

Varroa Mite Resistance: Testing for Varroa Sensitive Hygiene

This article describes the steps involved in testing honey bee colonies for varroa sensitive hygiene.

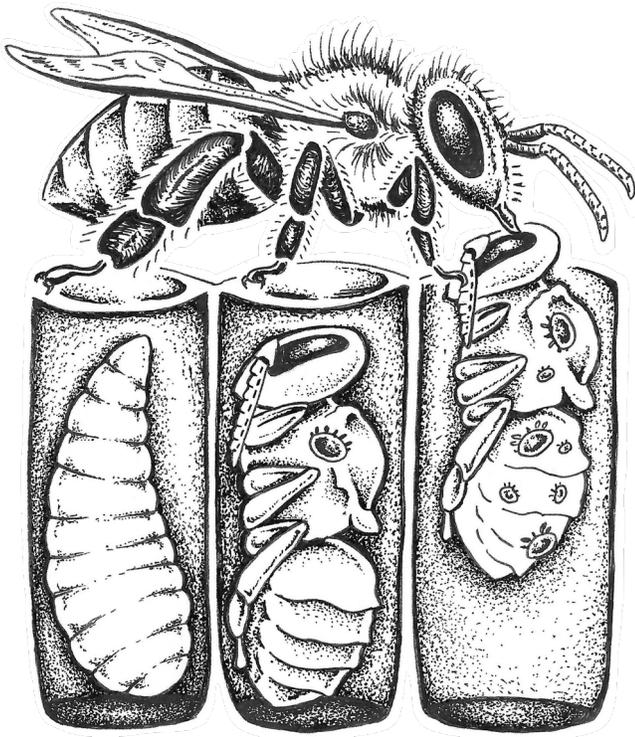


Image 1. A worker bee is removing a honey bee pupa from a cell containing a mother mite (foundress) and her offspring. Notice the middle cell, where a non-reproducing mite has not elicited this response. Illustration by Michael Hill.

Introduction

Hygienic behavior is characterized by the bees' ability to remove sick or damaged brood from cells in the hive. A specialized form of this behavior known as *varroa sensitive hygiene* (VSH) occurs when workers specifically recognize cells with reproducing Varroa mites and remove them (Image 1). Made popular by United States Department of Agriculture researcher John Harbo, bees that remove reproductive mites are said to exhibit the VSH trait.

This behavior can be tested for by uncapping cells of appropriate-aged pupae and looking for mites and their

offspring. Colonies that have a lack of mites in cells or a high proportion of non-reproducing mites are said to exhibit varroa mite resistance. This trait has been shown to be genetically controlled. Breeders can make selections based on a VSH *assay* or test to increase the prevalence of mite removal in colonies in their operations, reducing chemical applications to control Varroa mites.

For this test, the queen must have been laying eggs in the colony for a minimum of 7 weeks and no additional bees or brood should have been added to the colony. The bees that perform this behavior are younger bees, between one and three weeks of age. In order for the test to accurately measure the queen's score, all of the brood and workers must be the daughters of the current queen, and the colony should not have received a miticide treatment for at least 4-6 weeks.

This test only needs to be performed one time to get a queen's score.

Procedure

Equipment and Supplies:

Sharp forceps (tweezers), grafting stand, magnification, lighting (flashlight or headlamp), paper towels, datasheet



Image 2. The supplies for this test have been gathered in preparation for beginning the work. Image by Grace Pilch.

Procedure:

1. Find a frame of brood from the queen of interest that contains a large area of capped brood.
2. Open a few cells to determine the age of the pupae. For this test, the pupae must be 7-11 days post-capping. You can recognize this by the color of the pupa's eyes and the coloration of its body. The eyes should be dark purple and the body can be white to tan (Image 3).



Image 3. Left. A pupa with purple eyes that is the correct minimum age for this test. Middle. A pupa with white eyes and Left. A prepupa, both of which are too young for this test.

3. Mark the frame with the queen ID (Image 4).



Image 4. Mark the frame with the colony ID using a paint pen. Image by Mike Houtz.

4. In a quiet, well-lit location, set the frame on a grafting stand (Image 5).



Image 5. A brood frame is set on a grafting frame to get the proper angle for seeing into the cells as they are opened. Image by Mike Houtz.

5. Using forceps, carefully remove the capping from a cell. If the pupa is the right age, proceed. If not, choose a different cell to examine.
6. Carefully remove the pupa from the cell, keeping your eye on the cell.



Image 6. Using sharp forceps, open the cell to reveal the pupa and mites inside. Extra lighting can be helpful for seeing into the bottom of the cell. Image by Mike Houtz.

7. Examine the inside of the cell for mites. Move your head to different angles to ensure you have seen all surfaces inside the cell. Use magnification and light as needed (Image 7).

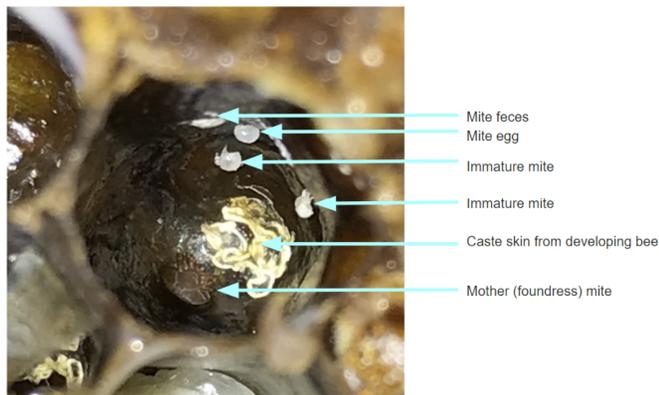


Image 7. A cell is opened to reveal a reproducing varroa mite. The items in the cell are labeled. Image by Robyn Underwood.

8. Examine the pupa for mites. Turn it back and forth to ensure you have examined all parts of the pupa for mites.



Image 8. Varroa mites adhering to the removed pupa. Image by Cory Stevens.

9. Set the pupa down on a paper towel. As you proceed, set pupae in groups of 5 or 10 for easy counting.



Image 9. Pupae are set in piles of five as they are removed from the cells. Image by Robyn Underwood.

10. Using hash marks, record the number of reproductive and non-reproductive mites seen.

11. Continue uncapping and examining cells until a) you open 5 cells containing reproductive mites or b) you reach 100 cells.

12. If you examine 100 cells and do not see any mites, examine an additional 100 cells.

13. Use the scoring table developed by John Harbo to determine the queen's score.

Percent of infested cells with non-reproductive mites	Number of cells containing reproductive mites/total number examined	Score
80-100%	0/200	4
50-80%	0/100 or 1/200	3
30-50%	1/100 or 2/100	2
20-30%	3/100 or 4/100	1
<20%	5/100 or more	0

Table 1. VSH scoring table. Adapted from [Harbo Bee Company](#)

14. Record this test result with your colony's data. The information can be used later for selection purposes.

More information on honey bee breeding can be found at [An Introduction to Honey Bee Breeding Program Design](#).

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Authors

Robyn Underwood, Ph.D.
Extension Educator, Apiculture
rmul@psu.edu
484-268-5208

Kate Anton
Research Technologist
kxa138@psu.edu
814-865-9806

extension.psu.edu

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