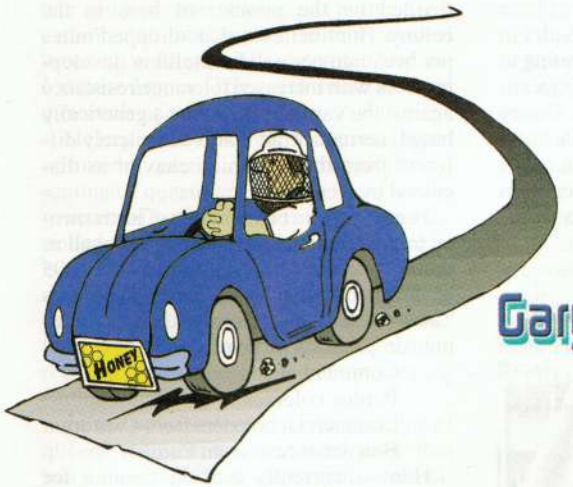
The Traveling Beekeeper



From the North Central Queen Assembly–Lessons from Gary Reuter, Greg Hunt and Joe Latshaw

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This is the second part of a summary of the presentations made at the first North Central Queen Assembly in Troy, Ohio at the Buckner Nature Center last October, cosponsored by the Ohio State Beekeepers Association and the publishing company, Wicwas Press. Nearly 90 highly motivated beekeepers cooperated to support, present and absorb the information-packed presentations of some of the leading bee breeders on the continent. The focus of the day was on the development of locally-adapted honey bee stocks in the northern parts of the country that are hygienic/mite tolerant AND able to meet the needs of the beekeeper—providing high honey productivity, good over-wintering ability, and extreme gentleness. In the December *ABJ* issue we reviewed the comments of Dr. John Harbo. This month we will review the presentations of Gary Reuter of the University of Minnesota, Dr. Greg Hunt of Purdue University in Illinois and Joe Latshaw of the Columbus, Ohio area.

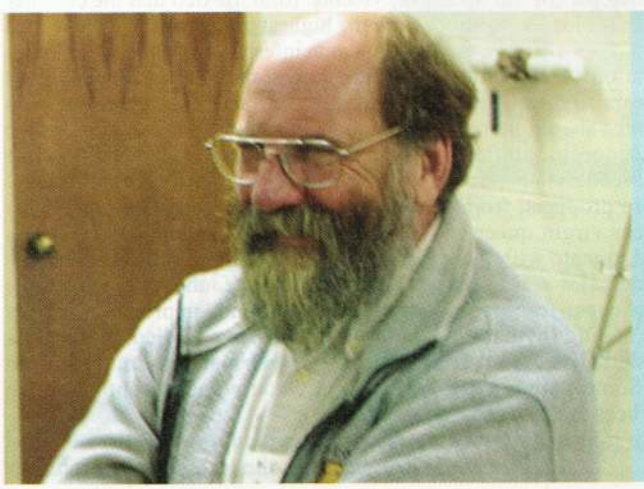
Gary Reuter is an entomologist and an educator with a passion for bees and educating people about bees. He works with Dr. Marla Spivak at the University of Minnesota—both joined the staff there in 1993. At that time the key research emphasis was on the development of bee stocks that demonstrated natural resistance to brood diseases, especially American foulbrood and chalkbrood. This also led to partial resistance to varroa mites in the same stock. A further emphasis was to develop this stock from a quality line of bees—the colonies in the University apiary were Starline bees selected for brood nest productivity and excellent honey production. They were also a gentle bee, not requiring as much smoke or protective clothing. Reuter said that this differed from stocks like the Russian, SMR/VSH stocks, and other similar lines selected from survivor stocks around the country, since the Minnesota colonies were already gentle and productive. "It is much easier to end up with productive, gentle colonies if you start with them—as compared to starting with unproductive bees that sting a lot."

Resistance to American foulbrood has a genetic origin, clearly established by Dr. Walter Rothenbuhler at the Ohio State University nearly 50 years ago. Rothenbuhler showed that two recessive genes were involved in this process. One gene controls uncapping diseased cells, while the other controls the removal of contents of diseased cells once they are uncapped. Rothenbuhler demonstrated that colonies that carried the gene for just uncapping did not remove the contents of diseased cells, whereas colonies that carried the gene for just cell cleaning did not uncap the cells to clean them. This example of a two-recessive gene system is often found in basic textbooks in genetics.

Reuter pointed out that the advantage of the genetic control of disease is in the timing of the larva or pupa removal; that the bees detect the developing disease before the cell contents become infectious to the rest of the colony. This permits the colony to clean up diseased brood without spreading the disease in the process.

The use of this two-gene system for selection has allowed the University of Minnesota researchers to keep bees for 10 years without treating for American foulbrood or chalkbrood. There may be additional genes involved, Reuter said. There seem to be other mechanisms of resistance to varroa mites, including the genes that control grooming behavior, a behavior that results in bees removing feeding varroa mites from each other's bodies and damaging them so they eventually die.

Reuter also cautioned the audience that there are a number of interpretations of hygienic behavior that some beekeepers believe are just wrong. It is wrong to use the general cleanliness of a hive, the cleanli-



Gary Reuter of the University of Minnesota

ness of a bottom board, the ability to remove a shop towel, or grooming behavior as a measure of colony hygienics. None of these behaviors are an expression of the two-gene system incorporated into the Minnesota Hygienic bees.

Testing for hygienic behavior

The original method to test of hygienic genes in a colony was to place comb with AFB scale into the hive and see if the colony developed disease or not. The colony's ability to clean out the scale often resulted in the colony chewing out the old comb to remove all the disease. If the colony did not possess both genes, it developed AFB and had to be destroyed.

To circumvent this rather brutal and very costly method of selection, Steve Taber cut sections of bee brood frozen in the deep freeze or in liquid nitrogen and then introduced the brood comb to the colony. This relatively simple assay provides researchers, bee breeders and even beekeepers a method to evaluate stock for diseased cell cleaning. For the final user of a bee stock, it provides an inexpensive method to test the claims of the person selling the "resistant" stock and to provide feedback.

In Minnesota, the breeding program also seeks to maintain honey-gathering ability, gentleness and ability to survive the Minnesota winter. The stock queens are maintained by instrumental insemination, using hygienic queens mated to hygienic drones so all the resulting bees, including the queens that are grafted from such stocks, are completely hygienic. All of the current lines in the program are at least 95% hygienic. While Spivak and Reuter continue to search for new lines to add to the program, they find it difficult to exceed the 95% level of cell removal they currently have in their bees.

The need to produce both hygienic queens and hygienic drones is a huge challenge for most beekeepers, considering the number of times a queen mates before starting to lay eggs. While it is difficult, if not impossible, for a beekeeper to use open mating to obtain 100% accurate mating, Reuter said that partial success would result in colonies able to remove part of the infected brood, providing the colony with an advantage.

To convert an operation to hygienic stock may take two years, Reuter said. The first year the colonies should be requeened with hygienic queens grafted from pure hygienic breeders or purchased queens that were produced from them. In the second year virgin queens are grafted and allowed to mate with the drones produced the first year. This system will allow the beekeeper to obtain 50% or better accurate mating (hygienic x hygienic) and establish the genes in the colonies in the apiary. Some testing will show how hygienic the bees are, and provide the beekeeper with information for future years.

Indiana program

Greg Hunt from Purdue University spoke about the bee-breeding program he has established in Indiana, often using money he has redirected from other research projects. Hunt advises that beekeepers have at least 100 colonies to obtain effective results in bee breeding. He seeks to control mating to make sure you are producing and requeening with the stock you have selected. Honey bees do not like to be inbred, because shared alleles for sex determination result in diploid drones. Hunt's Ph.D. dissertation was the mapping of the gene for sex determination.

Greg Hunt of Purdue University

To establish a breeding program Hunt considers it necessary to incorporate three things. First, you must utilize a characteristic you can measure in some manner. Second, you need to have a direct link between that characteristic and mite control. Third, the characteristic must be heritable. You will need to keep good records and clip and mark all queens in the program.

One of the measurable traits of interest to Hunt is the *Mite Drop* in colonies. There is evidence from Mexico that the colonies with the highest mite drop have the lowest varroa mite infestations, while the colonies with the lowest mite drop had the highest varroa populations. This observation is even more intriguing because many of the mites were chewed or damaged by the bees. This has been shown on both sticky-board studies and in the laboratory. This directly influenced the number of mites on adult bees, a different set of observations and behaviors as found in the hygienic work. This "second" approach to varroa control is not being studied in the USA (Ernesto de Guzman has moved from Mexico to Ontario and is continuing the work there).

Hunt wants Purdue to develop a method that measures the level of mite drop over the course of an entire growing season. Using sticky boards and measuring the mite drop per day, he will compare the overall bee population to develop a statistic that is essential — the number of dropped mites divided by the number of bees in the colony. Hunt believes that "dropped mites per bee" number will be useful in developing bees with increased tolerance/resistance against the varroa mites using a genetically based, heritable trait that is completely different from the hygienic behavior as discussed by Reuter.

Hunt is using a combination of instrumental insemination to maintain stock as well as drone flooding with desired drones. In 2005 he obtained young queens from four sources These stocks were selected and observed for mite drops on sticky boards:

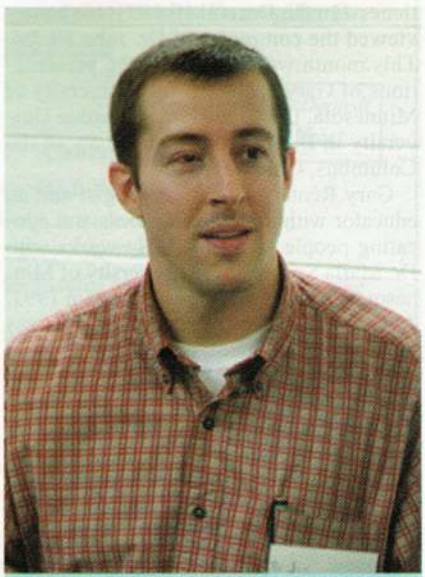
Commercial sources
Purdue colonies
Commercial breeders from California
Breeder queens from Purdue

Hunt is currently seeking funding for grooming behavior work, utilizing stock from additional sources. His preliminary work indicates increased mite grooming by worker bees in his selected stock, prompting him to call them *Indiana Mite Biters!*

Joe Latshaw

Columbus, Ohio native Joe Latshaw has been around bees most of his life, following researchers around the now defunct Rothenbuhler Bee Lab in Columbus as a boy. Now 31, Latshaw is already established as a bee breeder for commercial beekeepers and in 2007 became an integral part of the Ohio Queen Project. He is also completing a Ph.D. in bee behavior in Arizona.

Latshaw states that there are two sides to the bee breeding issue. The commercial beekeepers want stock they can use for queen production and for honey production. The hobby and sideline beekeepers have non-commercial concerns.



Joe Latshaw, part of the Ohio Queen Program

For commercial beekeepers, Latshaw argues that beekeepers must purchase breeder queens to obtain stock when they need it for a narrow grafting period. The purchase of queens saves the beekeepers time, is convenient and maintains quality and purity. Most commercial beekeepers cannot control breeding well enough to keep a line pure, Latshaw argues. They also must produce thousands of queens at a time.

He explained that there are several types of breeder queens. The instrumentally inseminated queens are preferred because the genetics of both sides of the cross are controlled. The second group of breeder queens is those controlled and maintained over many generations, so the queens produce daughters very similar to themselves. The third type of breeder queens is one kept by regional record keepers and demonstrating certain traits.

In the selection process the mating of queens with different numbers of drones has a huge influence on the potential outcome of the bees. A single drone insemination (SDI) may be extremely useful in a breeding program where fast results are desired. Multiple drone inseminations simulates more natural conditions in the resulting hive, while mating with huge numbers of drones (semen is collected in the laboratory and mechanically mixed) will add the advantage of producing multiple queens that have essentially all mated to the same population of drones. This fact also dramatically increases the diversity of the bees in the resulting colony, where there may be over 100 different subgroups of sister workers in the hive, each representing a different drone father.

Latshaw produces pure lines of queens, as well as a cross to produce a hybrid bee not unlike the old Starline bee. He will make Carniolian x Italian or Italian x Carniolian crosses in what he calls *terminal hybrids*. These bees will have all the advantages of the line breeding to maintain characteristics, as well as the hybrid vigor that produces larger, more productive colonies. Commercial beekeepers do not want to sacrifice production in their bees and find these terminal hybrids well suited for their beekeeping operations.

What does Latshaw seek in bees while making selections? Here is the list he presented in Ohio:

1. Honey Production—It should go without saying that this is still of high interest of most beekeepers.
2. Temperament—Latshaw likes bees that allow him to work without a veil and wearing shorts. In commercial operations this will reduce stinging and make work more pleasant. In pollination rentals it is a help with growers.
3. Wintering ability—This characteristic is not too important to commercial beekeepers, but is very important to sideline and hobby operators. Since the bees use photoperiod light cues to increase brood production this must be balanced with stored food reserves in large colonies kept in the north.
4. Disease resistance—This means saving more money for the commercial operator.

Next month we will continue reviewing the talks presented at the North Central Queen Assembly in Troy, October, 13, 2007 with a discussion of the Ohio Queen Program, as well as a model bee breeding program I developed for a 60-colony bee operation. If you are interested in email notification about a possible 2008 NCQA program and other bee breeding programs, send an email to ***ebeebooks@aol.com*** *and request to be put on the notification list. Or write to the address at the top of this article.*