Abstract
Caste Interactions, Reproductive Decisions, and Levels of Selection in Honey Bees

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November 6, 2015
This experiment will elucidate the different selective forces that determine caste interactions and the role these interactions play in determining which queen becomes the new queen of a honey bee colony. The success of the queen determines colony growth and survival, as well as whether the colony’s genetic material will be passed on to the next generation. Thus, long-term colony health and success are largely determined by the queen. My research will contribute to our understanding of the factors that determine how new queens are selected and thus enhance our understanding of honey bee colony health and success, as well as the levels of selection that have shaped reproductive decisions in this highly social insect.

The purpose of this experiment is to explore the factors that influence caste interactions (worker-queen and queen-queen interactions) in honey bee colonies during the queen replacement process. Caste interactions will be monitored in honey bee observation colonies in which workers are given the opportunity to interact with related and unrelated queens of high and low quality during queen replacement events. If a queen leaves in a swarm, workers will raise multiple new queens in order to replace her and they will kill each other in order to become the new layer of the colony. The outcome of queen replacement is influenced by a queen’s “quality” (i.e. her size and fighting ability) as well as the interactions she has with workers.

Three hypotheses will be tested. First, if caste interactions are shaped primarily by kin selection acting at the level of the individual worker, then workers will favor related queens over unrelated queens, regardless of queen quality. Second, if caste interactions have been shaped primarily by colony-level selection, then workers should favor higher quality queens over lower quality queens, regardless of relatedness because higher quality queens can promote colony growth and survival. Third, if the outcome of queen replacement is determined by queen size and fighting ability, then the larger, heavier queens should win regardless of worker interactions.