

TROPILAEELAPS MITES – A LOOMING THREAT TO HONEY BEES IN THE UNITED STATES

Jennifer M. Tsuruda, Assistant Professor, Department of Entomology and Plant Pathology

Tropilaelaps mites are harmful external parasites of multiple species of honey bees. These *Tropilaelaps* mites originated in Southeast Asia on Asian honey bee species (including the giant Asian honey bee, *Apis dorsata*) but have been spreading across the continent of Asia and as far as Iran to Papua New Guinea (<https://tiny.utk.edu/tropi-map>). Two species, *T. mercedesae* and *T. clareae*, are known to parasitize *Apis mellifera*, the honey bee species introduced to and managed in the United States. Currently, neither of these species of *Tropilaelaps* mites has been found in North America but concern has been raised about the impact should they arrive, as they have been spreading dramatically over the last few decades and are predicted to result in more damage to beekeeping than the parasitic *Varroa* mite. The impacts would be felt not only by beekeepers but also by growers who depend on honey bees for pollination services and the public who consume honey and hive products.

Biology

T. mercedesae and *T. clareae* are very hard to distinguish from one another, even under a microscope, so in the United States they are often collectively referred to as *Tropilaelaps* or Tropi, for short. Adult *Tropilaelaps* mites are external parasites of honey bees that are even smaller than parasitic *Varroa* mites, which have been a challenge to U. S. beekeepers for almost 40 years (Figure 1). In the USDA survey of beekeepers with five or more colonies, beekeepers in Tennessee and across the U.S. report *Varroa* mites as the number one stressor affecting colonies regardless of season. The addition of *Tropilaelaps* mites would not only add another stressor but also would likely lead to complex and interacting dynamics between stressors.

While *Varroa* and *Tropilaelaps* look similar in length from their anterior ends to posterior ends, *Varroa* are wider across than they are long from their anterior to posterior ends and *Tropilaelaps* are longer from their anterior to posterior ends (around 1 mm, which is roughly 1/25") than they are wide across (around 0.5 mm, which is roughly 1/50"). Male and immature female *Varroa* mites can be mistaken as *Tropilaelaps* due to their smaller size than mature female *Varroa*, but coloration is a distinguishing feature – immature and male *Varroa* are slightly tinted white color, while *Tropilaelaps* mites are pale reddish-brown in color.



Figure 1. A *Tropilaelaps* mite on the thorax of a newly emerged worker bee (left) and a *Varroa* mite on a newly emerged honey bee's thorax (right). Photo credit: H. Boncristiani and J. Tsuruda

Life Cycle

Tropilaelaps have a shorter life cycle than *Varroa*, taking around six days from egg to the adult stage. They can reproduce in both drone and worker brood cells and can produce more offspring during the honey bee pupal stage than *Varroa*, which can result in their populations growing more quickly than *Varroa*. However, more studies performed in temperate climates are needed to better understand how the mites would compete in the different regions of the United States. Similar to *Varroa*, they feed on developing bees and can transmit deformed wing virus (DWV) (Figure 2) and impact individual bees (e.g., decreased nourishment, reduced weight, and decreased lifespan once fully developed into an adult bee) as well as the overall honey bee colony (e.g., population growth, spotty brood pattern, likelihood of the bees absconding, and colony survival). It is important to note that these characteristics can also be due to other underlying issues and are not to be considered diagnostic indicators of *Tropilaelaps* or *Varroa*.

While the information presented sounds dire, another difference from *Varroa* is that *Tropilaelaps* do not have mouthparts that can easily penetrate adult honey bees, so they are highly dependent on brood (larvae and pupae) for feeding and survival, meaning their population will not be sustained when there is a complete brood break of more than a few days. Additionally, *T. mercedesae* are known to feed on young honey bee larvae that are not yet capped, so these open cells can facilitate visible detection as the mites move around (Figure 3). Adult *Tropilaelaps* mites are very quick on their tarsi (feet) and can move much more quickly than *Varroa* mites. A short video from entomologist Dr. Lilia de Guzman (USDA-ARS) shows their speed and ability to move in and out of cells and across the comb (https://tiny.utk.edu/Tropi_vid).

Possibly due to their limited feeding on adult bees and their ability to move across the comb quickly and easily on their own, *Tropilaelaps* spend limited on adult bees. The lack of time on adult bees is in contrast to *Varroa* mites spending significant time on adult bees, meaning the typical monitoring method used for *Varroa* mite infestations (alcohol wash) is not likely to be a reliable method of detection for *Tropilaelaps*. However, other measures, such as looking at brood and bottom board debris (especially after a chemical treatment), can be helpful ways to identify an infestation.



Figure 2. Deformed wing virus can be spread by both *Tropilaelaps* and *Varroa* mites. This worker bee shows characteristic crumpled and deformed wings as well as a shrunken abdomen that can occur when fed upon as a developing larva and/or pupa. Photo credit J. Tsuruda



Figure 3. Two *Tropilaelaps* mites on a developing honey bee larva. In contrast with *Varroa* mites, which feed on late-stage larvae (after capping) and adult bees, *Tropilaelaps* readily feed on younger larvae that have not been capped, as well as older larvae, but do not appear to readily feed on adult bees, likely due to the morphology of their mouthparts.

Management on The Horizon

Since *Tropilaelaps* has not been detected in the U.S., there are not chemical products currently registered for use. However, there is ongoing research to investigate detection and management techniques, as well as the efficiency of *Varroa* treatments as therapeutics against *Tropilaelaps*. While the very small size of these mites makes detection challenging, techniques such as uncapping infested brood with tweezers (rather than uncapping forks), sticky traps to measure mite drop, and powdered sugar rolls (as used for *Varroa*) show promise as methods beekeepers can use in their apiaries. While efforts to investigate chemical treatments for *Varroa* as treatments for *Tropilaelaps*, differences in the life cycle and behavior of *Tropilaelaps* (little contact of with adult bees compared to *Varroa*) result in lower efficacy of some *Varroa* products and more research is needed to see if formulations/delivery methods can be adapted. *Tropilaelaps* has not been as well-studied as *Varroa*, but there are increasing numbers of U.S. scientists traveling to Asia to conduct studies with live mites so the amount of research is likely to flourish in coming years.

A positive aspect to note is that research has shown that honey bees that directed hygienic behavior (detecting and removing diseased or damaged brood) towards *Varroa*-infested brood were also hygienic towards *T. mercedesae*-infested brood. This finding suggests U.S. efforts to breed/select for hygienic behavior against *Varroa* mite over the last few decades have likely helped our bee populations sustain traits that will give them a leg up if/when *Tropilaelaps* arrive.

Due to *Tropilaelaps*' need for brood for feeding, the creation of a complete brood break (no capped or uncapped brood) for several days should reduce the *Tropilaelaps* mite levels down to undetectable levels. These methods can be labor-intensive and impact the growth of the honey bee colony but are non-chemical options. Another management consideration is to start new colonies with packages of bees and foundation (no pulled comb) so there will be a multi-day broodless period in the colony. An ongoing collaborative project centered in the Southeastern U.S. has been tracking winter capped brood production to better understand winter brood dynamics. Knowing when brood levels are lowest helps beekeepers determine the most effective time to use oxalic acid as a winter "clean up" *Varroa* mite treatment (<https://tiny.utk.edu/winterbrood>). Additionally, understanding winter brood production will also help in developing winter "clean up" management recommendations for *Tropilaelaps*. By understanding and predicting when brood levels are likely to be lowest, beekeepers can remove the remaining brood (to create a complete brood break) with a low impact on colony growth and help ensure the *Tropilaelaps* levels are knocked down before the active beekeeping season starts. Some chemical treatments have restrictions for use during the active season (e.g., whether there is a honey flow, specific environmental conditions, and specific colony conditions) so coming out of the winter with the lowest level of mites is a great way to help ensure a successful active season.



Figure 4. Regular health inspections and recordkeeping are important to make sure a colony is healthy and on thriving. Regulatory inspections by the TN Department of Agriculture are required before moving colonies across state lines, and inspections by local inspectors are required before moving bees within TN. Photo credit J. Tsuruda

Prevention

Regulatory policies and practices are in place to keep these parasitic mites out of the United States. Regulation on importation and the movement of honey bees is the best defense against the introduction of *Tropilaelaps* to new areas since the mites will likely spread more quickly with the aid of human activity. Regulatory inspections and permits when preparing bees for migration help ensure only healthy and uninfested colonies are moved (Figure 4). A few states have already listed this mite as a regulated honey bee pest/disease, meaning beekeepers must report any possible infestation to their state's regulatory agency (usually the state's Department of Agriculture). Apiary registration is mandatory and free in TN. This helps regulatory personnel notify and create quarantine zones when disease outbreaks occur. If/when the TN Department of Agriculture (TDA) lists *Tropilaelaps* as a regulated honey bee pest/disease, it will be vital that beekeepers abide by the legal requirement to notify officials, as these policies are put into place to protect bees as well as beekeepers. Check out TDA's website for more information and for forms for registration and inspections: https://tiny.utk.edu/TDA_apiary_forms

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