

## Sampling for Varroa Mites and Treatment Thresholds

When to sample: early spring for overwintered colonies (April/May) and mid-to late summer (July) before harvesting honey.

The following are the best methods to estimate the number of *Varroa* in a colony of bees. The first two methods involve sampling the number of mites on adult bees, and the third method involves sampling the number of mites that fall on a sticky board placed bottom of the colony over a 24 hour period.



The first two sampling methods (powdered sugar and alcohol wash) require you to collect a sample of approximately 300 bees in a container. To do this, remove a frame of brood from the center of the brood nest. Make sure the queen is NOT on the comb. Shake the bees from the comb onto a bent sheet of metal (aluminum or steel) that fits in the opening where you removed the frame. **(You can also set the frame on its end and run the jar or sample container gently over the backs of the bees**

in a downward motion. The bees will roll over the lip of the jar and fall right in...much easier than using a sheet...don't try to scoop upward with the jar as the bees will fly off before falling in).



As a frame of reference, there are 7oz of bees, or 700 bees in this sample. You really only need to sample about 300 bees (approximately  $\frac{1}{2}$  cup of bees)

Pour the bees from the metal sheet into a sample container. There are approximately 100 live bees in 1 fluid ounce, although it is not so easy to measure one ounce of live, flying bees in a container! You might want to mark where 3 ounces is on a glass jar, and “bonk” the bees down to measure them.

#### **Powdered Sugar Method**

This sampling method was developed at the University of Nebraska. It has the advantage of not killing the bees. Prepare a sample jar as follows: Use a wide-mouth quart canning jar with a two-piece lid. Retain the metal ring of the lid. Replace the round flat portion of the lid with 8 mesh screen.

Pour about 300 bees into the jar from the bees you shook, cover with the screen and secure with the metal ring. Add powdered sugar into the jar through the screen (enough to coat the bees, 1 heaping tablespoon should be adequate).



Roll the jar around to distribute the sugar on the bees. Allow the jar to sit for 2-3 minutes. The bees will begin grooming the sugar and debris off of themselves (including the mites). Then invert the jar and shake over a piece of paper or white container to recover the mites. The bees will remain in the jar, and the mites and sugar will pass through to the paper or container (a white container is much easier to work with than paper in the field)



Mites coated with powdered sugar on the bottom of the white container

Mites cannot hold onto the bees when their feet are coated with sugar, so it is important to let the powdered sugar sit on the bees to help dislodge the mites. You can recover over 90% of the mites with this method. Count the number of mites in the sample. To estimate the total mite level in the colony, see below.

The mites are easily distinguished from other debris because they have a very regular oval shape and are red-brown in color.



Place the bees back in the colony. They will be "shaken-up" but will be readily groomed and accepted by their nest mates.

### Alcohol Wash Method

This is a very accurate method of sampling mites, but it kills the sample of bees (in our experience the powdered sugar method is just as effective). Prepare a sample container as follows: Use a wide-mouth jar or plastic container with a leak-proof lid. Put about 3-4 oz of alcohol in the container (rubbing alcohol or blue windshield washer fluid works fine for this). From the bees you shook into the bent metal sheet, pour about 300 bees into the alcohol and seal the container tightly.

Back at home, the alcohol from the sample jar can be strained through 1/8" screen into a white bowl. Shake the screened bees in the alcohol to dislodge the mites into the alcohol.

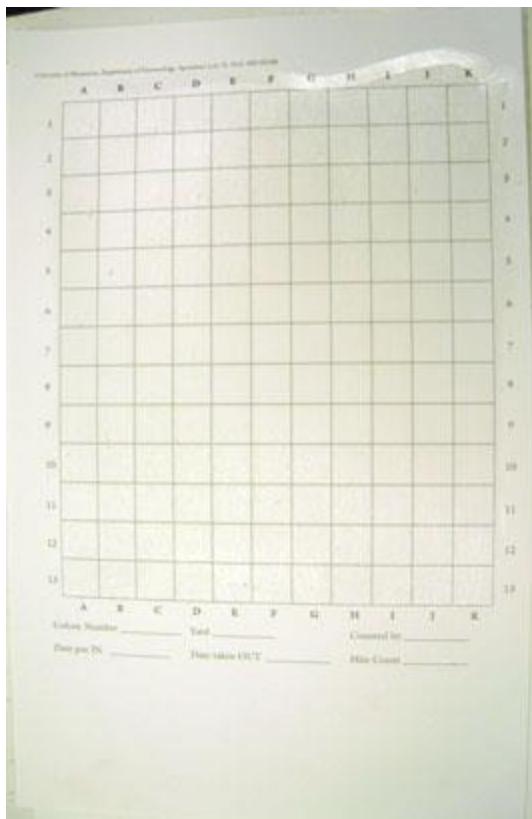


If you rinse and shake the bees thoroughly in alcohol (e.g., about 2-3 minutes), this method will recover 95-100% of the mites on the adult bees. Count the number of mites in the sample. To estimate the total mite level in the colony, see below.

### Natural Mite Fall (sticky board)

This method involves placing a "sticky board" on the bottom board of a colony, and monitoring the number of mites that naturally fall and adhere to the board over a period of 24 hours. The mites that adhere to the board may be alive or dead (due to natural mortality) at the time they fall. Some of the mites that fall are immature mites that emerged from the cells with the adult bees. Therefore, there will be many more mites collected on a sticky board within 24 hours compared to the number of mites collected on a sample of 300 adult bees.

You can purchase sticky boards or make your own. To make a sticky board, cut poster board or some stiff, preferably white paper, to fit under the brood nest (14" x 17"). Make it longer than the box (21") so that it extends out the entrance of the colony to make it easier to remove. If you print or draw a grid on the paper it will be easier to count the mites when you remove it.



To make it sticky, either coat it with Tanglefoot Pest Barrier or similar product or paint on a thick layer of petroleum jelly using a brush. Be sure to not paint part of board so you can handle it. Write the colony number, date and any other useful information on the sticky board.

Place the sticky board under a sheet of 8 mesh hardware cloth, leaving at least a ¼" space between the screen and sticky board so the bees do not get stuck to the board. You can create the space between the hardware cloth and the sticky board by using a screened bottom board or building a frame around the edge of the screen to hold it up. Do not use window screen because the mites will not fall through it.

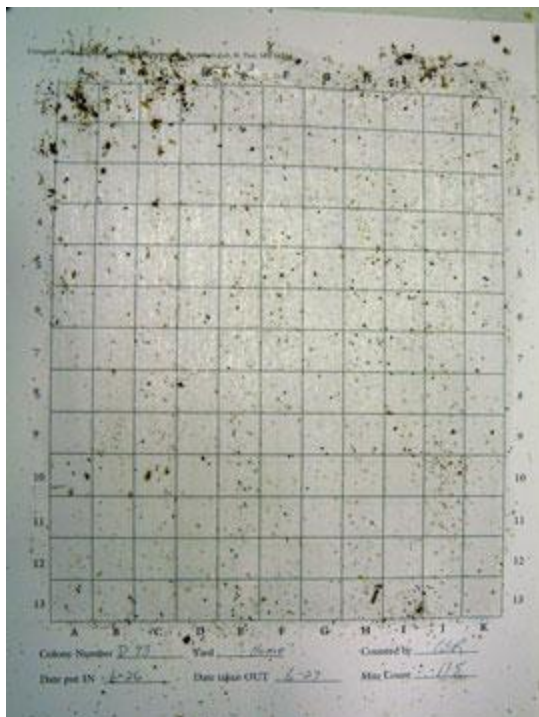


A commercial sticky board placed under a screened bottom board

Slide the screen and sticky board into the entrance of the colony.

Return in 24 hours, remove the sticky board and count the mites. If you want to bring it inside to count the mites, we suggest covering it with plastic wrap. To estimate the total mite level in the colony, see below.





Sticky board after 24 hours with approximately 100 mites



Close up of mites on sticky board. The mites are easily distinguished from other debris because they have a very regular oval shape and are red-brown in color.

### Estimating Total Mite Load

Research estimates show that when colonies have above 8-12% total mite infestation (that means, infestation in both sealed brood and on adult bees), they will require treatment to prevent collapse. How do you determine if your colony has 8-12% infestation?

When sampling mites on adult bees, it is very important to remember that from 50-75% of the total number of mites in the colony are located in the sealed brood, and therefore, only 25-50% of the mites are present on adult bees.

If you sampled bees using powdered sugar or alcohol and found 30 mites per 300 bees, that is equivalent to 10 mites per 100 adult bees, or a 10% infestation on adult bees. If there is sealed worker and drone brood in the colony when you sample, you should **at least double your estimate** to determine the overall mite level of the colony. In this case, your colony has at least a 20% infestation and they should be treated.





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If you find 60-120 mites on the sticky board after 24 hours, research estimates have shown that you have approximately an 8-12% total mite infestation (including mites on adults and in brood), and your colony should be treated.

Estimates of mite loads based on natural mite fall will vary depending on if the size of the brood nest is increasing rapidly (in spring) or diminishing (late summer and fall). We prefer to use the powdered sugar or alcohol wash methods, which we find quicker than and not as variable as the natural mite fall method.

**Treatment decision examples using the powdered sugar or alcohol wash methods:**

If you sample for mites on adult bees in late April or early May and determine that there is a 5% infestation on adults, you can assume there is over a 10% total mite infestation in your colony. If you treat now, you cannot put honey supers on while the treatment is in the colony. If you do not treat now, the colony may collapse after the honey is harvested.

If you sample for mites on adult bees in early May, and find a 2% infestation on adult bees, corresponding to over a 4% total infestation, you may opt to wait to sample again in late summer, and possibly treat then.

If you sample for mites in late summer, when there is a lot of brood remaining in the colony, and find 3% infestation on adults, or at least a 6% total infestation, you may opt to not treat, and sample again in early spring. The mites will not increase when there is no brood being reared in the colony during winter.

**Treatment decision examples based on natural mite fall:**

As stated above, if you find 60-120 mites on the sticky board after 24 hours, research estimates have shown that you have approximately an 8-12% total mite infestation, and your colony should be treated.

If you find less than 60 mites after 24 hours, you should continue to sample through the season, and consider treatment when mite levels exceed 60 mites



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### Comments on the Powdered Sugar Roll

The powdered sugar roll is a good monitoring mechanism, but there are a couple issues to be aware of with it:

1) **Variability in mite removal.** Depending on the circumstances, there can be variability in the removal of the mites. Some researchers claim the method will remove 80-90% of the mites from the sample of bees. Others will say it is lower, only 65-70%. A lot of this discrepancy is due to all the variables that exist when sampling and testing, regardless of whether one uses powdered sugar, ether roll or alcohol wash. Last year we collected samples from 17 hives and ran the powdered sugar roll (collect from center brood frames, dust with sugar, shake, let stand 2-3 minutes, shake out mites and sugar, let stand another minute, shake out again). We then took that same sample of bees and did the alcohol wash to see if we could dislodge more mites. In general we found and felt that the powdered sugar did a good job in that we would find sometimes 1 or 2 more mites after alcohol washing in the sample of 300ish bees

2) **Treatment threshold level.** The general thought is that with a sugar, ether or alcohol roll, whatever your mite count comes out to be per 100 bees you have to at least double it since you are capturing information about mites on adult bees, not mites in brood. Depending on who you read you will see a range of ideas on the percentage of mites on adult bees to mites in brood from 50% of the mites are on the adult bees and 50% of the mites are in the brood to 25% on adults, 75% in brood. Some will argue, correctly so, that this ratio changes throughout the season with 67% of the mites in with brood (33% on adult bees) during the summer and as brood rearing declines into fall the ratio swings the other direction.

As an example, say you did a powdered sugar roll and found 6 mites in 300 bees, that is 2 mites per 100 or 2%. Doubling that to account for mites in brood means your hive infestation is about 4%. If you err on the high side (the 25%-75% idea since we are close to peak, or probably just past peak now of brood rearing) then it is 6% infestation (and depending on how well you think the powdered sugar is removing your mites, you may have bump the number up) Typically the researchers feel that when the total mite load (on the adult bees and in the brood) is in the 8-12% range one should treat to prevent collapse.

Some argue that treatment should start at a much lower threshold level, maybe 6%. Some argue that the threshold changes with the seasons with a lower tolerance, 1-2 mites in a powdered sugar sample of 300 bees in spring, a little higher allowance in peak of summer 4-5 mites, and same 4-5 or lower going into fall.

If you sample drone brood, the thought is that the mites have a 10:1 preference for drone over worker brood, so you can work out the math for total hive infestation level from a sample of 100 drone brood as well.



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3) **You are your bees patient advocate and their doctor.** You need to monitor the situation closely, testing, questioning etc. If you tested for the ailment, established a threshold level for treatment, treated the ailment and tested again to find the technique or treatment (or combination thereof) didn't accomplish what was needed then just like a good doctor your next step is to "adjust the prescription" to manage the ailment.