

# Managing Varroa

## Part II

### Selecting for Resistance & Queen Rearing

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Last month's article examined some of the inaccuracies, distortions and half truths that surround the most common IPM mite control strategies. Relying on faulty IPM practices to control Varroa has cost beekeepers untold losses, both in dollars spent, and more importantly in time lost. Nonetheless, IPM advocates refuse to give up. Through the power of repetition they continue to beat the same old worn out drum. If a product or treatment strategy is deemed natural, organic, or green, it must have merit and is therefore worthy of nonstop, never-ending promotion.

If ever there was a Varroa control strategy worthy of continual promotion, it is genetic selection. Selecting and breeding for increased mite resistance has long been touted as the only realistic long-term solution to the Varroa dilemma. Unfortunately, widespread acceptance has been hindered by the misguided perception that stock selection and breeding is something only large beekeepers can undertake. In theory, small operators lack the necessary colony numbers, adequate colony management expertise, and the know-how to rear their own queens. Therefore, they can't possibly embark on a stock selection and breeding program. That statement may have had a degree of legitimacy 15 or 20 years ago, but it has absolutely no basis in today's beekeeping world. To the contrary, today it's the dedicated hobbyists and sideliners who are in the catbird seat when it comes to the development of a chemical-free mite control program. Their limited size is their greatest asset. They have the advantage of time. When you couple a simple stock selection and breeding program with timely broodnest manipulation, you end up with the beginnings of a chemical-free mite control program. Hobbyists and sideline operators are the prime candidates for this type of mite-control strategy.

Starting in 1998 Dr. Eric Erickson, the

now retired head of the Tucson bee lab, published three papers on the subject of stock selection and breeding for mite tolerance.<sup>1, 2, 3</sup> Published in the *American Bee Journal* in 1998, 1999 and 2000 these articles describe the basics of how to select for and propagate mite-tolerant stock. I recommend that anyone seriously interested in stock selection and breeding acquire these articles. They are literally worth their weight in gold! Absent that, in the August 2010 ABJ pp.777-781, Dr. Stuart Jacobson reviewed several different studies on Varroa-resistant honey bees, including a portion of Dr. Erickson's work. This is another excellent read for anyone interested in chemical-free beekeeping.

Small beekeepers intent on establishing a chemical-free operation don't have the luxury of colony numbers, or extensive management experience. They do, however, have the advantage of time. In addition to selecting for a degree of mite resistance, they can implement traditional broodnest management practices to supplement their selection program. This dual approach minimizes the time required to establish a treatment-free mite control program. Best of all, there are no special management skills or fancy diagnostic techniques involved. The only requirement is a basic understanding of traditional colony management technique.

#### Stock Acquisition

Dr. Erickson determined early on that Varroa-tolerant bees were present in most apiaries. He found that 3-10% of colonies in any apiary have some degree of tolerance, and this was in the mid 1990's. For those operating 30 or more colonies, you already have the fundamentals to start a simple selection program. Percentage-wise, the majority of readers are operating far less than 30 colonies. Therefore, you will need to acquire resistant stock from outside sources.

1. Start by contacting other local bee-

keeper's. Combining resources would increase the size of the selection pool. The local beekeeper's association might be able to supply the names of other interested parties. Your state association might be another good source of information; they may already be promoting queen rearing and mite-selection programs.

2. Set up bait hives to collect swarms. Whenever possible, place the bait hives in areas away from other managed colonies. This should increase the chances of collecting feral survivor stock. Structure removals and bee trees are other potential sources of survivor stock.
3. Local queen producers are another potential source of resistant stocks. They are almost certainly selecting for resistance, so a small queen purchase should supply your initial needs. If there aren't any local producers, check at the state level. Someone is producing locally adapted stock.
4. Purchase several production queens from a trusted producer. Then observe and carefully monitor their progress. Chances are one or two queens will stand out. Several beekeepers acting in concert would increase the chances for success.
5. Purchase an inseminated breeder queen(s) from a recognized breeder specializing in the development of resistant stocks. This is not practical for most small individual beekeepers, but it could work for a consortium looking to save time and developmental expense.

#### Selection Procedures

From the small beekeeper's perspective stock selection must remain as basic and uncomplicated as possible. The mechanisms responsible for resistance are irrelevant. Even if it were possible to identify them, there is virtually nothing the small operator could do about it. The only factors

that matter are a colony's overall condition and its mite count, or more specifically, the lack thereof.

The only way to ascertain a colony's condition and its current mite load is to monitor the broodnest, and sample the adult population on a regular basis. The first obvious signs of trouble will likely show up in the

form of damaged brood or the presence of wingless bees. Punctured cappings and open cells containing twisted and decaying larvae are signs of virus activity. Wingless bees and partially emerged adults, many with their tongues sticking out, confirm that diagnosis. Colonies exhibiting these symptoms are often on the verge of collapse.

Regular sampling of the adult bee population should sound the alert long before broodnest symptoms appear. Use whatever sampling technique you deem appropriate; just make sure the procedure is consistent throughout the season. Personally, I would recommend the powdered sugar roll described in the sidebar article. The cumula-

## Powdered Sugar Roll

In order to determine the effectiveness of your selection and breeding program, it is necessary that you implement some form of mite-sampling regimen. Monitoring the 24-hour mite drop with a sticky board is one option if your colonies are all in the same location. Multiple locations require too much time and travel expense to make this method practical. The use of open-screened bottom boards during periods of inclement spring weather also complicates this form of sampling. The alcohol wash method<sup>4</sup> of sampling is very effective, but it's somewhat messy and requires the sacrifice of the sample bees. The powdered sugar roll<sup>5</sup> overcomes all of these shortcomings. Its main advantage lies in its simplicity. Any first-year beekeeper can perform the procedure correctly on the first try. Sample accuracy is the other big plus. Sugar rolls normally recover over 90% of the mites in the sample bees, more than enough to determine the effectiveness of your stock selection program.

Start by selecting a comb of open brood, with preferably half of that brood within 24 hrs of being capped. This should provide the highest possible ratio of mites to adult bees. Hold the frame by one end and shake the adhering bees into the tub. Tap a corner of the tub on the ground or an adjacent hive top to accumulate the bees in the opposite corner. Use the measuring cup to scoop up the required number of bees, (a level ½ cup equals approximately 300-320 bees) and dump them into the Mason jar. Add one moderately rounded *Teaspoon* of powdered sugar through the screened lid. Now tip the jar at a 45 degree angle and slowly rotate it until all the bees are coated with sugar. The next step is crucial. Set the jar on a flat surface for a minute to a minute and a half. The now sugar coated bees will begin to tumble in the bottom of the jar; the tumbling generates heat which in turn causes the Varroa to back out from under the bee's abdominal segments. (If you hold the jar flat in the palm of your hand, you can feel that warmth) Once the sample has set the required minute and a half, invert and gently shake or jiggle the jar in a sideways motion above the cool whip container. Within 10 to 15 seconds the displaced mites will be clearly visible on the bottom of the container. Once the sampling procedure is complete, either dump the bees back into the open broodnest or at the main colony entrance.

Recent work out of the University of Minnesota<sup>6</sup> provides a simple formula to convert the results from a 300 bee sugar roll into a colony infestation level. The study also provides a similar formula to calculate the apiary infestation level. This should help anyone trying to develop mite-resistant stock to determine both their level of success and rate of improvement.



Required equipment - Rubbermaid tub, wide mouth pint Mason jar with a screened lid, a 1/2 cup measuring cup, an empty Cool Whip container, and a supply of dry powdered sugar.



Sugar-coated bees tumbling in the bottom of the sampling jar.



Varroa on the bottom of the Cool Whip container, note the absence of powdered sugar.

tive effects of bee viruses have significantly altered the mite resistance indicators quoted in Dr. Erickson's articles. Consequently, I would be hesitant to recommend any specific resistance levels based solely on my individual experience. I will, however, specify what doesn't work. The subsequent mite sampling data is derived from 300 bee sugar rolls and relates to my Northeastern Ohio operating territory. Based on my circumstance, a stationary operation with an extended overwintering period, any colony with a 10% infestation level at the end of July is in trouble. (10% infestation levels equate to 15 mites per 300 bee sugar roll) If left untreated, colonies in this condition are toast! If treated and requeened, they usually overwinter without concern. Quite frequently these colonies aren't exhibiting any obvious signs of trouble; there are no wingless bees or noticeable brood damage. Were it not for the sugar roll, it would be nearly impossible to detect trouble in time to avert disaster.

From an operational standpoint, starting around the first of June, monitor and sample the large production colonies on a monthly basis. It won't take long to determine which queens are your next generation breeders. Small operators can't afford to play the live and let die game. If you try, wholesale disaster will almost certainly pay a visit. Therefore, the monthly sampling procedure doubles as a treatment threshold monitoring tool. Swallow hard, and don't be afraid to treat the large production colonies when the need dictates. Early on in the selection process, colonies lost to non-treatment will have to be replaced from outside sources. Introducing unselected outside stock has the effect of shifting your stock selection program into reverse. Once treatment is complete, requeen all the treated colonies with daughter queens reared from your resistant stock.

### Queen Rearing

The ability to rear queens is absolutely essential to the development of any mite resistance program. Grafting is the standard method by which large numbers of queens are produced from a specific genetic source.

It's quick, simple and efficient. However, if you just have a couple of colonies in the backyard, or if you only need a few queens at any given time, grafting is simply not very practical. If you fall into either of these categories, you may want to consider notching.

Notching is a simple non-grafting queen rearing technique which I learned from Mel Disselkoen.<sup>7</sup> Simply put, notching is the practice of removing or destroying the bottom cell wall of one or more worker cells containing young larvae of queen rearing age. When you remove the queen from an established colony, when you divide a colony or make up a new split, the queenless colony will immediately begin constructing emergency queen cells. If you employ the notching technique, the queenless colony will focus their emergency queen rearing efforts on the larvae in the notched cells. By notching, the beekeeper in effect determines which larvae the colony will utilize to produce their replacement queen. The notching method I describe below is ideally suited to the small operator who needs a few queens to support the development of a mite-resistant breeding program.

I normally use five-frame nuc boxes for all my queen rearing needs, but three or four frame units will work equally well in this application. From the breeder colony I remove one frame containing a small amount of eggs and well fed young larvae. My intent is to rear a quality queen using a relatively small number of young nurse bees. I don't want large amounts of brood competing for the food and heat resources of the small rearing colony. Once I've transferred the brood frame and its adhering bees, I remove a second frame containing some recently collected pollen and as much nectar as possible. The older adults on this frame are shaken back into the parent or breeder colony. If pollen and nectar are in abundance, I generally remove a second feed comb. Again, due to the absence of brood in the rearing colony, the two well filled feed combs should provide sufficient stores until the new queen is producing brood. Two empty drawn combs, to provide storage for incoming nectar, complete the

five-frame unit. The last step in the setup process is to supply the nuc with nurse bees. With a five-frame nuc box, place the frame containing the brood in the center slot and position a feed comb to either side. Return to the breeder colony and remove two additional frames containing mostly open brood, check for the queen, then shake the bees into the open nuc box. Young nurse bees are the prime ingredient for successful queen rearing, so don't be stingy. If the weather is on the cool side, or if the rearing colony is to remain in the same location as the breeder colony, compensate by shaking in a third frame of young adults. Once all of the ingredients are in place, close the colony up to let the bees settle down for a couple hours prior to notching. Likewise, if the colony needs to be relocated, complete that procedure before you notch.

Larvae 12 to 18 hours old are generally considered the optimal choice for grafting purposes. The same rule applies to notching. In practice the notching procedure takes only a couple of minutes. Start by scanning the brood comb to determine which side contains the most larvae of correct age or size. Also check the amount of royal jelly that surrounds the young larvae. Well fed young larvae produce better quality queens than do poorly fed larvae. Notching allows you to make that choice. Once you have selected the appropriate side, lay the frame so the notching side is up, across the top of the open nuc box. With a soft bee brush, gently move the bees away from the area containing the young larvae. Using either the point of your hive tool or pocket knife, notch two cells, two or three inches apart, preferably on the upper half of the comb. Push a thumbtack into the top bar directly above each notched cell. These will be your reference markers when you check back in six or eight days to view your handiwork. Return the brood frame to the center of the nuc box and place the feed comb containing the fresh pollen adjacent to the notched cells. That's all there is to it. Close up the colony and be on your way.

Six or seven days after notching, the notched cells and most of the worker brood will be capped over. Use the reference



(l) With the notching, the bottom cell wall is removed with the point of a pocket knife or hive tool. (r) Thumbtacks placed on the top bar directly above the notched cells.

Notched cell, the equivalent of a supersedure cell built into the comb.



thumbtacks to locate and visually inspect the notched cells. They should appear somewhat larger than the run of the mill emergency queen cells. Remember, by notching you enlarged the area immediately below the young larva. The colony responded by building the equivalent of a supersedure cell directly into the comb, hence the larger than normal appearance. If the notched cells appear normal, check for and remove all the natural queen cells around the periphery of the capped brood, on both

sides of the comb. Invariably, most of the natural cells will have originated from older larvae; consequently, one of these queens will emerge first and destroy all your hard work. In those cases where the notched cells haven't been accepted, or where they appear to be inferior, leave the two best looking natural cells. Either way, in 16 to 21 days you should have a nice laying queen.

I would like to thank my good friend Mel Disselkoen for explaining the notching

technique. Mel is one of those unique individuals who willingly and generously donate their time and knowledge to help others succeed. Thanks Mel.

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