



VARROA MITE (VARROASIS) AND THEIR MANAGEMENT IN APICULTURE

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Introduction

Beekeepers encounter significant challenges from parasitic mites, which pose serious threats to honey bee populations. Effective management of these mites is essential for successful beekeeping with *Apis mellifera*. In Asia, numerous mite species are native and can thrive on various types of bees, making eradication efforts difficult, as feral nests of native bees act as reservoirs for re-infestation.

While not all identified mite species pose a threat, the Varroa mite, a natural parasite of *A. cerana*, has been especially harmful to *A. mellifera* since beekeeping development began in the region. Infestations of Varroa can lead to decreased bee populations and honey production, and in severe cases, may result in colonies abandoning their hives.



Figure 1. Varroa mites on bee

Varroa Mite

Varroa mite (*Varroa destructor*) is a relatively large mite, easily visible to the naked eye, with adult females measuring about 1.6 x 1.1 mm. They have a distinctive shape, appearing wider than they are long, and are reddish-brown and shiny, with a dorsoventrally flattened body

covered in short hairs. Adult females are mainly found inside brood cells and move rapidly on the comb's surface, while adult males and all immature stages (eggs, protonymphs, and deutonymphs) are typically confined to the brood cells.

Symptoms

Adult female Varroa mites use their pointed chelicerae to penetrate the delicate intersegmental membranes of bees and feed on their hemolymph. A honeybee colony affected by Varroa mites is referred to as being in a state of varroasis. When multiple female mites infest a single brood cell, the resulting brood may decay and exhibit deformities such as shorter abdomens or malformed wings. If only one mite infests a cell, symptoms might be less noticeable, but the lifespan of the bees can significantly decrease. Infested bees often have reduced fat bodies, impairing gland function and increasing vulnerability to pesticides.

Additionally, male honey bees may experience significantly reduced semen production. The mites compromise the bee's natural defenses, aiding in the transmission and replication of viruses through their saliva, which thrives in areas affected by Varroa. Colonies severely impacted by mites often dwindle to just a few bees and the queen, with many bees dying during foraging or drifting to nearby colonies, which in turn experience mite population growth before succumbing as well. This cycle can lead to significant colony losses. Adult bees with malformed wings crawling on the comb or at the hive entrance typically indicate a severe infestation.

Approaches for examining mites

- a) Direct sampling through the random opening of brood cells, especially drone cells, is the most reliable but also the most time-consuming method for detecting Varroa mites. This approach is simpler for older larvae and pupae; the broods can be extracted from the cells using fine forceps, allowing for examination for mite presence. To assess the severity of mite infestation, between 100 and 200 cells should be examined. For adult bees, they can be removed from the brood comb and placed in jars containing chloroform, ether, or alcohol on a piece of cotton wool. The bees are then inebriated, causing the mites to crawl onto the glass walls.
- b) Returning foragers can also be captured by hand at the hive entrance and exposed to sunlight, which helps reveal any mites clinging to their abdomens while foraging.
- c) Another method involves using specially designed trays made of zinc, plastic, or wood, sized to fit the bottom board of the hive, with a white or light-colored floor. These trays have a mesh screen with openings smaller than 2 mm, positioned about 1 cm above the tray floor. They are placed on the hive's bottom boards and inspected 1 to 3 days later for dead mites, as the screen prevents the bees from removing all the dead parasites from the hive.

Two primary techniques for controlling V. destructor are:

1. **Total Control:** Chemical control methods are commonly used but may not be very effective and can have indirect negative effects on honey bees. Organic acids such as formic acid and essential oils like thymol can be applied to brood-producing colonies.

- i) **Formic Acid:** This acid is effective at killing mites in sealed brood chambers. It is recommended to allow formic acid to evaporate within colonies containing sealed brood for 2 to 3 weeks, killing mites as they emerge from the brood. The ideal outdoor temperature for this treatment is between 12°C and 25°C. To minimize harm to the bees and larvae, formic acid should be applied late in the afternoon using a sponge or absorbent material. The procedure involves taking a 50 ml solution of 60% formic acid and applying it to the sponge for each comb, adjusting the number for smaller combs. A grid should be placed above the sponge at the bottom of the hive to prevent the bees from coming into contact with the acid, ensuring it's positioned as far from the brood as possible. This application can be repeated after 10 days.
- ii) **Oxalic Acid:** This acid works by direct contact with bees rather than through evaporation. The procedure consists of dissolving 32 grams of crystallized oxalic acid (dehydrate) in 1 liter of sugar water. Due to safety concerns, protective eyewear and acid-proof gloves are mandatory, along with a mouth protection device. Depending on the colony size, 20 to 30 cc of the solution is injected into the bee ways. Repeating this process can sometimes harm the bees, but there are applicators available for evaporating the acid.
- iii) **Lactic Acid:** This acid is a preferable option for treating bees, causing fewer issues in hotter climates. However, each comb must be individually removed and sprayed with the acid, with a dosage of 8 ml of 15% lactic acid per comb side. This treatment can be performed

twice, with a 7-day interval between applications.

- iv) **Ethereal Oils:** The only essential oil effective against Varroa mites is thymol. It can be applied either as a commercially available formulation or in crystal form. The procedure involves placing 5 grams of thymol crystals in a gauze bag atop the frames for 2 weeks.

2. Control by Hive Manipulation Techniques:

Since Varroa mites complete their life cycle on bee brood, and they prefer drone brood over worker brood, empty frames can be placed into the colonies to encourage drone brood production. Once the drone cells are sealed, the frames containing trapped mites can be easily removed and destroyed.