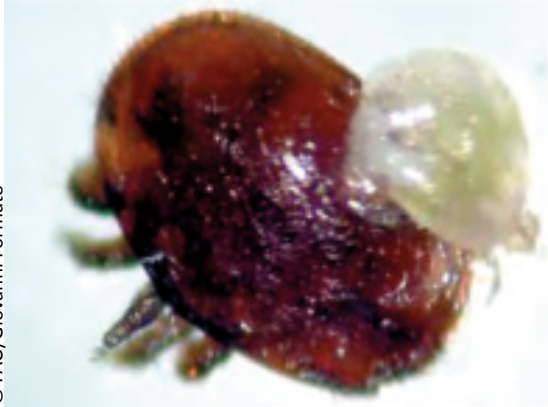


Figure 3. V. destructor female on a drone chest and on brood

2. Life cycle

The varroa life cycle has two stages: the phoretic phase during which they feed on the hemolymph (the equivalent of blood in bees) of adult bees, and the reproductive stage inside the brood cells. In fact, varroa replicates in brood cells and more intensively in male brood due to drones' longer metamorphosis cycle.

In one active season a single varroa female can complete up to a maximum of 10 cycles. During each cycle (every 30 hours) she lays two to six eggs on the bee's larva or on the cell walls. V. destructor eggs are oval, whitish and about half a millimeter long. From the first egg (haploid) will be born the only male. From subsequent eggs (diploid) will emerge only females.

The parasites colonize the brood when the bee larvae have six days of life. Within 24 hours an hexapod larva develops. After another 24 hours became a protonymph and emerges from the egg (Figure 4) The newly born varroa parasites start immediately feeding on the developing bee. The varroa reproduction period is related to the duration of the metamorphosis of the pupae in the brood cells, which are 12 days for the worker bees and 15 days for the drones. If the varroa male dies before mating, females remain irreversibly sterile and unable to procreate because of an involution of their genitalia.

Figure 4. Protonymph (left), deutonymph (center), adult (right) of Varroa destructor female

The varroa feeding site is always located in the abdomen of the pupa in order not to compromise its survival. At the time of the bee's emergence from the cocoon, the varroa offspring is inside the cell. The fertilised varroa adults that have just left

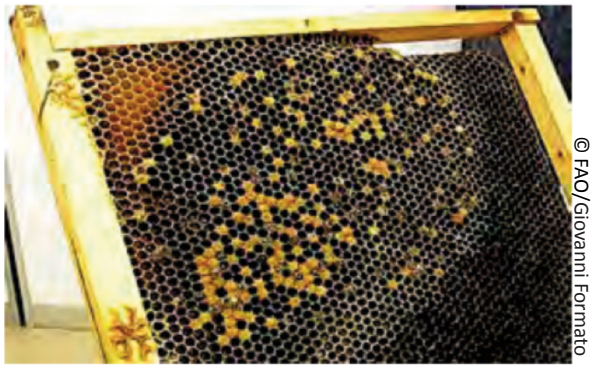
the cell will try to get on adult bees, passing to the phoretic phase, which is the stage during which they feed on the hemolymph of adult bees. Varroa immature females and the males are instead unable to survive outside the cell, because they do not have mouthparts that can pierce the integument of bees.

3. Symptoms

In bees colonies contaminated by varroa it is possible to observe:

- the parasites on the body of adult bees;
- scattered brood (index of high mortality of larvae) (Figure 5);
- a typical stench of dead brood;
- smaller bees (Figure 6);
- bees with deformed wings (Figure 7);
- clusters of bees restless and unable to fly;
- weakening of the colony as it becomes less populated and due to the reduced capacity of the bees in the collection and storage of supplies; and
- abnormal swarming (especially at the end of the season) and replacement of the queen.

Figure 5. Comb with scattered brood



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The average lifespan of adult bees in heavily parasitised colonies decreases ranging from 25 percent to 50 percent. Varroa not only sucks the hemolymph of the larvae and adult bees, it also causes little wounds on the body of the bees and makes them more vulnerable to other pathogens such as viruses, fungi and bacteria. This effect is augmented also by the possibility of viral multiplication in the salivary glands of varroa.

Figure 6. Smaller bee (left). Healthy bee (right)

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Figure 7. Healthy honey bee with normal wings (left). Parasitised honey bee with deformed wings (right)

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4. Transmission

This parasitic disease is transmitted very easily by direct contact from infested to healthy bees. For example this can happen during the visit of a flower, by drones who can freely enter different hives, during robbing of infested hives, as effect of drifting of infested worker bees among adjacent hives, etc. But the transmission may also

occur by the direct action of the beekeeper, for example by transferring parasitised brood combs (Figure 8) from one colony to another or by the migratory beekeeping practice.

Moreover, another factor of varroa transmission is linked to migratory beekeeping due to the transfer of heavily infested colonies or due to the delayed application of treatments. In fact this practice increases exponentially the physical contact between healthy and infested colonies. Hence the importance of simultaneous and co-ordinated anti-varroa treatments both within the same apiary and between closely located apiaries.

Figure 8. Combs with drones affected by varroa

5. Monitoring

Since the evolution of the disease is not very evident, the monitoring of the number of parasites in each hive through periodic inspections is very important.

The diagnosis of infestation needs to be carried out specifically.

- Check the number of parasites that fall on the hive bottom.
- Check the number of varroa mites affecting the male brood (which is the most affected).
- Check if the parasites are visible to the naked eye on adult bees, meaning that there are high levels of infestation.
- Apply the OIE endorsed method by which adult bees are dipped in alcohol and stirred in order to separate the varroa mites from the bees.
- Apply the powder sugar empirical method, which entails sprinkling powder sugar on bees collected in a jar and shaking it to cause the varroa to fall through a mesh as this allows to count the mites easily.

There are some bee subspecies which have the so-called hygienic behaviour by which they groom themselves and are able to contain the varroa infestation level (for example *Apis mellifera capensis, Apis mellifera intermissa*).

5.1 Warning

Please consult the relevant authorities or expert beekeepers in your country for the most efficient treatments and the authorised products in your region / country. It is important to use the treatments properly and according to the prescriptions to avoid creating resistance of varroa mites to the products. Some products can only be used after the harvesting of honey as they can leave residues in the honey.

6. Further reading

- Comini A., Pietropaoli M., Giacomelli A., Formato G. 2013. Varroa destructor: morfologia e ciclo biologico. Published by Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “M. Aleandri”, Italy, 2013
- Formato G., Vari G., La varroatosi. In “Aspetti igienico-sanitari in apicoltura” published by Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “M. Aleandri”, Italy, August 2007, 11-1

- Ellis J., Honey Bee Research and Extension Lab at the University of Florida, Video Field Guide to Beekeeping – Varroa Mites, January 2012. URL

7. Related/associated technologies

- Good beekeeping practices: 8409.
- Main diseases of honey bees: 8412.
- Nosemosis: 8413.
- AFB (american foulbrood): 8417.
- EFB (european foulbrood): 8418.
- Bee viruses: 8419.
- Strategy for integrated varroa management: healthier colonies through brood removal: 8401.

8. Objectives fulfilled by the project

8.1 Women-friendly

The technology is easy to use, it is affordable, it is light and manageable, it supports tasks specifically assigned to women; advisory services target women's needs and time availability.

8.2 Resource use efficiency

This technology allows for improved management of beekeeping and ensures better colony health.

8.3 Pro-poor technology

With improved management and improved bee colony health, this technology provides beekeepers with additional income and a source of food through improved quality of products such as honey.