



## Tracheal Mites

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The tracheal mite, *Acarapis woodie* (Rennie) (Fig. 1), is a parasite that lives and reproduces inside the tracheal tubes (breathing tubes) (Figs. 2 & 3) of adult bees. The mites are microscopic and infect workers, queens, and drones. The infection begins when the mites enter the trachea via the first thoracic spiracle of young adult bees (Sammataro et al. 2013). Adult mites pierce the tracheal wall with their piercing-sucking mouthparts and feed on the hemolymph (insect blood), which depletes the insect of nutrients. High numbers of tracheal mites reduce the bee's ability to breathe and may interfere with gas exchange and the insect's oxygen requirements for flight muscles (Delfinado-Baker 1988, Harrison et al. 2001). Tracheal mite infections can make the bees more susceptible to pathogens, which decreases their lifespan and reduces honey production as well as winter survival (McMullan and Brown 2009, USDA 2016).

There are three different species of mites in the genus *Acarapis*: *A. woodie*, *A. dorsalis*, and *A. externus*. Only *A. woodie* mites infest the trachea and are a pest of honey bees. The other species are found on the exoskeleton of the European honey bees and feed on the hemolymph (Somerville 2011, USDA 2016). However, these species do not appear to have as negative of an impact on the bees as *A. woodie*.

### The initial discovery of infection to the current outlook

In 1905, an unknown disease began afflicting nearly every bee hive on the Isle of Wight, United Kingdom, resulting in an almost 100% loss of the colonies on the island (Adam 1968). Although the cause was unclear, the disease was named the Isle of Wight Disease. In 1921, Rennie discovered and described the tracheal mites, which he believed to be the culprit of the Isle of

Wight Disease. This disease was later renamed acarine disease.



Fig. 1. Tracheal mite. Pavel Klimov, Bee Mite ID, USDA APHIS PPQ, Bugwood.org

After their initial discovery on the Isle of Wight, tracheal mites spread throughout Europe during the early to mid-1900s. To prevent the tracheal mite from invading North America, the United States government implemented the Federal Honey Bee Act of 1922, which restricted honey bee importation from countries that had the mite. However, the mite was discovered in Mexico in 1980, then in Texas in 1984 and Kentucky in 1989. It quickly spread throughout the U.S., and initial mite infestations resulted in 100% colony loss in some apiaries (Moore et al. 2015). At present, the mite isn't thought to be harming hives in the U.S. The reasons for the decreased virulence may be due to honey bees' increased resistance (Adam 1968) or the treatments used to treat Varroa mites

help control the tracheal mites.

Tracheal mites are found throughout all honey-producing regions of the world, except Australia and New Zealand. They were not discovered in Japan until 2010, and a survey in 2018 survey revealed that 40% of hives were infested (Maeda and Sakamoto 2020). A similar survey in Morelos, Mexico, determined that 7% of colonies in that state are infested (Figueroa 2018). In Tennessee in 2019, researchers found a very low incidence of tracheal mites, with only 20 infected hives in 40,000 colonies surveyed (Studer, M, Personal Communication 2022). It is believed that there are merely low levels of mites across the United States, but the exact percentage of infestations is unknown (Moore et al. 2015).



Fig. 2. Tracheal mites in the tracheal tube. Pest and Diseases Image Library, Bugwood.org

## Life cycle

The lifecycle of the tracheal mite begins when a female mite enters a young bee's trachea via the thoracic spiracle. Once inside, she will lay up to seven eggs in about four days. A female can lay up to ten eggs during her lifetime. The eggs hatch in three to four days. Males will develop through the stages of larva, nymph, and adult in approximately 12 days. Females complete development in about 15 days. The males and females mate in the trachea. Newly mated females leave the trachea to search for a new (Hood 2000).

Tracheal mite populations usually build up in cooler months because the bees cluster in the colony. The

proximity of the bees clustering allows the mites to easily spread to a new host (Moore et al. 2015).

## Symptoms and Diagnosis

Tracheal mites are difficult to diagnose because they are only about 150  $\mu\text{m}$  (1/200 of an inch) long. Diagnosis requires dissection of the bee's tracheal tubes under a microscope (Moore et al. 2015). There are a few common symptoms of trachea mites, but they are not diagnostic or unique. These symptoms include fecal spots on the front of the hive, a distended abdomen, and crawling bees (Moore et al. 2015). K-wings are also a symptom and occur when the wings no longer clip together, causing the rear wings to rest separate from the forewing (Fig. 4). When viewing bees from the top, the wings are shaped like a K.



Fig. 3. Tracheal mites in the tracheal tube. Pest and Diseases Image Library, Bugwood.org

## Sampling

To sample, collect at least 50 live bees to dissect from each colony. It is best to dissect freshly killed bees since tissues darken when stored in alcohol, making it difficult to distinguish the mites in the trachea. Methods for dissecting can be found from Sammataro (2006) or on YouTube at: <https://www.youtube.com/watch?v=e83shxkObNA>. The treatment threshold for tracheal mites is > 20% infection (Sammataro et al. 2016)

## Treatment

There are several options for the control and



management of tracheal mites:

1. Requeen the hive and/or purchase more resistant beestocks. Bees that groom themselves and/or other bees are more resistant to tracheal mite infestations (Danka and Villa 1998).

2. Make grease patties consisting of 1 part vegetable shortening to about 3 parts sugar. Place a patty in the hive near the brood chamber. The patties mask the smell of young bees, making it difficult for mites to find new hosts. The oil also decreases the chance of the mites transferring to other bees.

3. Use menthol crystals for chemical control of tracheal mites. This insecticide is applied when the temperature is between 20 and 60°F. As it warms, the menthol vaporizes, and the fumes kill the mites when the bee respires. The menthol must be removed 4 weeks before the nectar flow (Hood 2000).



Fig. 4. Honey bee exhibiting K-wing, a symptom of tracheal mite infestation. Honey Bee Research and Education Laboratory (honeybee@ifas.ufl.edu), University of Florida

## Conclusion

Little research is currently being done on tracheal mites in the United States. However, researchers and beekeepers ought to remain vigilant. Management options are relatively simple, but populations should be monitored so levels do not increase above recommended thresholds.

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Fig.  
Image

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