Marla Spivak
Getting Bees Back on Their Own Six Feet

Part II

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The idea came to Marla Spivak as she looked at a map of the United States, sitting in her office at the University of Minnesota, where she is a professor of apiculture. If the picture of her were a cartoon, a light bulb would appear above her head.

She is prone to having these sparks of perception. The first one came some twenty years ago, when she realized that our well-meaning medication of honey bees would come to naught, and that bees "need to develop their own defenses against diseases and parasites." She revived some old research and, together with Gary Reuter, developed the Minnesota Hygienic line – bees with the olfactory ability to identify and remove brood infected American foulbrood, chalkbrood and Varroa. Then she gave over the process of developing hygienic bees to all comers.

Another insight into bees' self-defense came from hearing a research talk about propolis-gathering ants that have low microbial activity in their nests. Her lab subsequently discovered that the honey bee immune system is quieted in the presence of a layer of propolis enveloping the inside of a bee hive. A further realization – that there could be more specific application to bee and even human health -- resulted in an ongoing study to fractionate propolis in order to discover its active components.

Three Minnesota beekeepers now have open-mated lines that test as well for hygienic behavior as the original instrumentally inseminated MN Hygienic stock. And the propolis studies have influenced respect for the precious substance, which was long regarded as a nuisance. Still, the overall decline of the honey bee, according to Jeff Pettis, head of the USDA Beltsville bee lab, is "unsustainable."

For three years Spivak had been pondering the question: What more can be done for bees to help themselves, "onto their own six feet"? The map she was contemplating in her office was marked with the locations of the queen producers in the U.S. Quite a few were in the South, but the map showed that the vast majority of American queens, with the exception of Hawaii, come from Northern California. The larger producers there, she knew, sell 20,000 to 50,000 queens a year – some up to 70,000. The smaller ones in the area produce around 10,000, all in a three month period. It's the continental center for queen rearing, the source for much of the genetics across the country. Of course, she thought, the answer was right there, simple and clear. What if those queen producers became the agents of change?

Many of the California queen breeders are located around the northeast edge of the Sacramento Valley at around 39°N at the foot of the Cascade and Sierra Nevada ranges. They are that far north because most are long-time family operations originally situated there for trade with Canada – started by Homer Park, Oliver Hill, Harry Laidlaw and others. The Koehnens have been there over 100 years. Northern California beekeepers shipped thousands of packages each spring to replenish Canadian apiaries that were routinely killed off every winter. When the Varroa mite was found in the U.S., the border was abruptly closed by the Canadian government – to no avail it turned out, but it left the breeders with huge stocks and drove many bankrupt. The new focus became queen rearing for the domestic market. "Although they are further north than is ideal for early queen production, it may be a blessing," said Spivak, "Because no queens can be sold within 100 miles of any AHB (African honey bee) sighting."

Photo: Alison VanAlten

Spivak in the bee yard with Bob Koehnen, whose family has bred bees in Northern California for over 100 years.

Her idea was, in concept, a good one, but people are more difficult to manage than insects. Spivak is quick to make the point that these people don't need to be told how to keep bees. "These guys know what they're doing. I think these bee breeders do an amazing job of selecting and raising good quality queens. They are really concerned about their bees' health. If you spend some time with them, you see how they handle their bees; they are being extremely delicate and careful. So my idea isn't to change what they are doing, I just want to enhance what they are doing. I want to help them help their bees defend themselves against diseases and mites. And I want to help them decrease chemical use so they can sell queens across the nation -- change the genetics across the nation in a way that would be beneficial."

She knew what hadn't worked. Beekeepers come to conferences, and they "sit and listen to the lectures by university people -- dense talk, dense data. They don't learn that way. They go out in the hallways and ask others, what's working for you?" Even if there were more state apiary inspectors in California, their job would be to prevent the spread of diseases. And there is only one university extension apiarist west of the Rocky Mountains, the respected Eric Mussen, who does not have enough hours in a day. What if a team on the ground provided a liaison between producers and researchers – like farm advisors for beekeepers? Such people are common in agriculture: the pest control advisor or the crop consultant.

In 2008 Spivak, together with her technician Gary Reuter, grad student Katie Lee, and colleague Alison vanAlten, went on the road in Northern California, visiting 19 queen breeding operations who agreed to see what she was about. Wherever they were welcomed, she explained her idea and tested colonies for hygienic behavior and pathogens. Building trust was a slow process. In 2009, Lee -- along with Betsy Ranum and weekly rotating help from Spivak, vanAlten or Reuter -- again spent the month of March visiting each bee breeder open to the idea.

In the spring of 2010, Spivak was on the road near Chico, California, having just analyzed hygienic tests for a breeder. "Their numbers were not so great this year" she said, "But that's no judgment. They wanted all of their colonies to be hygienic. They wanted it, and that's enough. They have to want it and they do. That was great. We can easily make that happen."

Borba, left, and Spivak pour liquid nitrogen onto circles of brood, setting up 24 hour hygienic testing at an apiary of Dan Suhre, who looks on.

What she is saying is that all news in this project is good news, whatever the results. It provides a base of information for decision making. For example, Spivak tests for the fungus *Nosema ceranae* (which has replaced *Nosema apis*). Thus far, the uses of the data have ranged from comparisons between treated and untreated colonies or those that have and haven't gone for almond pollination, elimination of costly treatments shown to be ineffective, and elimination of treatment where spore counts were low – allowing for the emergence of resistance and an indicator of good breeding stock.

A change in Nosema sampling was made when Dennis vanEnglesdorp, the Pennsylvania State Apiarist, toured some bee yards with her to discuss the project this year. Spivak explained the thinking: "The young bees can pick up spores, either from the comb or through trophallaxis. It takes about 12 days for those cells to start invading the stomach lining of the bee. You can't see the infection until the bees are about 12-16 days old; that's what some laboratory experiments show. Inside bees are 1-14 days old, and most of the foragers are outside. If you sample foragers, you are sampling in favor of finding it. If you sample nest bees, you are biasing in favor of not finding it…So we decided to take some inside-outside samples."

In apiary after apiary, Spivak gathered bees with a bee vac made by the innovative Reuter. In a nearby shed, honey house or barn her Brazilian student Renata Borba counted out piles of 120 test bees, crushed them and shook each group into 1 ml water. (She now skips the laborious step of removing the abdomens at the suggestion of vanEnglesdorp.) Seated on an upturned bucket or a super, Spivak peered through the microscope that she brought from her lab, looking for Nosema spores in the prepared samples. For every colony she counted spore by spore against a hemacytometer, a grid used for counting blood cells; then she prepared a report for each beekeeper.

The next stop of the day was at Can-Am Apiary, named for the once thriving cross-border commerce in bees. Leonard and Linda Pankratz greeted Spivak warmly and wasted no time getting into the testing since they still had to bank queens. Then Leonard Pankratz, a long experienced beekeeper, showed Spivak something he had never seen before – robust, healthy larvae and adults adjacent to dwindling pupae. He wondered if there could be a

connection to the spraying of the fungicide Pristine on a nearby orchard. There in the bee yard, Spivak dialed Jamie Ellis at the University of Florida and then Reed Johnson at the University of Nebraska and explained the problem to the researchers. Both agreed to add the chemical to the list of those they are testing on brood and promised to get back to her.

She was on the road again, watching the clock, aiming to meet Buzz Landon at his apiary in an almond orchard. She and Borba wanted to check the results of their 24 hour tests on time -- circles of brood frozen with liquid nitrogen. They would see how well the bees have cleaned out the cells, an indication of hygienic behavior. A non-hygienic colony can take as long as six days.

Landon, a young, gentle-spirited guy, has 500 hives in almonds and reports a 10% loss for the last year – a third of the national average. He keeps his bees in the Chico area almonds February thru mid-March then breeds queens and makes nucs in his local yards. The tests looked good – very good: some circles were 100% clean of dead brood, and others were well on the way. Spivak remarked that his comb looks new. "The comb is like the liver," she explained to Borba, "It absorbs everything."

Spivak uses a bee vac, invented by her assistant Gary Reuter, to gather a sample of bees for Nosema testing. Renata Borba waits to bag the bees, while Leonard Pankratz works ahead in his apiary.

Spivak recommends replacing comb within the brood nest every three to five years, even though it is costly to both the beekeeper and the bees. She points out that old comb harbors spores from American foulbrood, chalkbrood, and Nosema which can remain viable for years. It also absorbs pesticides, which accumulate to the detriment of the bees.

Testing for Nosema by (from left, clockwise) Renata Borba, Marla Spivak, Esmeralda Garcia and Georgina Garcia. The Garcias, grafters at the apiary of Pat Heitkam, are counting out bees to be put into dilution by Borba and read for spores by Spivak.

Landon explained that chemical companies have field days with tents and refreshments to sell treatments, but there is no objective information for beekeepers and queen producers. "As it is now, someone phones and says so-and-so is doing something or other, and we all start doing it." So why not, he asked, have a field day for this project?

Spivak is gathering such ideas as plans for the team take shape. Another suggestion is experimental apiaries to test treatments the beekeepers are interested in, for example, the walnut oil that one has asked about. "What form the team ends up in, I can't say," she remarked. "I'm going to have to let go of my baby because how the project evolves is going to be bigger and better than I can anticipate -- and that's good," she said.

And so it went, as Spivak traveled the back roads – listening, testing, observing, answering, counting bee samples and leaving the beekeepers with results to make decisions on their own.

Reuter and Borba made the next trip to Northern California, staying a night up a remote valley in the camaraderie of Frank and Sheri Pendell in Stonyford. The Pendells count the isolation of their apiaries as an advantage for breeding bees. The task at hand, to which the researchers devoted the better part of a day, was to find the Pendell drone congregation areas and send samples to David Tarpy at North Carolina State University. He is studying the reproductive quality of commercial bees; in this case, he will test the viability of the semen in the drones as well as genetic diversity. The work is funded by a grant from the USDA National Research Initiative.

Leonard Pankratz of Can-Am Apiaries selects nucs for testing by Marla Spivak.