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Sampling Methods for Varroa Mites on the Domesticated Honeybee

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Introduction

Varroa mites (Fig. 1) are serious pests of the apiculture industry throughout the Americas. The mites were first reported in the United States in Florida in 1987, apparently as an accidental introduction along with illegally imported South American queen bees. By 1989, the mite was found in 19 of the southern states and has continued to spread throughout the United States and much of Canada. To date, the varroa mite has killed one-half of the managed honeybee colonies and almost all of the feral honeybee colonies in North America. If a varroa mite infestation is left untreated, it can kill a bee colony within one to three years. As a result, the varroa mite is considered to be one of the most severe threats to the apiculture industry.

Figure 1. Varroa Mite

Figure 2. Mite infested brood

Adult varroa mites are 1.1 mm long x 1.6 mm wide, with a flattened reddish-brown appearance. The mites are external parasites and often can be seen between the overlapping abdominal sternites, at the bases of wings, or between the head and thorax feeding on the bee's hemolymph (blood). An adult bee can be infested with varroa by a process called "close transfer" where mites move from one bee to another in the field and in the hive. This transfer, along with the introduction of infested bees and brood to an area (Fig. 2), can result in the rapid spread from one colony to another

Symptoms of varroa mite infestation in a colony may include "restless" behavior, brood neglect that results in "spotty" brood patterns, discarded pupae at the hive entrance, and malformed, discolored workers and drones. In colonies with severe mite infestations, workers with deformed wings often can be seen on the combs and crawling from the hive entrance. Losses due to varroa mites are often confused with losses from winter mortality and queenlessness. The extent of symptoms varies with the degree of infestation and the only reliable way to determine if colonies are infested is to sample both the adults and brood for the presence of mites. It is also believed that a colony can be severely affected when a mite population rises above 2,000 to 3,000 (Delaplane & Hood 1997, Martin 1999), although there is some

debate as to whether certain viruses also need to be present for clinical damage to occur (Ritter et al. 1984, Ball & Allen 1988).

Various methods have been used to determine if a colony is infested with varroa mites necessitating some type of control. This publication presents various varroa sampling methods and compares their relative effectiveness.

Detection Methods

- **Ether (or Alcohol) "Roll"**

  Materials:

  - A wide-mouth mason jar with a tight fitting lid
  - Alcohol or any commercially available engine starter fluid

  Brush or shake approximately 100 to 200 worker bees sampled from near the middle of the hive into the wide-mouth mason jar. Place the lid on the jar of captured bees and spray a short burst (about one second) of engine starter fluid (approximately two teaspoons of alcohol) into the closed container. After about one minute, gently roll the jar from side to side to coat all of the bees with the ether (alcohol). If varroa mites are present, they will fall off of the bees and adhere to the sides of the jar where they can be counted. This technique will separate up to 50 percent of the mites from the bees (Burgett et al. 1987).

- **Powdered-Sugar "Shake"**

  Materials:

  - A wide-mouth mason jar with a two-piece lid. Remove the center portion of the lid and replace with #8-mesh screen
  - #8-mesh (3 mm x 3 mm mesh) hardware cloth or any other mesh that will retain the bees while letting mites pass through
  - Tablespoon measure
  - Powdered sugar

  Brush or shake approximately 100 to 200 worker bees sampled from near the middle of the hive into the widemouth mason jar. Replace the modified lid and add a heaping tablespoon of powdered sugar through the mesh screen. Roll the jar from side to side to distribute the sugar over all of the bees. Wait a few minutes and roll the jar again. Pour the sugar and dislodged mites through the screen onto cheesecloth. Separate the mites from the sugar by sifting the sugar through the cloth, leaving the mites on the cloth surface.

  The bees can then be returned to the colony where their hive mates will groom them clean because the sugar stimulates the bees' grooming behavior. The powdered sugar makes it difficult for the mites to adhere to their host, causing the mites to fall off the bees. This technique works well and is considered superior to the ether roll, separating up to 90 percent of the mites from the bees (Ellis 2000, Macedo & Ellis 2001).

- **Sticky-Board (Mite Census)**

Materials:

- A stiff piece of white poster board that is sufficiently large enough to cover the hive bottom board
- #8-mesh (3 mm x 3 mm mesh) hardware cloth or any other mesh that will retain the bees while letting mites pass through
- Aerosol cooking spray or other type of adhesive (Tanglefoot®)

The sticky-board provides a passive method to monitor mite population levels within the hive. Sticky-board can be purchased from a bee-supply dealer or made from adhesive covered poster-board attached to the underside of #8-mesh hardware cloth that covers the top of the paper. The screened sticky-board is placed between the hive floor and brood frames. The screen separates the mites from the bees and prevents the bees from reaching the sticky paper and becoming entrapped. As mites are dislodged during the bees' grooming process, they will fall through the screen cover and adhere to the sticky white paper on the bottom board. The sticky-board should be placed in the hive for 24 hours and removed as necessary to examine for mites. If more than 40 mites are recovered, then the colony should be treated. Sticky-boards are a more reliable method of monitoring populations of varroa mites than brood sampling. The sticky-board sampling may be expedited with the use of an acaricide as described below.

- **Drone/Brood Sampling**

Materials:

- A pair of forceps
- Some type of magnification that allows close observation of brood
- Capping-scratcher

A capping-scratcher is used to remove the caps and pupae from the brood comb. The capping-scratcher is inserted deep into the cells beneath the capping (and into the pupae). The cappings and pupae are lifted from the comb and the pupae are examined for mites. Varroa mites prefer to feed on drone brood. Remove a sample of 100 drone pupae with forceps and count the number of infested pupae to calculate the percentage infestation level. An infestation level of less than 5 percent indicates sufficiently low mite numbers to not warrant treatment. A level of 25 percent or more infested brood indicates a severe infestation, which will require immediate treatment (Central Science Laboratory (CSL) 1996). Due to the variation of this sampling method, it is best used for a "presence-absence" determination. It is not very good for comparison purposes.

- **Sticky-Board with Acaricides**

Materials:

- Same as used for sticky-board technique (see above)
- Apistan®, Checkmite+®

Using the sticky-board (see the description of the stickyboard technique above) with an acaricide provides another method for monitoring mite population levels

within the hive. The use of Apistan® and Checkmite+® acaricides (formulated as impregnated plastic strips) increases the risk of bee kill so be sure to follow label directions for the product you are using (Fig. 3). It is also recommended that beekeepers rotate acaricides for varroa control to ensure prolonged use of products and minimize the risk of contamination of wax and honey. Withdraw the board placed between the hive floor and brood frames after one to three days and check for varroa mites on the sticky surface. Varroa mite infestation levels should be maintained at a level below 1 percent throughout the spring build up period, and 5 percent or less throughout the fall broodless period. The higher threshold in the fall period accounts for the decrease in brood and subsequent movement of mites onto adult bees. Using the sticky-board with acaricide technique is recommended above all other techniques because of its effectiveness in estimating varroa mite numbers even when mite populations are low or clumped within the hive (Devlin 1998).

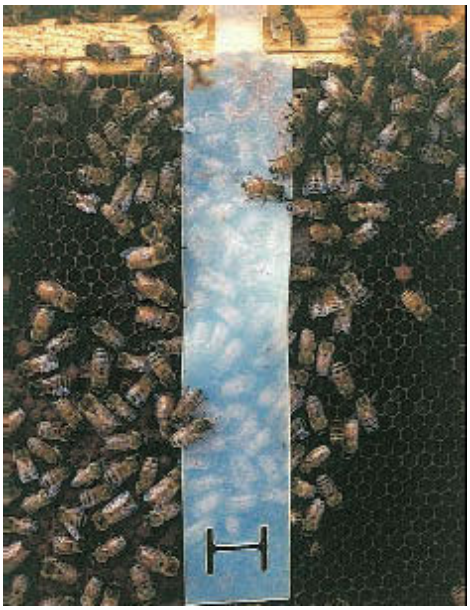

Figure 3. Use of acaricide impregnated plastic strip.

In order to use the information collected from any of the methods described above, it is essential that you collect uniform samples. It is a violation of federal law to apply Apistan® or Checkmite+® during a nectar flow or while honey supers are on your colonies. For additional information on these methods refer to USDA Handbook AH690, *Diagnosis of Honey Bee Diseases Updated 2000*.

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