

TRACHEAL MITES

MAAREC Publication 4.2
February 2000

Bee colonies were first discovered with tracheal mites (*Acarapis woodi*) in the U.S. (Texas) in 1984. The bee colonies within which the tracheal mites were found were quickly destroyed (depopulated) according to the policy at that time but they continued to spread.

LIFE CYCLE AND SPREAD OF TRACHEAL MITES

The life cycle of the tracheal mite is relatively well known. The mites live in the tracheal tubes (breathing airways) of all 3 honey bee castes. Heavy mite populations result in sick bees that don't work as hard nor live as long as healthy bees. Young immature mites pass from the host parent bee to a newly emerged house bee of the same hive. They apparently can "tell the difference" between a young adult bee and an older adult bee – perhaps using substances from the exoskeleton of the adult honey bee.

Tracheal mites pass quickly from bee to bee and once an infestation is established, the mites pass rapidly from colony to colony in an apiary. This rapid movement was demonstrated from a study in North Carolina in which 12 mite infested and 12 non-mite infested colonies were established on a remote location on the outer banks of North Carolina, 20 miles north of Cape Hatteras. After 2 years, only 2 mite infested colonies had survived (they were weak and unproductive) while 4 of the original non-infested hives were alive (but only 1 was apparently mite free). The study found that once a bee colony is infested it remains infested with mites, although the numbers fluctuate during the year with the highest level during the winter. Another study from Minnesota showed similar results with only 11 of 75 colonies surviving after 22 months in an apiary initially with a low mite population in 1/3rd of the colonies.

The tracheal mite is very difficult to detect – in fact, we often don't realize the level of bees with mites until there is heavy colony death over winter. Our recommendation is to assume colonies have tracheal mites whether they are sampled or not. The illustration shows their structure. The body is oval, widest between the second and third pairs of legs. A few long fine hairs are present on the body and legs. It has elongate, beaklike mouthparts for active feeding on the host.

TRACHEAL MITE LIFE CYCLE

The entire mite life cycle is spent within the trachea or breathing tubes in the thorax of adult honey bees except for

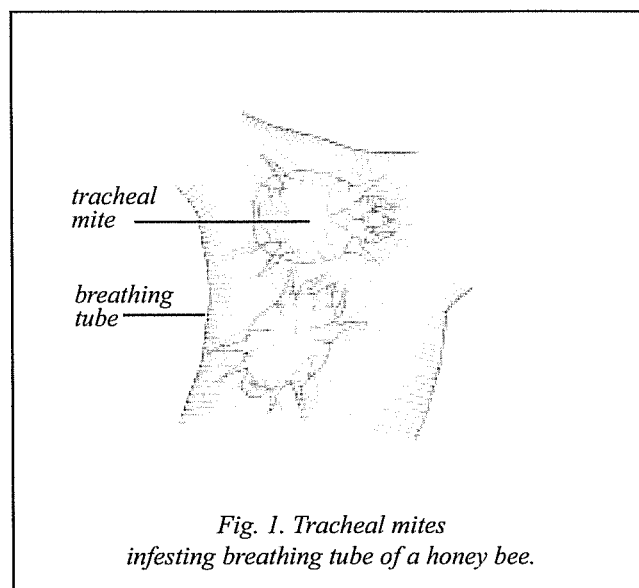


Fig. 1. Tracheal mites
infesting breathing tube of a honey bee.

brief migratory periods. Mites are also occasionally found in air sacs in the thorax and abdomen. Within the trachea, the mite reproduces and feeds. Mites penetrate the breathing tube walls with their mouthparts and feed on blood. Normal thoracic tracheae are clear, colorless, or pale amber in color. Infested tracheae deteriorate progressively and show patchy discoloration. In a slight infestation, one or both tracheal tubes contain a few adult mites and eggs which can be detected near the spiracular openings. The tracheae of severely infested bees have brown blotches, with brown scar tissue, crustlike lesions, or they may appear completely black, and are obstructed by numerous mites in different stages of development, as well as mite debris. As a result of mite feeding, the blood of infested bees has a higher than normal bacterial count.

Within 24 hours after worker bees emerge from their cells, female mites migrate into their trachea by passing through the first thoracic spiracle and remain there for life's duration or until their host dies. Each female mite lays 5 to 7 eggs within 3 or 4 days after entering the trachea and continues to lay eggs throughout her life. The eggs require 3 to 4 days to hatch. The life cycle consists of an egg, larvae, resting stage, and adult male or female. All stages of the mite may be found in older bees.

Mites are spread within the colony as a result of bee-to-bee contact. Mated female mites leave the breathing tubes where they develop and climb to the tip of a body hair. As bees come in contact with one another, the mites attach themselves to the hairs of a passing bee and enter the tracheae through the thoracic spiracles. If the mite does not locate a new host within 24 hours, it will die. Mites leave the trachea after the death of the bee. Drifting bees between hives and swarms from infested colonies are ways that the mite can be spread within the apiary and between apiaries.

Large variations in susceptibility to infestation exists among bees. Worker bees become rapidly less susceptible to infestation as they age, and bees more than 9 days old rarely become infested. Queen honey bees also exhibit a rapid decline in susceptibility to mite infestation with increasing age.

When tracheal mite infestation is light or in its early stages, honey bees are not adversely affected. Infestation levels tend to decline in colonies when they are actively foraging. Colonies rarely show signs of infestation in summer or fall. The disease however, shortens the lives of adult bees, affects flight efficiency, and causes a large number of crawling bees that are unable to fly. In extreme cases, colony populations dwindle and, ultimately, the colony dies. Colonies are most affected during winter confinement and early spring when mite infestations are at a maximum as the bee population is comprised of older bees. Heavily infested honey bees are killed by the mite – colonies that have more than 30 percent infestation die before spring allows more brood rearing and resumption of foraging.

TRACHEAL MITE CONTROL

Menthol crystals are currently the only approved chemical treatment for tracheal mites in the United States. Menthol is a crystalline alcohol obtained from oil of peppermint. It is commonly used for odor and cooling properties in items such as cough drops, candies, cigarettes, and shaving creams. Menthol crystals start to evaporate at about 70°F – the best evaporation rate is between 80 and 85°F. Menthol is a fumigant and must change from a solid crystal state to a gas to be effective.

Menthol treatment effectiveness depends on temperature, formulation (crystals or pellets), dosage, colony size, condition of equipment, position within the hive, and exposure time. For best results, crystals should be placed in 7-inch square (1.8 oz) plastic screen packets, with the mesh size small enough to keep the crystals inside. When daily temperatures are 60°F or less, the packets should be placed on the top bars of the hive. If the temperature reaches 80°F, the packets should be on the bottom board. Placement of the packets on the top bars when it is too warm outside may drive the bees out of the hive. Do not use menthol during surplus honey flow periods. Fall treatment is cost effective – spring or summer

treatments are of little value. Menthol does not free a colony of mites but brings the level of mites down so the bees can still be productive.

Early menthol treatments incorporated menthol into cardboard by melting it with a grease (vegetable shortening [Crisco®], or petroleum jelly) to attempt to increase vaporization of the menthol and obtain a continuous release of the chemical into the hive environment. This technique is one similar to use of “extender patties,” a method preferred by larger beekeepers to administer terramycin drugs in a grease/sugar mix carrier to bee colonies, especially in the Western U.S.

As it turns out, it was not entirely the menthol that provided tracheal mite control. The vegetable shortening (or vegetable oils) themselves interfere with tracheal mite transfer between bees. If this grease/oil is released into the bee hive over a period of time, some degree of mite control is possible without use of a pesticide. There are 2 formulas in use:

- 1 lb. vegetable shortening (such as Crisco®)
- 2 lbs. granulated sugar
- or
- 1 lb. vegetable oil
- 3 lbs. granulated (or powdered) sugar

The grease/oil and sugar needs to be blended well so the patty doesn't crumble. This technology is new and needs to be checked so use caution if you try it. Apparently “oiling the bees” helps interfere with mite transfer to young adult worker bees. Grease patties should be used in early spring and again in the fall for best results.

Menthol and grease patties, plus development of bees more resistant to tracheal mites, is our current management plan. During the early 90's, a miticide (Mitcur®) was available for treating tracheal mites. It is no longer registered for use in bee hives.

MAAREC, the Mid-Atlantic Apiculture Research and Extension Consortium, is an official activity of five land grant universities and the U. S. Department of Agriculture. The following are cooperating members:

University of Delaware
Newark, Delaware

University of Maryland
College Park, Maryland

Rutgers University
New Brunswick, New Jersey

The Pennsylvania State University
University Park, Pennsylvania

West Virginia University
Morgantown, West Virginia

USDA/ARS
Bee Research Lab
Beltsville, Maryland

Requests for information or publications should be sent to: MAAREC, 501 ASI Building, University Park, PA 16802 Phone: (814) 865-1896 Fax: (814) 865-3048 Web site: <http://MAAREC.cas.psu.edu>

This publication is available in alternative media on request.

The mention of trade names or commercial products in this publication is for illustrative purposes only and does not constitute endorsement or recommendation by the Mid-Atlantic Apiculture Research and Extension Consortium or their employees.

The U.S. Cooperative Extension Service and the U.S. Department of Agriculture provide Equal Opportunities in employment and programs.

Participants in MAAREC also include state beekeeper associations, and State Departments of Agriculture from Delaware, Maryland, New Jersey, Pennsylvania and West Virginia.

MAAREC Publication - 4.2. Author: Dewey M. Caron, University of Delaware.