Analysis of Honeybee Aggression

By Dylan Voeller and James Nieh

I. Principles introduced in this exercise

A. Aggression: how they attack

B. Defender's perspective: what to attack

D. Differences between European honeybees and Africanized honeybees

C. Results of aggression

II. Introduction

Honeybees are famous for many things, including their ability to inflict painful stings. This exercise focuses on honeybee aggression and uses a video demonstration of honeybee attacks and the kinds of things that honeybees like to attack. Perhaps this can help you learn what to avoid in the future! Although the video and exercise focuses on the commonly found European honeybee, the behavior of Africanized honeybees is quite similar, except that their aggressive response is, as a group, more intense.

General honeybee aggression

Honeybees generally attack only to defend their colony, but will also attack if they are seriously disturbed outside the nest. Common sources of attack stimulus for honeybees include alarm pheromone, vibrations, carbon dioxide, hair, and dark colors (Crane 1990).

This makes sense because mammals, which are common predators of bees, are usually hairy, dark colored, and exhale carbon dioxide. If you think about this you will realize that bees are drawn towards attacking sensitive areas around the head of a common predator.

Stinging is the ultimate final act of a honeybee because soon after, she will die. First the bee becomes alerted; she takes on a guarding stance and protrudes the sting, which recruits other bees by releasing alarm pheromone. Secondly, the bee will search for the source of stimulus and orient towards it. Finally she will attack; emitting a high pitched buzz and making body thrusts towards the source of disturbance. In such a defense response, honeybees rarely pursue stimuli for long distances (although Africanized bees can pursue victims for hundreds of meters. If a sting does occur, the bee will die soon after stinging because the sting is left behind and the bee disembowels itself in flying away. Once the bee's sting is inside a victim, it pumps out more venom and emits alarm pheromones. During this time, the stinging bee will spend its dying moments distracting its victim by flying around its head as if it were going to sting again.

Africanized honeybees

Africanized honeybee venom is not more painful or voluminous than normal honeybee venom, its just that many more bees will sting! This is because Africanized honeybees are very sensitive to alarm pheromone (the odors, smelling a bit like banana, which foragers release from their sting gland and glands located in the head when they are alarmed) and produce much more of it than temperate honeybees. The threshold for stinging response in Africanized honeybees is also much lower; only a minor disturbance such as a slight motion, vibration, or odor is needed. A study by Collins (1985) showed Africanized honeybees respond 2.4 times faster to alarm pheromone and about 30 times as fast to a moving target! Once Africanized bees have been stimulated, they are also much more likely to respond in group attacks. During such attacks they will sting anything in sight that is moving and may pursue a source of disturbance for up to a kilometer (Winston 1992).

The rapid defense response of Africanized honeybees is most likely a result of adaptation to life in tropical climates, where there is a higher rate of predator attacks on colonies. These higher attack rates favor the evolution of rapid colony defense, since successful nest defenders are able to survive and produce more offspring than those that are killed off by a predator, such as a badger who is hungry for honey. The biology of Africanized bees, including their higher level of aggressiveness, is thought to play a role in their successful invasion throughout the New World. They appear to be limited from expanding to more northerly areas because of cold winters, but in general survive better in the wild than temperate honeybees. Africanized bees therefore have the potential to seriously disrupt native pollinator communities in terms of competition for food sources and nest sites.

III. Materials & Methods

A. Open and view the first bee attack video.
B. What are the bees attacking?
C. What happens when a bee stings?
D. How do other bees react to the odor of alarm pheromone?
E. Open the video of bees stinging a cotton ball. Does this response decrease with distance?
F. Are there any there any other stinging preferences? Color, hairiness?

IV. Sample Results

(Insert screenshots of what bees like to sting)

V. Sample Discussion Questions

A. What stimulated the bees to attack?
The bees were agitated and reacted to alarm pheromone.
B. Once stimulated, what did the attackers focus on?
Dark hairy objects
C. Why might the bees show such an attack preference?
Common mammal predators are often dark colored and hairy. Sensitive areas such as the nose, mouth, and ears are also dark.
D. Have you ever seen a bee attack before or been attacked? If so, what do you think stimulated the bee's response?
You could talk about your personal experience, or that of someone you know
E. What are some strategies for avoiding Africanized bee attacks?
Keep away from nesting areas and be alert when active in outdoor areas where bees and their nests are common. Close off any openings in and around your home that might make a good nest site if Africanized bees are known to inhabit your area.
F. Why changes might be caused by Africanized bees introduced into an ecosystem in which they weren't formerly present?
Africanized bees could outcompete native bees with their aggressive behavior and faster rates of reproduction. However, there is controversy about whether Africanized bees truly have had a significant impact on native bee populations. If they do have such an impact, nest sites and available food may become dominated causing declines or even extinctions in native bee populations. This could lead to declines, extinctions, and other changes in the plant communities that depend on bees for their reproduction and, in turn, changes in the animal populations that depend on those plants for survival.

VI. Sample Conclusions

VII. References

Collins, A.M., 1985. Africanized honeybees in Venezuela: defensive behaviour. *Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya.* International Bee Research Association: 117-122.

Crane, E., 1990. Bees and beekeeping: science, practice, and world resources. Ithaca, New York, Cornell University Press, 109-111.

Hunt, G.J., Guzman-Novoa, E., Fondrk, M.K., Page, R.E., 1998. Quantitative trait loci for honey bee stinging behavior and body size. *Genetics 148*: 1203-1213.

Winston, M.L., 1992. *Killer bees: the Africanized honey bee in the Americas*. Cambridge, Mass, Harvard University Press.