Georgia

Breeding an Economically Viable Honey Bee for Reduced Chemical Beekeeping

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Lead Institution:
University of Georgia

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"Bee Breeding...is one of the most important services non-profit public institutions can provide."
—Keith Delaplane

At the turn of the 21st century, two Australian researchers classified a small, vicious pest that had begun to make beekeeping a constant but losing battle. Aptly named *Varroa destructor*, this tiny mite attaches to the body of adult bees or larvae and sucks their blood until they die. A major infestation of Varroa can kill a hive of tens of thousands of bees in as little as six months.

Beekeepers have long dreaded finding Varroa mites in their hives, but those who do typically treat them with doses of synthetic acaricides. Although these chemicals control the Varroa populations to some degree, they can have adverse effects on the bees and the bee handler, in addition to contaminating the honey. But with no natural enemies for the mites and the speed at which the mites can obliterate a hive, most beekeepers have few options outside of chemical control.

University of Georgia entomologist Keith Delaplane wants to change that. His solution—to breed honeybees that can resist Varroa mites.

Although uncommon, some bees already possess Varroa mite resistance, as evidenced by the fact that a few bees in each hive survive Varroa infestation. Delaplane's team—including his graduate students and technician Jennifer Berry—want to turn this individual resistance into a trait possessed by a new species of Varroa resistant bees, a project that he says is near the top of every beekeeper's wish list.

"Bee breeding is not a profitable enterprise or industry," he said. "It takes time—years—during which time you get no revenue. So it is one of the most important services non-profit public institutions can provide."

Although some genetically improved bee stocks exist, they don't seem to be successfully utilized. First, most beekeepers can't wait the four to five years it often takes to build up desirable characteristics into enough bees to sell. Second, most beekeepers don't have the training or equipment to artificially inseminate bees. In addition, several current Varroa resistant varieties seem to be weaker in other areas, such as colony growth, so beekeepers have been reluctant to use them.

Delaplane believes that beekeepers shouldn't have to choose between keeping their hives alive and increasing the volume of their product. So in addition to breeding for resistance to Varroa, Delaplane plans to select characteristics for generous honey production. However, selecting queens with both characteristics can take time, especially since the stock of queens is very small. Only a handful of producers provide queens for the US, about 25% of which reside in the southeast.

The breeding process itself is delicate and precise. Bees mate on their wing, so breeding them involves one of two procedures: saturating the neighborhood with a multitude of desirable drones, or artificially inseminating her. Delaplane said that many breeders choose artificial insemination because it is more exact and makes it easier to control selection criteria. But it involves a keen eye and a steady hand, as the breeder must inject semen into the queen with the use of a delicate instrument and microscope.

Delaplane said that their first stock of Varroa resistant queens will be ready for delivery this summer. Getting to that point, however, has been a long journey, since they chose only a small percentage of each generation's queens.

"Each year we make controlled measurements for the characteristics we want," he said. "Then we index them and come up with a score, or a number that ranks the queens. From that, we select the top 20 percent."

His current stock is the product of five years of selection. After one more selection in the spring, he says the resulting stock will be ready for delivery in June. And although he will miss the typical bee market in the southeast this year, he will hit the peak of the northeast and western bee markets.

Ultimately, Delaplane's team wants to reduce the amount of chemicals used each year to control Varroa mites. Improving the genetic line of the honeybee will delay the economic threshold enough to save over eight million chemical applications from being used in hives, and in doing so, will improve the reproductive performance and longevity of queen bees.