

NEW DIRECTION FOR THE MINNESOTA HYGIENIC LINE OF BEES

by MARLA SPIVAK and GARY S. REUTER

A Brief History of the MN Hygienic Line

Gary Reuter and I, at the University of Minnesota, have been breeding honey bees for resistance to diseases and *Varroa destructor* since 1994 with the goal of reducing, or eliminating, the use of antibiotics and pesticides by beekeepers. Through our ongoing collaboration with MN and ND beekeepers, we have demonstrated that bees bred for hygienic behavior rarely, if ever, show clinical symptoms of American foulbrood or chalkbrood and have significantly fewer *Varroa* mites compared to unselected colonies. Hygienic bees resist these diseases and mites by detecting diseased or mite-infested brood and quickly removing the infested brood from the nest. The removal of the pathogen before it is infectious limits disease transmission, and removal of mite-infested pupae reduces the reproductive success of the mites.

Our original goal in 1994 was to encourage beekeepers and queen producers to select for the hygienic trait from among their own colonies and stocks of bees. We were met with initial skepticism about possible negative trade-offs of selecting for hygienic behavior. Beekeepers were concerned that breeding for this trait might compromise honey production or make their colonies more defensive. To address these valid concerns, we bred a line of hygienic bees and distributed breeder (instrumentally inseminated) queens to beekeepers so they could try the line in their own operations and sell daughter queens to other beekeepers nationally. We collaborated with beekeepers over many years to test the line in eight commercial operations. Our studies showed that in addition to helping the bees resist AFB, chalkbrood and *Varroa*, the MN Hygienic line is a good honey producer, and is gentle and easy to manage. Today, queens from the “MN Hygienic” line can be purchased nationally and the feedback we receive tells us

that the line is well respected by beekeepers.

We are now returning to our original goal of having queen producers and interested beekeepers select for this trait from among their own, tried-and-true stocks of bees. It is very important for beekeepers to have many stocks of bees to maintain a healthy level of genetic diversity in the U.S. population. Fortunately, the hygienic trait is found in all races and stocks of bees.



It just needs to be enhanced through some simple selective breeding.

There is a relatively easy field test for the hygienic trait. A portion of sealed worker brood within a colony is freeze-killed, and the amount of dead brood that is uncapped and removed is recorded. If a colony removes >95% of the freeze-killed brood within 24 hours over two repetitions, it is considered hygienic. The rapid removal of freeze-killed brood is correlated with the removal of diseased and mite-parasitized brood. It is then easy to raise queens from colonies that are hygienic.

Now here is the catch: A queen raised from a hygienic colony must mate with drones from other hygienic colonies for the

colony to express the trait (the hygienic trait is recessive). If the queen mates with 20 drones, over half of them should carry the hygienic genes. This way over 50% of the worker bees in the colony will be genetically predisposed to detect and remove diseased and mite parasitized brood quickly and this is a high enough percentage for the colony to show resistance to diseases and mites.

To get around this problem, we raised hygienic breeder queens and instrumentally inseminated them with semen from hygienic drones at the University of Minnesota. We distributed these breeder queens to Glenn Apiaries, and they raised and inseminated a new generation of queens for sale. We also auctioned off breeder queens at the MN Honey Producers annual summer meeting. Although many beekeepers purchased breeder queens over the years, three beekeepers in particular purchased them every year for over 10 years—Darrel Rufer, Mark Sundberg and Jeff Hull. They took the queens to southern locations for the winter, and raised daughters from them. After 4-5 years of doing this, they noticed a good change in their bees: they didn't have chalkbrood anymore, and AFB levels were way down. This change came about because the hygienic queens produced hygienic drones, and over time, the majority of drones in the mating population were hygienic. They reached the >50% genetic benchmark and it became evident in the performance of their colonies. We have tested their colonies for hygienic behavior and we know that the vast majority of their colonies are hygienic based on the freeze-killed brood assay; that is, they remove >95% of the freeze-killed brood within 24 hours.

A couple things to emphasize here: The good change they noticed in their bees took 4-5 years to materialize. The beekeepers were persistent and patient.

The New Direction

To return to our original goal of having beekeepers select for hygienic behavior from among genetically diverse stocks of bees, our first step will be to stop raising and inseminating hygienic queens at the University. Our second step will be to assist D. Rufer, M. Sundberg and J. Hull in propagating the trait from their naturally mated colonies, instead of providing them with inseminated breeder queens. And our third step will be to test at least 100 of their progeny colonies to determine the proportion that are hygienic according to our strict criteria using the freeze-killed brood test. We will make these results available to these queen producers and they are free to advertise the results to all beekeepers. In effect, our effort can be considered a small-scale pilot certification program for the hygienic trait. Beekeepers can continue to purchase MN Hygienic queens, but from these three beekeepers, the queens will be certified.

We are also working with California Bee Breeders to select for hygienic behavior. If our pilot certification program works, it may provide incentive to queen producers nationwide to certify their stocks for hygienic behavior, and eventually other resistance traits. In the future, U.S. beekeepers may want to implement a more formal national stock certification program, which should be implemented and monitored by an independent group. Our goal is to initiate a small, pilot program just to see if it works.

Certifying Traits

Generally when people think about stock certification programs, it is to certify a pedigree. In the case of bees, a race of bees such as Carniolan or Italian, or a line of bees such as the Russian or Buckfast lines could be certified. It is possible and maybe worthwhile to certify pedigrees of bees. However, what we are proposing is to certify a trait, hygienic behavior. We're not concerned with the type or pedigree of bees selected for hygienic behavior; they can be Italian, Russian, Carniolan or mutts! We are interested in selecting diverse stocks of bees for hygienic behavior first, and in time, other traits that will help the bees resist diseases and mites. And we are interested in truth in advertising: We want beekeepers to have some verification that the traits they are paying for are actually present in the bees.

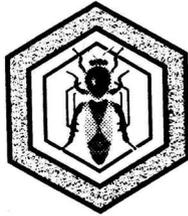
What do you think?

We are interested in feedback from beekeepers about the possibility of certifying traits. If you could drop either one of us a short note with your opinion, we would appreciate it.

Thanks!

Marla Spivak spiva001@umn.edu
Gary Reuter reute001@umn.edu
www.extension.umn.edu/honeybees

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