Project Description

The queen bee is an essential working part of the honeybee hive. She must ensure that the hive stays populated by controlling the gender of the eggs she lays in order to keep balance in the hive. However, if the beekeeper is not satisfied with the way the queen bee is controlling the hive, the beekeeper can replace the queen bee to correct hive behavior and optimize honey production as well as egg production (Dunn). Furthermore, when the beekeeper raises his or her own queen, the hive will benefit, in part because the beekeeper is more aware of the habits of the queen bee he or she is raising. For instance, the offspring of a queen bee that shows swarming habits will likely also produce bees that swarm (Caron, 1999).

Last summer 2011, with Dr. Trisel as a mentor, I compared two different methods of queen bee rearing. The first method involved a Cupularvae box, in which we discovered that it produced too much stress on the queen bee and had very little to no success in producing viable larvae. The second method involved hand grafting larvae (ages 12-24 hours) directly from hive frames; this method produced superior results, percentage wise. These results were presented at the 2012 Celebration of Student Scholarship.

I feel it is important to take the knowledge gained from our queen rearing research to the next step to continue to improve efforts in developing a locally adapted, hygienic queen. In this next step I would like to begin research on artificial insemination. During a (naturally-mated) queen bee’s mating flight she leaves the hive and mates with anywhere from one to forty drones. A few drones provide enough sperm for the queen to use for the rest of her life. The ideal situation is for her to receive semen from at least 10 unrelated drones for the sake of genetic diversity within the hive. Research indicates that the hives with the most genetic diversity are significantly less affected by diseases (Seeley, 2006). Research also suggests that queens who have mated with several drones are usually more accepted by the workers bees. The worker bees are attracted to the pheromone release by the queen bee and through scientific testing the pheromone is much stronger when the queen has mated with several drones (Tarpy and Grozinger, 2007). Flights outside the hive are dangerous for the queen due to predators such as dragonflies or birds, and may be one of many reasons that the queen may not successfully return to her hive (Crandall).

With artificial insemination the queen does not have to leave her hive which could increase the success and survival of the queen produced. Through artificial insemination we can also eliminate rejection because of weak pheromones by ensuring that the queen has been mated by several drones.

With grant support for this summer, I will be able to extend my queen bee research with the guidance from Dr. Trisel. I would like to compare the success rate between artificially inseminated queens (A.I.) and naturally-mated queens. We are hypothesizing that artificially inseminated queens will have better initial survival and their colonies will be more resistant to pests and diseases. We also want to determine if the A.I. bees are equal in performance
(longevity and egg laying capacity) compared to naturally mated queen bees as suggested by research (Schley).

For the A.I. procedure, semen from Varroa Sensitive Hygienic (VSH) Carniolan drones will be utilized (supplied free by the USDA Bee Research Lab in Baton Rouge, LA). The queens will be reared from a Varroa sensitive line using the hand-grafting technique that was previously found successful. When the queens chosen for A.I. have matured they will be anesthetized with carbon dioxide and placed in a device to keep the queen immobile and safe. Immediately after the insemination procedure, the queens will be marked so that they are easily tracked and one wing clipped to keep them from flying. The queens will then be placed in individual hives for nourishment needs and attendance by worker bees. After a few days we will begin monitoring the queens for egg laying.

The queens chosen for natural mating will be marked and released into hives and checked to ensure they return to the hive after their mating flight and are successfully accepted by the workers. The naturally mated queens will also be periodically checked for successful egg laying. After egg laying has been documented, one wing on each queen will also be clipped. If our A.I. technique is successful we can improve the genetics of the local population, and we will have made progress toward developing a breeding program at FSU. By the end of this project I hope to have mastered the techniques necessary in the delicate art and science of artificial insemination in queen honeybees. In accordance with the FSU strategic plan and the help of Dr. Trisel, I can continue to facilitate development of local queen bee breeding programs which will benefit beekeepers throughout the region. Dr. Trisel and I regularly give honeybee presentations to local groups and state and local beekeeping associations. During these presentations we promote FSU and help educate the public.