

Chapter 45 Project

Bee-havior

Project + Timeline

In this project, you will apply what you have learned about population biology, ecology, behavior, and natural selection as you develop a report on bees and other Hymenoptera species. In order to prepare for your report, you will outline information about two different species and then answer some discussion questions. This preliminary work will help you form an outline from which you can prepare your report. You should complete this project with a partner. Plan to conduct your research and prepare your report over one to two days.

Directions

You've likely encountered a species from the phylogenetic order of Hymenoptera before—just think of the last time you saw an ant or a bee. The honeybee is known for its well-named, sweet condiment (honey!) as much as it and other members of the order might be associated with the unpleasant shock from its stinger. Further still, the role bees play as pollinators underscores the complex relationship we have with this species.

It is no surprise, then, that this species and its relatives can be used to examine several different complex aspects of biology and ecology, including the intersection between behavior and population dynamics. In this project, you will analyze and compare aspects of the population ecology and behavior of two different Hymenopteran species. You and your partner could each research a single species or research both species together. Then, compare notes after you have read about the life history and behaviors of your selected species.

1. What two species will you compare? How are they related within the order?
2. For each species, describe its life history strategy. Would you categorize each as an *r*-selected or *K*-selected species? Why?

Identify three behaviors that are observed in each species. Add the behaviors of your first species (Species 1) to the first row of Table 1 and the behaviors of your second species (Species 2) to the first row of Table 2. Then, answer the questions about each behavior in Table 1 and Table 2.

TABLE 1: Behaviors of Species 1

Behavior Description	Behavior 1:	Behavior 2:	Behavior 3:
What is the stimulus that triggers the behavior?			
What function does the behavior provide for the organism?			
How did the behavior likely evolve?			
How does the behavior develop or change over the life of the organism?			

TABLE 2: Behaviors of Species 2

Behavior Description	Behavior 1:	Behavior 2:	Behavior 3:
What is the stimulus that triggers the behavior?			
What function does the behavior provide for the organism?			
How did the behavior likely evolve?			
How does the behavior develop or change over the life of the organism?			

Now, select one of the behaviors for each species and reflect on its connection to the previous questions.

3. How does the behavior contribute to the species' life history and categorization as an *r*-selected or *K*-selected species?
4. If the species had the opposite *r*- or *K*-selection categorization, how would you expect this behavior to change?

Honeybees, and many other species of Hymenoptera, display complex social interactions and a hierarchical hive structure (known usually as hives or colonies). Honeybees are considered a eusocial species, in which a single female produces offspring and nonreproductive individuals work together to care for these offspring.

5. What is an example of an innate behavior present in sterile honeybee workers? How does this behavior evolve if these bees are unable to reproduce? What type of evolution does this represent?
6. What are some of the factors that influence the carrying capacity of a honeybee colony or a population of either of the two species you chose?

Colony collapse disorder is a phenomenon in which many of the worker bees disappear from a colony, leaving the queen, larvae, and food behind. When answering the following questions, consider how such a challenge may affect the distribution of individuals in a population of Hymenoptera.

7. What would the age structure diagram look like for a honeybee colony that is increasing in size?
8. What would the age structure diagram look like for a honeybee colony that is mildly decreasing in size, perhaps due to a decrease in flower availability?
9. What would the age structure diagram look like for a population that is suffering from colony collapse disorder, in which worker bees have disappeared?
10. What other populations would colony collapse disorder effect? What ecological or agricultural impacts do you predict from this phenomenon?

Now you should have an outline of the life history and behaviors of your two species along with a perspective of how different factors shape a population's structure and behavior. You and your partner should use this outline to develop a short report (two to four pages) in which you address the following:

- Compare and contrast the two species and their life history
- Connect the life history and evolution of the species to specific behaviors, both innate and learned (such as spatial learning)
- Include an analysis of the challenges populations of both species face

Project Materials

- Project worksheet
- Pen or pencil
- Computer with a word processor and internet access

Student Checklist

- ☐ Complete Table 1
- ☐ Complete Table 2
- ☐ Complete all questions
- ☐ Complete report