

VARROA MITES

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The varroa mite, *Varroa jacobsoni*, is considered by many to be the most serious malady of honey bees. It now occurs nearly worldwide. This external parasite feeds on the hemolymph (blood) of adult bees, larvae, and pupae. Heavy parasitism results in heavy bee mortality and subsequent weakening of the colony and can lead to colony death.

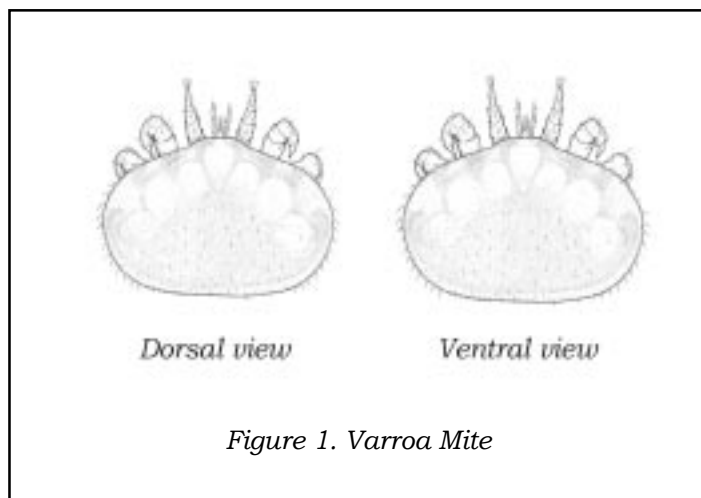
The varroa mite is an external parasite that is visible to the naked eye. The female mite is brown to reddish-brown in color, measuring 1.1 to 1.2 mm in length and 1.5 to 1.6 mm in width (about the size of a pinhead). Males are smaller, about 0.7 mm by 0.7 mm, and light tan in color. Adult males do not feed and are not found outside of brood cells.

Adult female mites can live outside the brood cells and are also found on adult drone and worker bees. This behavior allows them to invade new host honey bee colonies and survive the winter in these colonies. The flattened shape of the female's body makes it easy for the mite to hold onto a bee and move easily into the cells of developing bee brood. When on adult bees, female varroa are found mainly on the top of the bee's thorax at the point where the wings attach, between the head and the thorax, between the thorax and the abdomen, or between overlapping segments of the abdomen. These are places where the mites can easily use their piercing mouthparts to penetrate the exoskeleton of their host and gain access to the bee's hemolymph (blood). These are also places where mites are less likely to be removed by the bee's grooming.

VARROA MITE LIFE CYCLE

When female mites are ready to lay eggs, they move into brood cells containing young larvae just before the cells are capped. They go to the bottom of the brood cells and immerse themselves in the remaining brood food. After the cells are capped and the larvae have finished spinning cocoons, the mites start feeding on the larvae. They begin laying eggs approximately three days after the cell has been capped. A fertilized female mite lays a total of 4 to 6 eggs. The adult female and its immature offspring feed and develop on the bee as it matures.

The mite life cycle consists of four developmental stages: the egg, two eight-legged nymphal stages (protonymph and deutonymph), and the adult. The



period from egg to adult takes about 6 to 7 days for the female and 5 to 6 days for the male.

Mating occurs in the brood cells before the new adult females emerge. The adult males die after copulation since their mouth parts (chelicerae) are modified for sperm transfer rather than feeding. The old female and the newly-fertilized female offspring remain in the brood cell until the young bee emerges. The adult bee serves as an intermediate host and a means of transport for these female mites.

Varroa mites have a definite preference for drone brood. More mite offspring can mature during the longer development time (capped period) of the drones. However, worker brood also is attacked. Queen brood is attacked only in cases of heavy infestation. Female mites produced in the summer live 2 to 3 months, and those produced in the fall live 5 to 8 months. Without bees and brood, the mites can survive no more than 5 days. They can, however, live in a comb with sealed brood at 68°F for up to 30 days.

We do not know precisely how varroa mites spread so rapidly. We do know that these mites can be spread by the movement of honey bee colonies (migratory bee-keeping), the shipment of queens and package bees, and the movement of colonies for pollination rentals. Beekeepers probably spread an infestation from one colony to another through normal apiary manipulations. Infestations also are spread as a result of drifting (especially drifting drones) from one apiary to another and swarming bees.

DAMAGE AND SYMPTOMS

Individual developing bees, if infested with one to two adult mites (and offspring), usually emerge without visible damage and are normal in appearance. They may, however, suffer from malnutrition, blood loss, or disease. Individuals that are heavily-infested with more than a few adult mites (which produce as many as 20 nymphs) usually become visibly crippled or die in their cells without emerging. In addition to the loss of hemolymph, varroa mites are known to transmit a number of pathogens including several viruses.

When adult bees are infested with two or more mites, they become restless and fly with difficulty. Their life span is generally shorter than unparasitized bees and they perform tasks poorly.

On a colony level, the symptoms of a varroa mite infestation depend upon the degree of infestation. Low-level varroa infestations are difficult to detect. Medium- to high-level infestations may result in the appearance of a spotty brood pattern, as well as the presence of malformed worker and drone adults with deformed wings (may be associated with deformed wing virus) and small abdomens. Such bees are often unable to fly and can be seen crawling. Bees will uncap and throw out infested brood, which can sometimes be found at the hive entrance. Parasitized pupae will appear to have small, pale or dark-reddish brown spots on their normally white bodies. Colonies become severely debilitated as mite populations reach extremely high levels at the end of the broodrearing season.

Determining Varroa Mite Levels using the Sugar Shake Method

Materials needed

- measuring cup (**1/2 cup size only**)
 - 1 quart wide mouth jar
 - light metal mesh cover for the jar (8 mesh to the inch hardware cloth)
 - Powdered sugar
 - Plastic tub or cardboard box
 - Backing sheet or hive lid
- 1) Select brood frame well covered with bees.
 - 2) Examine frame thoroughly for queen. If queen is found, return her to the colony.
 - 3) Shake frame of bees into a plastic tub.
 - 4) Concentrate bees into corner of box by knocking the corner of the tub on its side.
 - 5) Scoop 1/2 cup full of bees and dump into wide mouth quart jar and cover with screen lid.
 - 6) Add 2 tablespoons of powdered sugar to jar through the screen lid. Ensure all the bees are well covered. If it is humid and during nectar flows, add more sugar
 - 7) Keep the bee filled jar upright while shaking the jar vigorously from side to side, coating the contained bees. Bees should be well coated and appear white (like a powdered doughnut). If you

can see color of bees through the sugar, add more sugar and reshake.

- 8) Turn jar upside down and shake vigorously over baking tray or similar light colored surface, moving jar around so that sugar and mites are spread evenly over entire surface. (Don't just shake in one place so sugar builds up and may cover mites).
- 9) Count mites then dump tray or wipe surface clean and repeat shaking process (usually mites move their legs for a few seconds after falling onto the tray which helps to distinguish mites from dirt particles).
- 10) Repeat shaking and counting until no more mites or sugar falls out of jar.
- 11) Record number of mites removed.
- 12) Pour the bees from the "shake jar" back into the hive.

Determining Varroa mites levels using IPM Varroa Sticky Boards

Materials needed

- 15 sticky boards (per assessment)
- Vaseline to coat boards
- Screen inserts or bottom boards in hives or screen (8 mesh) frames to place on top of sticky board (make frame for screen using 1/8 inch thick wood slats or cardboard strips stretching the screen across the frame prior to securing it)
- Cellophane®

Prepare prior to sampling:

Cover each IPM sticky board with Vaseline® (and 8 mesh hardware cloth screen if applicable).

- 1) In the apiary, write on the back of each board, the number of the colony you are placing the board into and the date you are inserting the board.
- 2) Place a screen over the Vaselined portion of the board.
- 3) Insert sticky board above bottom board and under screen insert.
- 4) Remove the board after 3 days.
- 5) Count the mites and record, (**OR**) to count mites at a later time, cover vaseline portion of sticky board with Cellophane using duct tape to secure the Cellophane on the back. **Do not allow boards to be in direct sunlight.**

SOME NON-CHEMICAL METHODS OF REDUCING VARROA POPULATIONS

Since varroa mites are found in higher numbers in drone brood than worker brood, it is possible to reduce varroa populations by removing mite-infested drone brood. Frames of drone comb are inserted into colonies to "trap" varroa mites. After the queen had laid brood on the frame and the cells are capped, these frames are removed from the colony and frozen to kill the varroa and the brood. This is especially effective in the early

spring when varroa are concentrated on small patches of drone brood.

Varroa can also be trapped on sticky boards (see above). Since some of the mites that fall to the bottom board are alive, trapping these and removing them from the colony on a regular basis can help to reduce varroa populations. A similar technique utilizes a screen-bottomed (8 mesh-per-inch hardware cloth) bottom board, which allows falling mites to fall completely out of the colony; again reducing the varroa population.

TREATMENT

Apistan Strips

Apistan®, a plastic strip impregnated with the miticide fluvalinate, has been used for varroa control in the United States since 1988. These strips are used to deliver a contact pesticide, which means that the mites must come in contact with the strips in order for the material to be effective. For this reason, the strips are hung vertically inside the brood nest.

Always read and follow all label instructions. Current label recommendations require that all honey supers be removed before any chemical mite control treatment is applied. Leave the strips on the colonies for a minimum of 6 weeks and a maximum of 8 weeks. The number of strips placed on a colony depends on the number of frames of bees in each colony. Use one strip per five (or fewer) frames of bees; distribute the strips evenly throughout the brood nest. Colonies are typically treated in late summer or early fall to improve winter survival. However, since varroa populations typically peak in August and September, we may need to consider treating colonies with Apistan earlier; during early spring (before the honey flow) or the summer dearth (spring honey removed, fall honey supers not yet placed on colonies). If necessary, supers can be reapplied immediately after the strips are removed from colonies. Destroy any honey left in the hive during treatment or use it as bee food. By knocking down the population earlier, we may better protect the bees from mites and virus through winter.

Apistan, strips should be used once and then discarded; they should not be reused. Used strips cannot deliver the same dose of fluvalinate that new strips can. Treating with used strips can expose the mites to a sublethal (non-killing) dose of the pesticide. While used strips may kill some mites, they will not kill as many as new strips. The surviving mites will then reproduce. It is likely that many of their offspring will be resistant to fluvalinate even at the full dose. By reusing the strips we invite the mites to develop resistance to our chemicals more quickly.

Note: In the fall of 1997, mites resistant to fluvalinate were

detected in several commercial and sideline operations in the U.S. We recommend that beekeepers who have Apistan-resistant mites (please consult your bee inspector) use an alternative chemical (as of 1999, coumaphos or formic acid) to control varroa. However, Apistan® should still be effective in most hobby and sideline beekeeping operations.

Coumaphos Strips

In January 1999, coumaphos, a second chemical treatment for varroa mites was approved on a section 18 emergency-use basis. Beekeepers who have Apistan-resistant varroa mites (please consult your bee inspector) should switch to coumaphos for varroa mite control. Coumaphos is incorporated in a plastic strip which is sold under the brand name of "Check Mite+ Strips". Coumaphos strips are hung between broodnest frames similar to Apistan® strips. Treatment length is 45 days. Always read and follow all label instructions. Remove all surplus honey from hives before treatment. Wear chemical-resistant-gloves during applications and removals and use extreme care in handling this material; it can be absorbed through the skin.

Mite Away II

Application Precautions

- Wear acid resistant gloves at all times when handling pads (PVC or neoprene).
- Use ventilating mask
- Do not set pads on any metal surfaces due to corrosive nature of formic acid.
- Remove entrance reducers and screen bottom boards from hives during application of this product. Remove any supers. Colony must be reduced to 1-2 deep hive bodies or the equivalent. All holes in the hive should be sealed except the bottom hive entrance which must remain fully open.
- Outside daytime temperature highs should be between 50 - 79°F at the time of application.
- It is highly recommended that the pads be removed from the hives in the event of a heat wave (if daily temperature highs exceed 82°F) within the first 7 days of treatment.

Directions for Use

1. Remove the Mite-Away II™ from the outer pouch. **Do not remove the pad from the inner perforated pouch,**
2. Place one Mite-Away II™ with the HOLES DOWN on two 4 inch x 0.5 inch x 0.5 inch spacer sticks placed 4 inches apart on the frame top bars.
3. Place a 1.5 inch rim on the top box to accommodate the pad, the spacer sticks, and an additional 0.5 inch space between the pad and inner cover.
4. Leave the Mite-Away II™ pad in place for 21 days.

ApiLife VAR

Application Precautions

- Remove any supers. Colony size must be reduced to 1-2 deep hive bodies or the equivalent.
- Use when average daily temperatures are between 59°F and 69°F. Do not apply the treatment when bees are robbing.
- Remove Api Life VAR tablets from hives at least 1 month (30 days) prior to harvesting the honey.
- Do not use API LIFE VAR at temperatures above 90°F.

Directions for Use

1. Take one tablet and break into four equal pieces.
2. Place pieces on the top corners of the top hive body as close in to the brood nest as possible without placing directly above brood nest.
3. After 7-10 days, replace with a fresh tablet broken into pieces as above.
4. Repeat procedure again, 7-10 days later and leave last tablet for 12 days. After 12 days remove residuals from colony.

For more information on treating varroamites see MAAREC bulletins:

- Integrated Pest Management (IPM) For Beekeepers
- Chemicals Approved for Legal Use in Honey Bee Colonies

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

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