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NebGuide

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Using the Sugar Roll Technique to Detect Varroa Mites in Honey Bee Colonies

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- Comparing Inert Dusts for Detecting and Assessing Varroa Mite Infestations
- Using Powdered Sugar to Detect and Assess Varroa Mite Infestations
- Why Do Dust-like Materials Dislodge Varroa Mites from Bees?
- Interpreting the Results of Sugar Roll Testing

This NebGuide describes a rapid and efficient technique for detecting and assessing varroa mite infestations. It uses powdered sugar to dislodge mites from bees.

The varroa mite was first discovered in the United States in 1987. Globally, it is the most important pest of honey bees and it has caused extensive losses in feral and managed colonies. Once introduced, varroa mites have never been eradicated from any country or region, and beekeepers must adopt an integrated pest management strategy to protect their colonies. Early detection and assessment of infestation levels are important components of a varroa management plan. Since varroa mites feed by piercing the intersegmental membranes on the underside of the bee's abdomen, they are not easily observed on bees until colonies are severely injured. Beekeepers need to use a detection technique to check their colonies for mites. In addition to detecting mites, beekeepers need to accurately assess the infestation level to determine when control measures are warranted.

Mature female varroa mites are large, reddish brown, crab-shaped mites (length 1.1mm, width 1.6mm). Males are round, soft-bodied, whitish, and much smaller (length 0.8mm, width 0.7mm). They are seldom seen since they complete their life cycle within sealed brood cells. The life cycle of the varroa mite is divided into two phases. In the reproductive phase the mite reproduces in a sealed honey bee brood cell. In the phoretic or dispersal phase the adult female mites live on adult honey bees. They remain firmly attached to their host and are not readily observed on adult bees until colonies are heavily infested (*Figure 1*). The number and location of the mites varies according to the time of year. Mite populations are lowest in the spring, increase during summer, and are highest in fall. During the brood rearing season, up to 90 percent of the mites in a colony will be in sealed brood cells. When brood rearing ceases, almost all live mites will be on adult bees; however, some mites can be found in hive debris throughout the year. When interpreting sampling results, the partitioning of mites among brood and adult bees must be considered.

Figure 1. Varroa mite on adult honey bee.When mites can be seen on bees,colonies are usually heavily infested.

The five most commonly used detection and assessment methods for varroa are: 1) ether roll, 2) alcohol wash 3) brood examination, 4) sticky boards placed on the bottom board, and 5) acaricides with sticky boards. A detailed description of these methods can be found in USDA Handbook AH690, *Diagnosis of Honey Bee Diseases*. While these methods

are valuable tools, they all have limitations. Ether roll is the most widely used of the five methods; however, it only detects a portion of the mites present in a sample, requires killing the sampled bees and can trigger defensive behavior when used in the apiary. The alcohol wash technique is efficient, but it is time consuming and sampled bees are killed. Sticky boards with or without acaricides do not kill sampled bees but they require two trips to the apiary. Brood examination is time consuming, requires killing brood, and can only be performed when brood is present.

Comparing Inert Dusts for Detecting and Assessing Varroa Mite Infestations

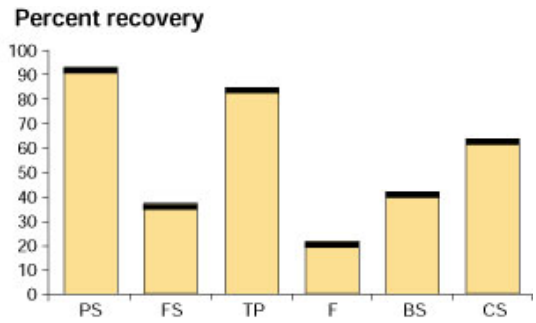

Figure 2. Mite recovery rates using six dusts formulations: powdered sugar(PS), fine sugar(FS), talcum powder(TP), wheat flour (F), baking soda(BS), and corn starch(CS).

Inert dusts can be used to detect varroa mites and to assess the colony infestation level. The method can be performed in the apiary, it does not require killing bees or brood, and some dusts are more efficient at recovering mites from adult bees than the widely used ether roll technique. Powdered sugar, talcum powder, fine sugar, wheat flour, corn starch, and baking soda were evaluated for use in recovering mites from adult bees. Powdered sugar and talcum powder performed best in dislodging varroa mites from adult honey bees (*Figure 2*). In addition to being the most efficient dust, powdered sugar does not leave a toxic residue in the hive and is readily available. Powdered sugar was followed in efficiency by talcum powder and corn starch. Baking soda, fine sugar and wheat flour did not perform as well.

Using Powdered Sugar to Detect and Assess Varroa Mite Infestations

You will need the following items to detect varroa mites with powdered sugar:

- a wide-mouth glass canning jar with two-piece lid;
- 8-mesh per inch hardware cloth or any other mesh that allows mites to pass through while bees are retained; and
- one rounded teaspoon (7g) of powdered sugar.

Figure 3. Approximately 7 grams of powdered sugar is added through the hardware cloth

Figure 4 . The jar with bees and powdered sugar is inverted and shaken over a white surface.

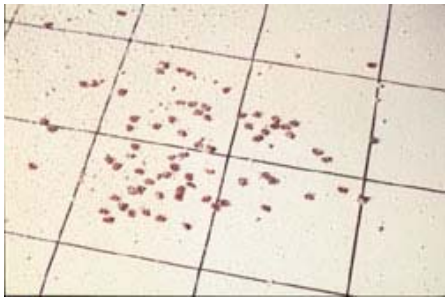

Figure 5 . Mites and powderd sugar pass through the hardware cloth while bees are retained inside the jar.

Keep the metal ring that comes with the two-piece lid but discard the central portion. Cut a circle of the hardware cloth to fit inside the ring. Collect approximately 300 adult bees in the wide mouth pint or quart canning jar. Add the powdered sugar through the hardware cloth (*Figure 3*). Roll the jar to distribute the dust and coat the bees. Let the jar sit for approximately one minute, then invert the jar and shake over a white surface to recover the mites (*Figure 4*). The bees will remain in the jar, and the mites and dust will pass through the screen (*Figure 5*). After testing for mites, the bees can be returned to their colony unharmed.

Why Do Dust-like Materials Dislodge Varroa Mites from Bees?

There are three possible explanations for the efficiency of dust-like materials in recovering varroa mites from adult honey bees. First, varroa use sticky pads to adhere to their host. Dusting the bees may make it difficult for the mites to adhere or cling to the bees. Second, dusts seem to stimulate the bees' grooming behavior. When dusted, bees begin to groom themselves and persist at grooming for an extended time. A third explanation is that dusts on the mite's body may stimulate it to release from its host to groom itself.

The "sugar roll" technique described in this NebGuide is an inexpensive, efficient and quick way to detect and assess varroa mite infestations. Furthermore, there is no risk of leaving toxic residues in the hive, and the bees can be returned to the hive unharmed after the process.

Interpreting the Results of Sugar Roll Testing

The first step in using the sugar roll technique is to determine approximately how many bees you are sampling. Calibrate your jar by collecting bees, gently shaking them to the bottom of the jar, and marking the jar with a permanent marker to indicate the depth of bees in the sample. Then kill the bees with rubbing alcohol and count them. In subsequent sampling fill the jar with bees to the fill line you marked. Make your fill line approximately 300 bees.

In the Midwest, sample colonies in the spring and fall. In the fall, colonies with more than 0.12 mites per bee when brood is not present will have increased winter mortality if mite populations are not reduced. Colonies with more than 0.25 mites per bee will almost always perish in winter. When brood is present in the fall, 0.03 or more mites per bee indicates that the beekeeper should remove the honey crop as soon as possible and implement measures to reduce mite populations. This translates to recovering nine or more mites from a sample of 300 bees.

In the spring, brood will be present in all normally developing colonies. When mites are detected with this technique, it is best to implement a strategy to reduce mite populations. Alternately, beekeepers should plan on resampling their colonies no later than mid August. If mites exceed the previously described threshold, beekeepers should quickly remove their honey crop and implement measures to reduce mite populations. This may require sacrificing honey production to preserve colonies. Mite populations can increase 10 to 100 fold during the brood rearing season. The rate of increase is affected by the length of the brood rearing season and emigration of mites from other colonies.

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