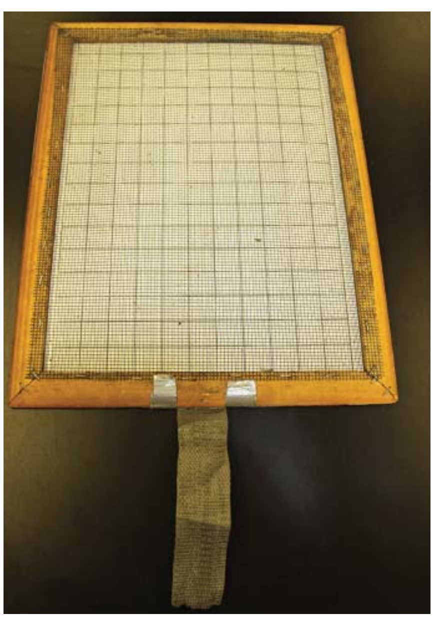
More Natural

Do we treat? Do we walk away? Do we do a little dance?

Jennifer **Berry**

"Why did my colony/ies die?" This seems to be a common question we receive from beekeepers either at meetings, in the field, or over the phone. After a brief inquiry, it usually becomes obvious that the colony/ies either died from starvation or mite infestation. Since we've already covered feeding in an earlier article, I won't bore you again, so let's now turn our attention to the main reason colonies die: *Varroa destructor*. Yet, folks continue to ignore the situation, maybe due to a lack of knowledge, or understanding or reality or awareness, or – while others believe that waving a magic wand will work. Unfortunately, for all the above, it's not the answer.

It has been a challenging year for the bees in Georgia. But, it was in the early part of the year that set the stage for some disastrous events that will occur this Fall and Winter. The southeast experienced a very warm December and January. Hence, queens never shut down, and brood production continued throughout the Winter. In turn, mites continued to lay eggs and reproduce along side the bees since there were plenty of tasty young larvae available. So, once again, mite populations are at much higher levels than normal. By Summer's end, your colonies' population could be crashing. And, by Winter, you may find your wooden boxes void of bees.



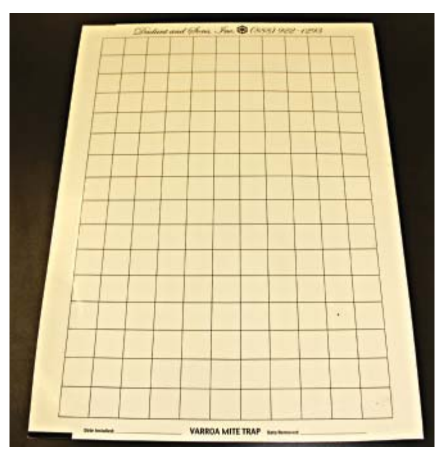
Framed screen Varroa *trap.*

So what do we do? Do we treat? Do we walk away? Do we let nature take its course and allow these weak bees to die? Do we do a little dance? When becoming a beekeeper, it is important to know or understand that those bees, in that hive, in your backyard, need your help to survive. In the July issue, I concluded in, "Is Natural Really Natural?", that our modern honey bees aren't indigenous to the Americas; settlers brought them here. Ever since, we have imposed our human-centric management techniques on them, laced our environment with a myriad of toxic chemicals, converted vast amounts of natural landscape to monocultures, golf courses, shopping malls and parking lots, and, finally, negligently imported exotic honey bee pathogens and parasites. How can we expect honey bees to thrive on their own under these conditions? How can we stack the odds against them, and then demand that they survive without our help? If our environment was more "natural," then perhaps we could expect honey bees to proliferate more naturally and independently.

Like pets, when we bring honey bees into our lives, we take on a certain responsibility for their care and welfare. Here in Georgia, animals can have a fit with fleas and ticks. I refuse to let mine suffer. So, I treat them with medication (chemicals) to eliminate the pests and prevent disease. If they get sick, I take them to the vet and administer any medication (chemicals) as directed. For that matter, if I get sick and rest/home remedies fail, I go to the doctor and take the medicine (chemicals) prescribed – along with a spoonful of sugar, of course! All that being said, if mite population has exceeded the level that the colony can tolerate and all other "non-chemical" strategies have been exhausted, then, yes, I advise that medication (chemicals) needs to be applied in order to save the colony. Some of us may oversimplify that it doesn't make sense to put an insecticide into a box of insects. However, if it will lower the mite population and ensure the colony's survival, then so be it.

I'm telling you what we do, not because I think it's the best way, or the only way, or "it's my way or the highway," but because we've learned over the years through trial and error along with close observations when working with successful beekeepers.

Before one can truly become a "good" beekeeper, one must understand the mite-bee relationship. *Varroa destructor*, an ectoparasite (one that lives on the surface of its host), is a relatively new parasite on *Apis mellifera*. *V. destructor* evolved on its original host, *Apis cerana* or the Asian honey bee. Over the years, the host (Asian bee) and the parasite (*Varroa*) developed a host-parasite equilibrium, so to say. If no equilibrium is



Sticky board from Dadant.

reached, the parasite will continue to kill off the host, which may eventually lead to there being no host. When this occurs, the parasite dies. But, if the virulence (degree or ability to infect or cause disease) of the parasite is mitigated somewhat and the resistance of the host is improved, a possible balance may follow. Since the Asian bee and *Varroa* evolved together, *Varroa* does not devastate the Asian bee. In this case, over time, Asian bees developed behavioral traits, such as hygienic behavior, or grooming in order to reduce mite populations. The mites are there, but they are not able to reproduce to destructive levels.

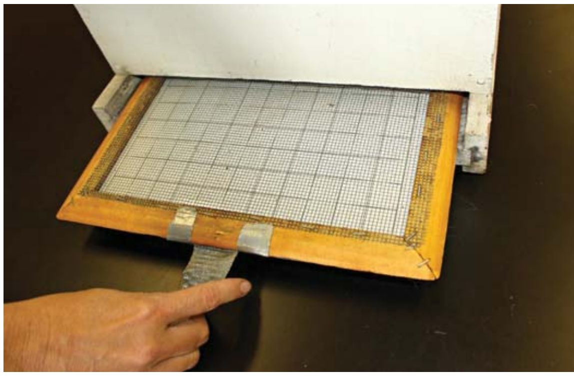
Lamentably, this is not yet the case with our A. *mellifera* bee-mite relationship. They've not reached the host-parasite equilibrium. As a result, the number of bee colonies, as well as beekeepers, have been dramatically reduced here and abroad. There's simply more to keeping bees now than before mites came ashore. This is why it is imperative that beekeepers understand economic thresholds (ETs) – the number of pests that must trigger the administration of control measures to save the host - and know how to apply them to their particular situation, location, time of year, etc.

Here at the lab, we begin to pay attention when mite levels are hovering around 40-60 mites in a 24-hour natural mite drop. Instructions for inserting sticky *Varroa* screens are very simple. You can use a *Varroa* mite trap below a screened bottom board, which can be purchased from several supply companies. Or, you can make a framed, metal screen in order to keep the bees from sticking to the surface of the trap, and insert it into the entrance of the colony. The traps are left in the colony for three days, removed, and the mites are counted. The total number for that colony is then divided by three to give us an average 24-hour count. If the colony is a five-frame nuc, full of bees, then 10-15 mites would be too many. If it is a single deep with a honey super, then 30-40 mites would be over the limit. For a stronger colony, say a double deep with a super, then 60 mites is our limit. The original research was actually conducted here at the UGA bee lab. If you are interested in reading more, go to www.ent.uga.edu/bees, click on "Research Archives," and click on "**Economic threshold for *Varroa jacobsoni* in the southeastern USA. K.S. Delaplane & W.M. Hood 1999.**" Disregard the name *jacobsoni*, rather than *destructor*; it hadn't been correctly identified at that time. And, due to increasing concern over the viruses transmitted by the mites, you'll note that we have lowered our mite margin.

It is also essential to understand the biology and behavior of mites in order to be a better beekeeper. *Varroa* mites must cohabit with honey bees in order to survive and can only reproduce on honey bee brood. Mites are small (1-1.8mm long and 1.5-2mm wide), but compared to their host the honey bee, they are one of the largest ectoparasites known. Their flattened oval shape is perfectly designed to slide between the abdominal segments of bees and their hardened (sclerotized) cuticle protects the mite from bee aggression.

There are two stages during the lifecycle of the female mite. The first is the phoretic stage in which female mites live on adult bees. They puncture the soft tissue between segments and feed off hemolymph (bee blood). They are carried throughout the hive, from bee to bee, or to other colonies through drifting or robbing. When brood is present, this phase can last 4.5-11 days or up to six months when brood is absent. This phoretic stage is when most miticide treatments are effective. Reason; mites are exposed at this stage and not under the protective layer of wax. On average, the life expectancy of the female mite is 27 days when brood is present and multiple months in the absence of brood.

The second stage, or reproductive phase, begins when the female mite, now titled the foundress mite, infests worker cells (15-20 hours prior to being capped) and drone cells (40-50 hours before capping). Once she enters the cell, she submerges herself into the brood food, extends tiny breathing tubes, and remains buried until the larva consumes all the brood food, hence releasing her. Afterward, the mite climbs onto the larva and begins feeding. Seventy hours after being securely sealed within the worker or drone cell, and protected from the bees and the environment, she begins to lay the first egg. This egg develops into a male, which only has one stage; he will never leave the cell and will die once the adult bee emerges. After the



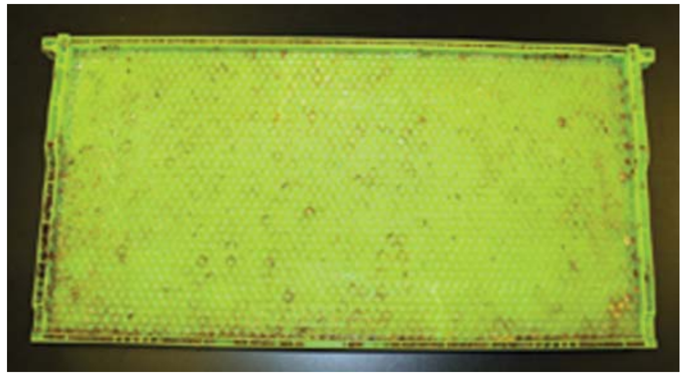
Screen being inserted into a hive.

male egg is laid, subsequent female eggs are laid at 30-hour intervals. The foundress mite only has 13 days to lay eggs in worker cells and 15 days in drone cells. This allows for those eggs to hatch, molt, become sexually mature, and mate all before the adult bee emerges. The mite operates on the bee's clock. So, the entire mite reproduction cycle must be completed within the time frame of the developing bee. Otherwise, any progeny not completely developed will die.

Once the eggs hatch, they must start feeding. So, the foundress mite creates a hole through the cuticle of the pupa in order for these newly emerged protonymphs to feed. Without the establishment of these feeding zones by the mother mite, the nymphal stages would not survive. The chelicerae (insect fangs) of the protonymphs are too soft to penetrate through the cuticle and the male's chelicerae are only used for sperm transfer. The developing protonymph molts into a duetonymph, next a deutochrysalis, and eventually into the adult mite. The entire developmental process (egg hatch to adult molt) takes about 5.8 days for females and 6.6 days in males.

The reproductive rate of mites is 1.3-1.45 in worker brood and 2.2-2.6 in drone brood. However, five mites along with the foundress mite can successfully develop and emerge along with the adult drone bee. Hence, one female mite can potentially replicate herself five times in drone brood, but only once in worker brood. So, it makes sense that the foundress mite would choose drone brood over worker to complete her reproduction. We will revisit this idea about drone brood later. In the average temperate region, *Varroa destructor* populations can increase 12-fold in colonies having brood during half the year. However, in areas where

Varroa on the screen.



Drone frame.

brood is produced year-round, mite populations can increase 800-fold. That's why the *Varroa* "window" is greatly reduced in northern portions of the U.S. Here in Georgia, it's been two years since we've seen a broodless period. Consequently, mites have really taken a toll.

Not only are the mites sapping the strength of the developing brood, but they are also vectors for a variety of honey bee viruses: Kashmir bee virus (KBV), Sacbrood virus (SBV), Acute bee paralysis virus (ABPV), Israeli acute paralysis virus (IAPV), and Deformed wing virus (DWV). Before the introduction of *Varroa*, bee viruses were basically benign. By feeding, the foundress mite inadvertently injects viral particles into the developing pupae, and, along with additional feeding sites by subsequent mites, activates the virus. It is the viral infections that eventually take out the colony slowly over time through population decline, scattered brood patterns, crippled bees unable to forage, and loss of social structure!

The big question now is what can we do to hold back the onslaught of these parasites? First, start off by purchasing queens that have been selected for resistant traits. This is not a cure-all, but it's one part of a whole management scenario. Next, install bottom boards with screens; these have been shown to incrementally help to reduce mite populations.

In early Spring, insert drone brood foundation into the brood chamber next to the outer frame of brood. As mentioned earlier, the foundress mite prefers to reproduce in drone brood because of the extra time for more of her progeny to develop to adults. Insert the frame directly into a colony as soon as drone brood rearing commences. Now, if you are in the northern section of the country, you don't want to do this too early. Here in Georgia, we insert between late February and early March when the bees are flying and able to move around the hive.

Once the drawn drone frame is in place, the queen will lay eggs into the cells. When the cells are capped, remove the frame and place it into the freezer for 24 hours or until solidly frozen. Afterward, let the frame thaw. Use a capping scratcher to remove the dead drones and mites. Then, put it back into the colony and let the bees clean it out. If you want, leave it in for a second round of mite removal. Remember, you will need **drawn** comb in early Spring since the bees will not be drawing comb out just yet. So, get those frames drawn out this year and protect them until next Spring. Wax moths and small hive beetles would love to destroy the entire frame.

Another management option is brood cycle disruption, which will slow down mite population growth. If there are no suitable bee larvae available, then the foundress mite cannot reproduce. And, that's what we want – no reproduction! Here at the lab, as well as in my personal colonies, we do a combination of all the above. Relying on just one strategy may not do the trick.

Monitor your mite loads. Some colonies may take years before reaching the ET. Some may never reach it. And, still, others may reach it in their first year. That's why it's best to start checking levels NOW, and, if they are too high, you must do something.

At this point, late Summer, it is too late for resistant queens, brood cycle disruption, and screen bottom boards to do what needs to be done if levels are too high. You need to get levels down quickly. Colonies are gearing up to produce Winter bees. If these bees are compromised by mites (viruses), then they will not survive the Winter. Plus if you don't have drawn drone frames, then treatment is your only option. We recommend ApiLife Var®, a Brushy Mountain Bee Farm product, or Api Guard®, a Dadant & Sons product. The active ingredient in both miticides is Thymol, an essential oil. There are other products out there, but we've had the best success with the thymol-based ones. Just make sure you read all the accompanying material and follow the instructions completely. Too little won't work, and too much can kill bees. One more thing, powder sugar will not work at this point as a treatment option. The sugar only dislodges mites found on the adult bees and doesn't touch the reproductive stage under the cell. 80% of the mites are under the protective wax cap during brood rearing and hence are not affected. Trust me, I wish this wasn't the case. When we first started testing powdered sugar, we were so hopeful that it would be a successful mite treatment. It was very disappointing when we discovered it did little in reducing mite populations.

As a side note, my fellow researchers and I have never received money from a single chemical company that produces the chemicals (miticides) mentioned above. So, we can extinguish the myth that researches want beekeepers to remain reliant on chemicals because it is making us rich or keeps us in business.

I hate to be so straightforward here, but, if you want to be a beekeeper, then do what it takes to be a good beekeeper. If your bees are hungry, feed them. If they are overrun with mites, treat them. Your bees are your responsibility. If you refuse not to feed or take care of them because it is somewhat un-natural, then don't become a beekeeper. It's not fair to the bees.

Take care! BC

Photos by Ben Rouse.