

*He said, "Go and tell this people: 'Be ever hearing, but never understanding; be ever seeing, but never perceiving.' Make the heart of this people calloused; make their ears dull and close their eyes. Otherwise they might see with their eyes, hear with their ears, understand with their hearts, and turn and be healed."*

-- Isaiah 6:9-10

I recently came across a backyard beekeeping website that made me want to cry. It was a very nice-looking website with lots of articles and videos about backyard beekeeping. What was so sad was that much of the information was not only complete nonsense but even worse, harmful. One of the bits that jumped out at me was an article on "varroa control" by a self-proclaimed expert who said she waits until "seeing signs of mites, such as deformed wings," then treats the colony with mineral-oil fogging<sup>1</sup>. Then she "looks at the bees to see if they still have mites."

I have far too many personal stories of beekeepers asking me why their hives are empty. I'll ask, "When did you last treat for varroa mites?" and they'll often answer, "I didn't treat because I looked at my bees and I didn't see any mites." When I ask, "By 'looking at the bees' do you mean you took a mite sample?" they'll reply, "No, I just looked at them."

Often these are folks who cannot spot the queen, yet they have some sort of super-human ability to assess the proportion of mites in a colony just by looking at a frame of bees.

Even though the message about how to assess varroa mite infestations is widely available (I've explained it at least four times myself in these articles since September 2013), many folks either continue to allow themselves



**How many varroa mites do you see in this picture?**

to be deluded by internet charlatans or they aren't paying attention. Either way, now is the time for redemption.

Before describing a very easy, yet very accurate, way to assess mite infestation levels, it may help to lay out a few facts so we can understand why we should care.

### **Fact One: Any Mites You See Don't Tell the Story**

Yes, varroa mites are visible to the naked eye. Mature adults are reddish-brown and about the size of a pin head. If they are immobile against a white background, you should be able to see them. However if they are on the back of a moving, furry, golden/brown/black bee, among thousands of other moving, furry, golden/brown/black bees, chances are good that you won't see very many of the ones that are in plain view. This is a bit like looking for a brown needle in a very large brown haystack when all the hay is tumbling and rolling over itself.

However that wouldn't be impossible for someone with super-human ability, just very difficult. What makes it impossible is that while a few mites can be seen riding in plain view on the back of a bee, research at the University of Maryland shows that 99% of them are not riding on bees' backs like Hopalong Cassidy, happily waving at us with one of their little mite hands while clinging on with the others. Instead they are hidden on the underside of the

<sup>1</sup> Mineral-oil fogging was a clever concept that was thoroughly vetted 10 or more years ago and dismissed by researchers and informed beekeepers as being ineffective, unnecessarily stressful on the bees, expensive and way too much work! It is also on the Prohibited Substance list for Certified Naturally Grown beekeeping.

abdomen, feasting on the bees' fat deposits. They also can partially hide in the overlap between the sclerites (the series of plates, top and bottom, that form the bees' "skin").

Don't forget that bees are searching for mites too, so to be successful, mites must be able to avoid detection by bees, not humans. And they are very good at it. For example, once she drops into a pre-pupae's cell, a mother mite buries herself beneath the brood food at the bottom of the cell, breathing through a long tube to avoid being discovered by nurse bees. If a mite's Ninja skills are good enough to survive scrutiny by bees, why would anyone think that a casual glance by a human would lead to discovery?

But let's say that we do see a mite or two riding on a bee. Big deal. Every honey bee colony in North America has varroa mites. If you see absolutely none, that confirms the fact that "looking" doesn't work! However the question we want answered is this: what is the relative proportion of mites to bees in my hive? If there is one mite per thousand bees, I'm not overly concerned. But if there are 100 times that number, my colony is likely very sick from the viruses that mites spread and may soon perish without quick intervention, if it isn't too late already.

If you remember my Bee Math article (November 2015), we guesstimated that there can be about 1,100 bees on a frame face. Can anyone calculate a percentage of mites to bees on a frame face, given all the caveats above, just by looking?

### **Fact Two: If You See Mite-Related Damage, the Game is Already Over**

Relying on seeing the visible symptoms of varroa-borne disease as a mite assessment technique is like closing the barn door after the cow has already gotten out, trotted toward town and been hit by a semi-truck while crossing the interstate highway. Honey bees, like humans, live with all sorts of viruses in our bodies at all times. When the amount of a virus passes a certain threshold level, and/or when the stress of bodily damage or any number of

other stressors activates the virus, symptoms appear and bees die. Viral load in individual bees increases with the varroa infestation level of a colony. Once the level is high enough to trigger symptoms, eliminating the original vector (the mites) doesn't eliminate the virus; the colony can continue to weaken and die even if the mites have been removed.

An analogy often used by State Bee Inspector Lewis Cauble is, "Say my friend gives me a cold. If I then kill my friend, it doesn't cure my cold."

### **Fact Three: Killing Backyard Bees via Neglect Doesn't Help the Species Survive**

Some folks seem to have the strange idea that if they neglect their bees and let them die from varroa-borne diseases, the species will somehow improve and that will solve the varroa problem once and for all. However, it is ludicrous for backyard beekeepers in our area to think that they are accomplishing anything constructive with the "live and let die" approach. Killing colonies and then buying new ones to replace them, or replacing them with escaped swarms, doesn't impart any improved genetics whatsoever into the honey bee gene pool. All it does is pollute the surrounding areas with sick, varroa-infested bees.

Plus, there is absolutely no assurance that bees and mites will eventually "work it all out" and live together as friends. Extinction is far more likely, just as the dodo bird became extinct when faced with an exotic predator it had no capacity to deal with.

A cynic could well ask, if the "live and let die" approach to our bee livestock is so obvious and noble, then why don't we apply the same philosophy to our dogs and our children? Do we expect our dogs to find their own food during times of dearth, and let them die from rabies rather than vaccinating them? Do we withhold treatments for diabetes, meningitis, strep throat etc. from our children so all but the strongest will sicken and die, in order to toughen up the human race?

### **Fact Four: Effective Varroa Treatments are Cheap, Easy to Apply and Are Well Tolerated by Bees**

The annual cost of treating a colony to kill varroa mites with a safe, legal, effective, commercially-available treatment is less than \$7. That's less than the price of a single pound jar of locally-produced honey.

There is a lot of mostly-uninformed beekeeper rhetoric about staying away from "chemicals." Almost no one I know treats their colonies with synthetic chemicals – the most popular, and highly effective, treatments used in our area are the two thymol products, ApiLife Var and ApiGuard, and the formic acid product, MiteAway Quick Strips. All three of these are approved for "Certified Naturally Grown" use and formic acid is on the USDA Organic approved list.

Each of the three treatments listed above are powerful substances; that's why they work. They must be applied strictly according to the label directions – the label is the law. Following the directions to the letter will help ensure that the treatment works well with little if any damage to the colony. But even if there were to be short-term minor damage, it is better than death of the entire colony due to varroa-induced disease.

### **Fact Five: Assessing Mite Levels is Not Difficult**

So if legal, effective, genuine treatments aren't expensive and aren't contrary to organic principles, and there is absolutely nothing to be gained by letting colonies die a miserable death, why don't people do something to save the lives of their bees?

Maybe one reason is that many people don't know how to assess mite levels or they are uncomfortable doing so. Having never taken a mite count, when their bees die they blame the death on pesticides, GMO crops or just say, "the bees left." Ignorance is bliss. However ignorance doesn't prevent mite damage – the mites don't care whether we acknowledge them or not.

I must admit that I used to have trouble taking mite samples. The Bee Inspector method of holding a frame in one hand and gently coaxing bees to fall into a jar with the other hand usually netted me a dozen or so bees in the jar. I know this method can work – I've seen it demonstrated many times – maybe I just don't have the necessary coordination. However several years ago I discovered the University of Minnesota shake-into-a-bucket method for taking a sample and it is so easy and simple that even I can do it. Plus, it incorporates bees from more than one frame so takes a more representative sample than jiggling bees off of one face of a single frame.

### **How to Sample Mites the Easy Way**

For the UM shake-into-a-bucket method, you'll need eight simple items for your sampling kit:

1. A five-gallon bucket or similar container. I like to use a large cat litter bucket (mine is Tidy Cat), the kind with the hinged lid. Not only is the bucket necessary for the sampling process, it holds all of my paraphernalia when I'm not using it.
2. A mason jar with a rim lid. Some people use pint jars; I prefer quarts because there is more room to jostle the bees in the powdered sugar. Plastic peanut butter or mayonnaise jars work great if you cut a properly sized hole into the plastic lid, turning it into a rim.
3. A piece of 8-wires-per-inch hardware cloth, cut into a circle to fit under the rim of the mason jar lid. Home Depot/Lowes doesn't carry #8 mesh, but you can get a small piece from bee supply stores or specialty hardware stores. Or ask for a scrap at your next local beekeepers' club meeting. Or contact me and I'll sell you a jar-sized piece for a dollar. You must use #8 mesh: any smaller and the mites won't fall through, any larger and the bees will escape.
4. A small scoop that will hold 100 mL (0.42 cup). I use the plastic cap off of an old spray-paint can. Pour exactly 100 mL of water into the scoop and clearly mark the

level with a permanent Sharpie. Dump out the water; it is only used to find the spot to mark the volume.

5. A white surface. I use a Styrofoam picnic plate. If your bucket in #1 is a regular 5-gallon bucket with a lid, the lid would serve this purpose well.
6. Powdered 10X confectioners' sugar.
7. A small container of water for dissolving the sugar. I like to use a spray water bottle but that is fancier than it needs to be.
8. A hive tool. This needn't be different than your regular ol' hive tool. Just don't forget it.

To take a sample, do the following:

1. With your equipment at hand, open the hive that is to be inspected.
2. Select a frame from the brood nest that has big fat larva almost ready to cap. Make sure the queen is not on the frame. Finding her and setting her safely aside beforehand is a wise precaution.
3. Hold the frame over the empty 5-gallon bucket and give it a quick up-and-down shake. Nurse bees will tumble off of the frame into the bucket.
4. Repeat with another frame, until you have a nice sample of nurse bees.
5. Tamp the bucket once on the ground so the bees on the inside fall to the bottom in a clump.
6. Take your marked scoop and scoop bees up to the 100 mL mark. If you don't get it perfect, it's better to have a few too many rather than a few too short.
7. Pour the scoop of bees into your mason jar.
8. Place the mesh cover on the jar and secure with the rim.
9. Using the broad end of your hive tool, scoop up a heaping tablespoon's worth of powdered sugar and dump it onto the mesh lid of the jar. It should fall into the jar; encourage it as needed. Repeat two or three more times.
10. The bees in the jar now look a little bit like they are in a snow globe. Gently but firmly swirl and shake the jar so that the bees

become completely covered in sugar. Don't be timid. This is one of the most important steps in the process.

11. At this point, the sugar-coated bees look like they would be quite tasty with a bit of chocolate sauce. Resist the temptation to eat them. Instead, set the jar in the shade for five minutes to give the mites time to fall off the bees.
12. Hold the jar upside down over your white surface (plate, bucket lid, whatever) and vigorously shake up and down, like you would with an uncooperative pepper shaker. Sugar, mites and debris will fall out of the jar. Continue until nothing more comes out. Swirl the jar and shake some more. Repeat until absolutely nothing more can be harvested. This shaking step is the point of the whole exercise so we don't want to leave anything behind.
13. Add a bit of water to the powdered sugar on the white surface. The sugar will dissolve, clearly revealing anything else that fell out of the jar. There will be pollen specks, dirt and varroa mites.
14. Count the varroa mites. They look like tiny ticks. If you have great eyesight, you may be able to see their eight tiny legs.
15. The 100 mL sampling scoop holds 300 bees, so divide the number of mites by 300 to get the percentage of mites per bee in the sample. Since more than half of the adult mites in a hive are feasting on pupae underneath the cappings, multiply the percentage you found by two to get an estimate of the overall percentage of mites per adult bee in the hive.
16. Oops! Don't forget the sugar-coated bees in the jar! Remove the mesh lid and gently shake the bees onto the entrance board of the hive they came from. They'll be dizzy and confused but unharmed. Their sisters will eagerly lick the sugar off of them as they excitedly describe the wild ride they just had.

This isn't the 100% most accurate way to count mites. The gold standard is an alcohol

wash, where alcohol is used instead of powdered sugar. The bees die, but every single mite can be harvested. The dead bees can be counted so that a precise percentage is calculated. However, studies comparing the alcohol wash method with the sugar shake method show that the sugar shake results are fairly close to the alcohol wash results, close enough for hobbyist purposes. So most people prefer to use the non-lethal sugar shake method. Using the UM shake-into-a-bucket technique, sugar shake sampling can be done by anyone; no special skill is required.

### Alternative Sampling Methods

A popular alternative technique is the sticky-board method, where a board, often marked in a grid pattern, is placed underneath the screened bottom board. It must be greased with vasoline or some other adhesive. After three days the board is removed and the mites are counted. The number is divided by three to provide an estimate of daily mite fall.

There are many problems with the sticky-board method. One is that it is very difficult to sort through three days' worth of hive litter to try to find mites. From a statistical standpoint, the biggest problem is that the number of mites is not normalized (it isn't a ratio or percentage) so has no real meaning out of the context of that specific hive. For example, does a high number mean that there is a mite problem or does it reflect the fact that the bee population is extremely large, and so even a low percentage of mites per bee would yield a high number of mites on the board? Conversely, does a low number mean that there isn't a mite issue, or does it mean that we have so few bees that there can't help but be a low number of mites regardless of the percentage of mites per bee?

I have only done sticky-board sampling a few times. I don't think it has any value for what I am trying to accomplish and it is much more time-consuming than the sugar shake.

Drone sampling is another mite assessment technique but it is very imprecise. In a hive with a severe mite infestation, you can remove a

dozen or so capped drones from their cells using an uncapping fork and often see mites feasting on a few of the pupae. This "test" will reveal the presence of mites if you see them, but isn't proof of the absence of mites if you don't see them. And it can only tell you presence, not a percentage. Furthermore, since mites aren't distributed evenly in brood cells, you would need to harvest a very large number of pupae to get a truly representative sample.

### When to Sample

It is wise to sample before the honey flow in spring and again at the start of summer when the flow ends. This will tell you whether you have a critical situation with any of your hives. It also will educate you on the population dynamics of varroa mites.

Then in August/September, sampling is important because this is when the nurse bees that raise the overwintering bees are developing. To raise healthy overwintering bees, their nurses should be free of mites. In my hives, sampling doesn't really tell me whether I need to treat in August/September – I always need to treat then if I expect to have live, healthy, thriving bees the next spring – but I do depend on it to tell me if my treatment-of-choice worked. So I sample before treating and afterward.

### We Are All In This Together

Since varroa mites are a community problem (bees fly, carrying varroa mites with them), let's all be good neighbors and responsible livestock owners by working to keep this plague in check. Please don't turn a blind eye to the presence of varroa mites in your hives. Use a reliable method for sampling them. That method doesn't have to be difficult. Then use an effective, legal treatment to keep mites under control.

See the article ["Know Thy Enemy"](#) for information about how *varroa destructor* kills bee colonies. Then read ["How Mite We Smite Mites?"](#) and ["What's the Deal with Oxalic Acid?"](#) for tips on effective treatments.

*Randall Austin is a NC Master Beekeeper who keeps a few honey bee hives in northern Orange County. He can be reached at [s.randall.austin@gmail.com](mailto:s.randall.austin@gmail.com).*

*Copyright 2015, no reproduction in whole or in part without permission of the author.*