

# Acarine Disease or Honeybee Tracheal Mite

Khalil Hamdan, Apeldoorn, The Netherlands

Acarine disease is caused by an endoparasitic mite called *Acarapis woodi*, which belongs to the Arachnid family, which includes spiders. The mite lives, multiplies and feeds in the bee's breathing tubes (tracheae), primarily in the large prothoracic tubes. Acarine disease only affects the adult honeybee and does not affect the immature bees (brood). Worker bees, drones and queens are all susceptible to infestation. It is a parasitic disease, but less severe than varroa mite. The mite population is seasonal. There is an autumn buildup, a winter peak, and a summer decline. The greatest losses of both individual bees and of colonies are in winter and early spring. A bee colony in which more than 30-40% of the bees are infested with the mite is less likely to survive than a lightly infested colony. Bee colonies vary in their susceptibility to acarine mites due to differences in their genetics. Bees from strains having resistance usually have very low infestation. The hybrid Buckfast bees are known to be highly resistant to acarine mite.

## The Mite

The acarine or tracheal mite is a tiny microscopic creature, whitish in colour and oval in shape with a few long fine hairs on the legs and body. An adult mite has 4 pairs of legs and an immature mite has only 3 pairs. The mite has suckorial mouthparts for feeding on the host.

*Acarapis woodi* spends its entire life cycle within the breathing tracts of the bee. The only time it will be on the outside of the bee is when the mated mite leaves the host bee to enter a new host. The mite cannot live for more than a day or two outside of the bee. It is specific to the honeybee and does not have other hosts.

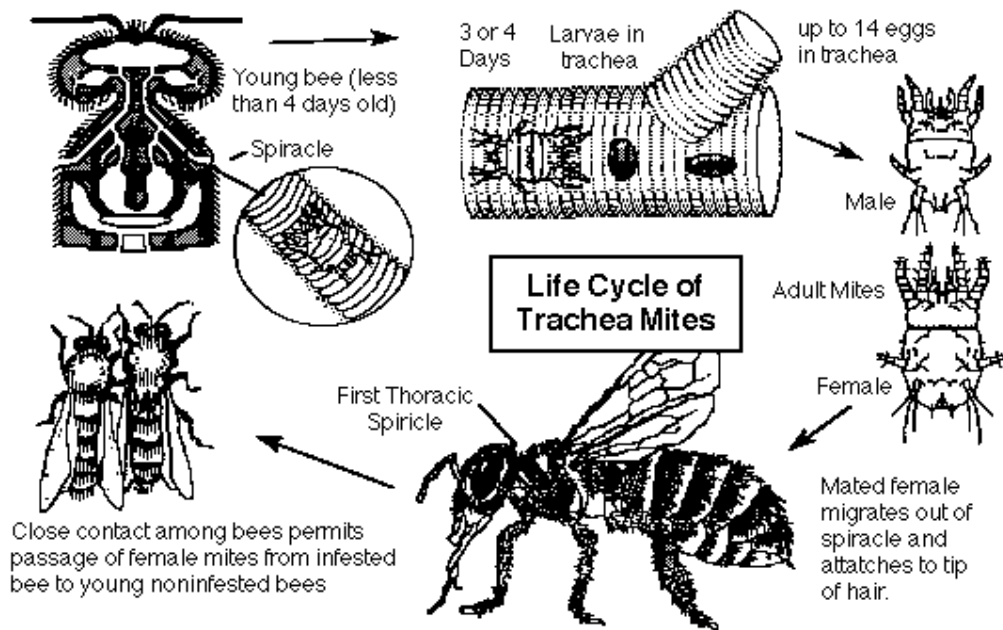
The mites prefer young bees, less than 7 days old before their chitin hardens and rarely invade the trachea of older bees thus the problem does not disseminate when there is no breeding.



**Acarine mite (*Acarapis woodi*)**

## Life Cycle

The life cycle of the *A. woodi* takes place in the breathing tubes. The developing stages of the mite are egg, larva, nymph and adult. The mated female mite enters the breathing tubes through the first spiracle (breathing opening) in the thorax, attracted to it by the puffs of air produced by the respiratory system of the bee. The mite starts to lay eggs. Each female lays 5 to 7 eggs which hatch in 3-4 days. The nymphs and adults pierce the breathing tube wall with their mouthparts and suck the bee's blood and interfere with the oxygen exchange in the breathing tubes. The adult mites mature in about 14 days. Mating occurs within the breathing tubes where the mites develop. Once mated, the female mites leave to the external surface of the bee to locate a new bee to begin the reproductive cycle again.



**Diagram of tracheal mite life cycle**

Image credit: maarec.psu.edu

## Spread and Infestation

Mites are spread within the hive as a result of direct contact between bees. Mites transfer quickly from bee to bee.

The infestation is spread from one hive to another by drifting of the infested bees.

Beekeepers also contribute in the transfer of mites by combining or dividing infested colonies.

Swarms from infested colonies and movement of colonies by migratory beekeepers, and the sale of infested packages of bees and queens are factors in the dispersal of this mite.

## Effects

- The acarine mite impairs flight efficiency of adult bees.
- Increases mortality of colonies during winter and early spring.
- Reduces longevity of infected bees.
- Reduces brood rearing, which leads to a reduced population of bees in the spring.
- Decreases honey production.

## Symptoms of Infection

Acarine disease is a winter problem. The effects of the disease are seen in early spring when the colony population consists of mainly older bees. It is merely the old and heavily affected bees that are killed. Bee colonies rarely show signs of infestation in summer or autumn. It is difficult to detect the disease when the infestation is light or in its early stages. The symptoms of heavy infestation include:

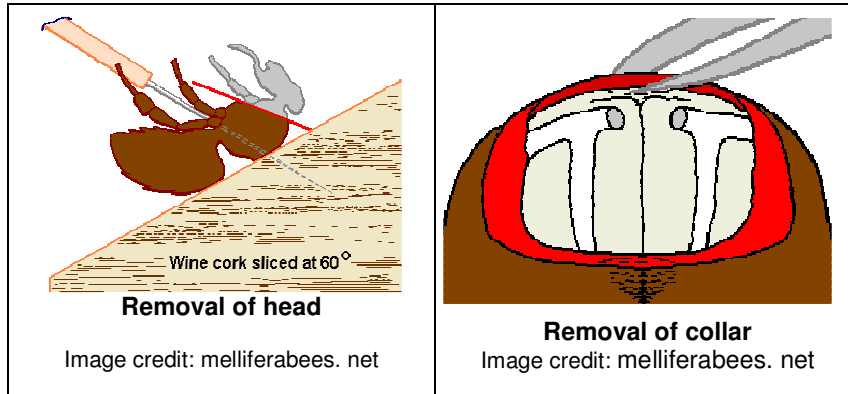
- Colonies die or have a dwindling population in late winter and spring.
- In cases of severe infestation, a large number of bees crawl about near the entrance of the hive unable to fly. This is seen when they attempt to fly when a warm day comes in late winter or early spring after the bees have been confined to the hive for a long time.
- Bees with acarine mite infestation may have one hind wing sticking out at right angle from the body.
- Acarine infection can be suspected if there is a large number of dead bees in the winter and there is enough honey in the hive.

Acarine mites are undetectable with the naked eye. The only certain way to detect mite infestation is to examine bees for the mite's presence using a binocular dissecting microscope or higher power hand lens. The thorax of suspected bees can be opened to expose the main tracheae where the mite is commonly found.

## Detecting Acarine Mite

A sample of 30-50 bees is collected from the suspect colony. These should be bees crawling in the front of the hive. They may be placed in a matchbox or in a plastic bag. Live bees must be killed in a deep freeze at -20 °C (- 4 °F) or with ethyl alcohol and examined one by one.

The bee is placed on its back on a cork glued to a baseboard. A double needle is thrust at an angle through the thorax, between the second and third pairs of legs as shown at the drawing below.



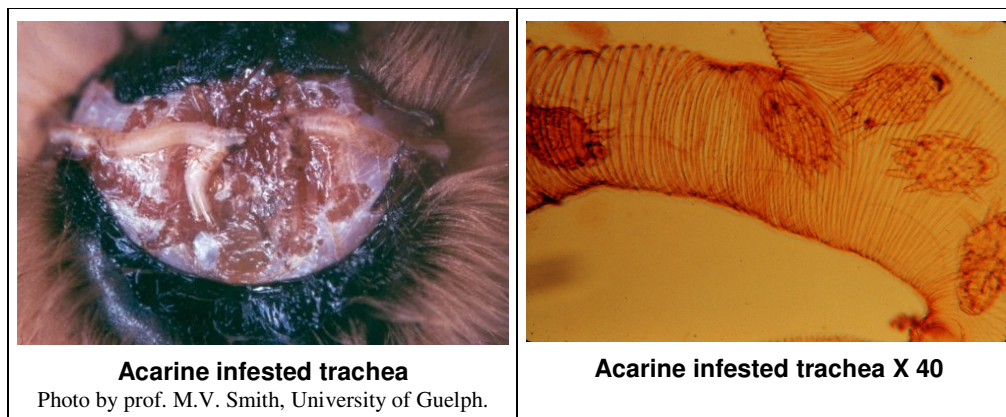
With the bee now firmly impaled, head and front legs are cut off with a blade. The collar of the thorax is removed with fine forceps or tweezers to expose the entire main tracheae for examination. Each trachea is examined under a dissecting microscope at X18-20. Clear or white trachea indicates there is no infection. If it is orange, brownish or dark the bee is infected with acarine.

In light infestations, mites can affect one trachea while heavy infestations involve both tracheae. Light infestations are near the spiracle opening.

For quick examination of a few bees, remove the head and first pair of legs. With a fine pair of scissors or a razor blade, cut a thin transverse section of the prothorax to obtain a disk (chitin ring) contains the main breathing tubes. Place the disk on a microscope slide and add a few drops of lactic acid. This helps to separate the muscle.

With the aid of a dissecting microscope, separate the muscles with forceps, remove the trachea, and examine the trachea at any suitable magnification.

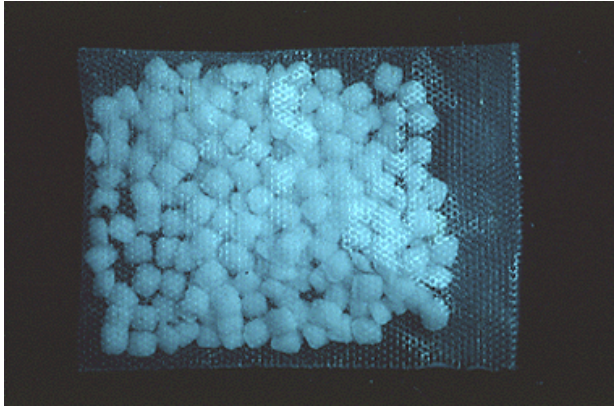
At low magnifications the mites are visual on the wall of the trachea as small oval bodies, with higher magnifications (50X magnification) the mites can be seen more clearly.



## Treatment Methods

### Menthol

Menthol crystals are used as a fumigant. Menthol is obtained from peppermint plant *Mentha piperita*. The menthol crystals are placed in a small flat packet formed from plastic screen. Each packet contains 50 grams (2 ounces) of menthol.



#### Menthol packet

Image credit: maarec.psu.edu

The crystals change into vapour (gas). The evaporation rate of menthol depends on temperature. Temperature must be above 15.5 °C (60 °F) and below 89, but ideally in around 21 °C (70 °F). When temperature is over 30 °C (90 °F), the menthol may evaporate quickly, causing the bees to stand outside the hive abandoning brood rearing activity for the day. In colder weather, the menthol will not evaporate in sufficient amounts and the treatment will not be effective.

Menthol vapour is heavier than air and should be placed inside the hive, on the top bars above the brood nest, but above a temperature of 27 °C (80 °F) the menthol should be placed on the hive floor, so some of the vapours pass out of the hive entrance. If a screened bottom board is used the board should be closed off.

As the menthol evaporates and its vapours fill the hive, the bees inhale the fumes in, and the mites are killed. Menthol vapour will kill adult mites, but does not kill eggs or larvae, therefore it must be present in the hive for two weeks (the development time of a mite) to kill all adult mites as they mature.

the dosage recommended for treating colonies for acarine mite infestation is 50 grams (2 oz) for each average 2-story hive.

Treatments should be done every autumn and early spring when daytime temperatures are expected to be above 15.5 °C (60 °F).

The duration of treatment should be between fifteen and twenty five days with entrance reduced. Replace the menthol as needed during the treatment period.

Treatment must end one month before the first nectar flow to avoid contaminating marketable honey.

It is important that all colonies in the apiary receive mite treatment at the same time. Untreated colonies serve as sources for mite reinfestation and reduce mite treatment effectiveness.

### **Treatment with grease patties**

These patties are made from 1 part by weight of solid vegetable shortening (lard) such as Crisco mixed thoroughly with 2-3 parts of granulated sugar. Another formula is 1 part liquid vegetable oil to 3 parts granulated or powdered sugar. Some add natural extract oils such as spearmint and lemon grass to the mixture to make the patties more attractive to the bees. The grease or oil masks the smell that the mites use to find a young bee.

The patty is formed similar to a hamburger about 100mm (4 inches) in diameter and placed into the hive on wax paper. One patty per hive is placed centrally on top bars in the brood box. The bees come to eat the sugar and get oil on their body, which interfere with the mite transfer between bees and the mite's ability to reproduce. As a result, the mite eventually dies.



### **Grease patty**

Image credit: maarec.psu.edu

Grease patties should be used in early spring and again in late autumn for best results. Additional patties can be given to the bees if consumed.

### **Apiguard**

Apiguard is used for the control of both acarine mites and varroa mites in several countries. It is a natural product and has no harmful effect on brood or

adult bees. The active ingredient is thymol, derived from the plant thyme. Apiguard is a slow release gel and comes in 50 grams (2 oz) aluminium trays.



1. Open an Apiguard tray



2. Put the tray on top of the brood frames



3. Replace with a second tray after two weeks



4. The treatment lasts about 4-6 weeks

Image credit: Vita Europe Ltd

### **Flower of sulphur**

Flower of sulphur is used by some beekeepers against acarine mites. A teaspoonful of the fine powder is added to a lit smoker and puffed on the bees late in the evening after flying has ceased and the entrance of the hive closed for about 20 minutes. The fumes of sulphur will enter the breathing tubes of the infected bees thus killing the mites.

**Tip:** The best treatment for acarine mite is to treat the colony and then requeen with a queen bred for acarine mite resistance.