Evolution of an Ant-mimicking Beetle Write-Review-Revise Assignment (10 pts)

Background Information

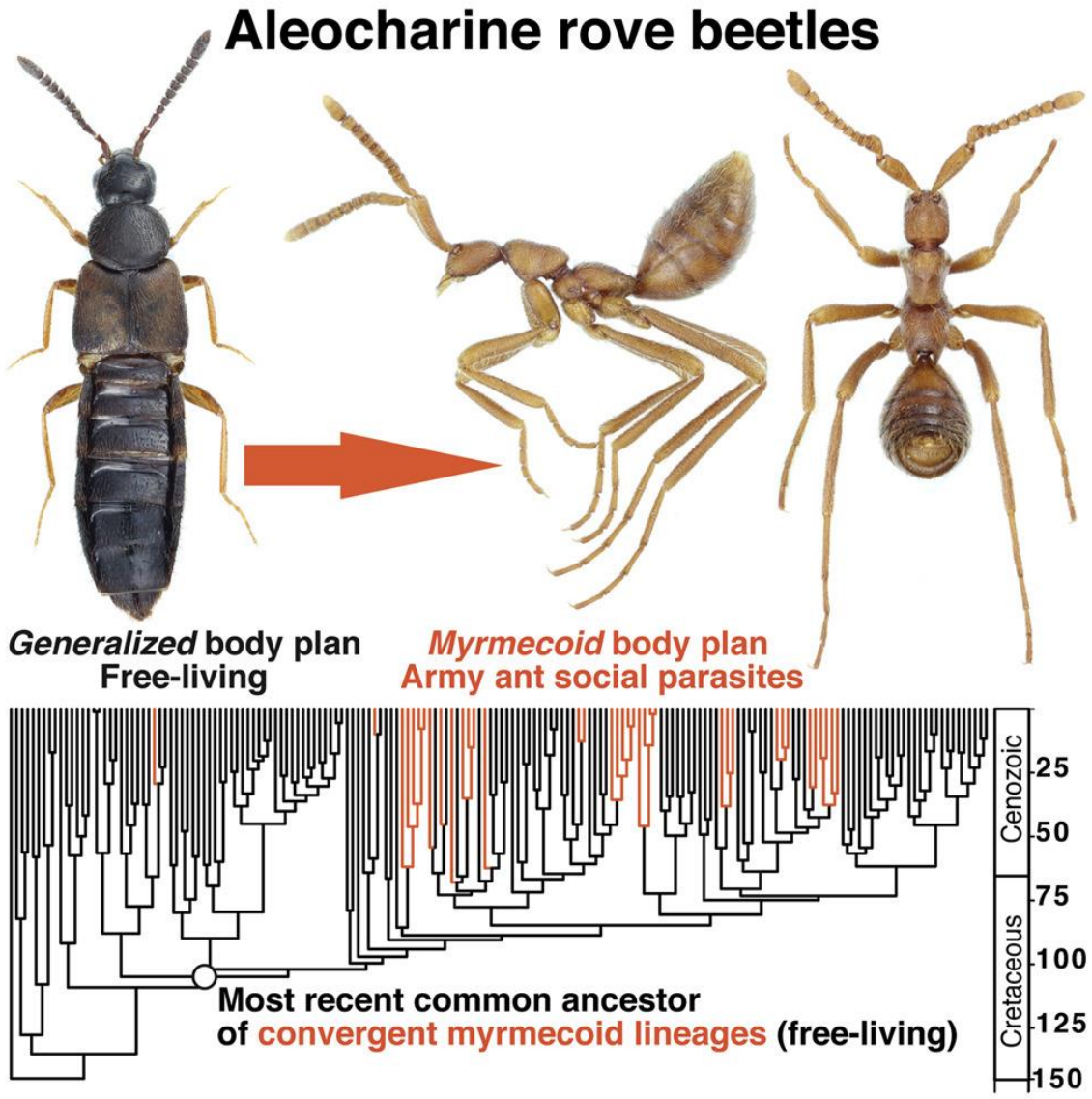
Rove beetles are a large family of beetle species found all over the world. Although most rove beetles live freely on their own, many species in the subfamily Aleocharinae live closely with another type of insect: army ants. These beetles are called "ant-mimicking" beetles because they have developed bodies, behaviors, and chemical signals similar to those of ants, which tricks the ants into accepting the beetles into their colonies. Once the beetles begin living in the ant colonies, they secretly steal the ants' food and eat their eggs. Species like these beetles, which live with and take advantage of other species' colonies, are called social parasites.

There are many species of ant-mimicking rove beetles, each of which has adapted to mimic the specific army ant species that it lives with as a parasite. In this study, scientists explored the evolutionary origins of all the ant-mimicking rove beetles. The scientists used DNA sequencing to analyze samples from many Aleocharinae beetle species, both those that live with ants and those that do not. They then used this data to make a phylogenetic tree, a diagram of the evolutionary relationships among the species.

Figure 1.

Figure 1 shows one species of ant-mimicking rove beetle (front) next to the ant species (back) that it mimics.

Figure 2.



The top half of Figure 2 shows more species of rove beetles from the same subfamily, Aleocharinae. "Free-living" beetles (example shown on the left) have a generalized beetle body type. "Army ant social parasite" beetles (examples shown on the right) have a specialized ant-mimicking (also called "myrmecoid") body type. The bottom half of Figure 2 shows the evolutionary relationships among multiple Aleocharinae lineages that are either generalized (black) or ant- mimicking (orange). The labeled circle indicates the most recent common ancestor of all the ant-mimicking lineages.

Write-Review-Revise

This assignment is the first of our Write-Review-Revise Assignments. The purpose of these assignments is to:

- Practice critical thinking skills in analyzing presented data
- Practice writing in your own voice to explain Lecture Unit concepts
- Evaluate the work of your peers based on defined criteria
- Analyze and re-evaluate your own understanding of the presented data and how it relates to Lecture Unit concepts.
- Experience key principles of peer review in the scientific process.

The assignment is divided into 3 parts:

- Part 1: Initial Submission (3 pts), **Due Sept. 3rd**
- Part 2: Guided Review of 3 peers (1 pt each). **Due Sept. 10th.**
- Part 3: Final Revised Submission (4 pts). **Due Sept. 17th.**

For Part 1: Initial Submission, respond to the following:

1. Explain the following features of Figure 2:
   - What type of graph is this?
   - What do the different branches represent?
   - What is represented along the Y-axis?
   - What do the different colors represent?
   - What does the circle represent?

2. Compare the following pairs of organisms. What similarities or differences do you observe in each pair, and why do you think those similarities and/or differences exist?
   - The ant and ant-mimicking beetle in Figure 1
   - The free-living/generalized beetle (left) and parasitic/ant-mimicking beetle (right) in Figure 2
   - The ant-mimicking beetles in Figure 1 and Figure 2

3. Using principles from the theory of evolution by natural selection, describe how the body plans of ant-mimicking beetles may have evolved over time.

4. Explain what a “most recent common ancestor is in your own words. What can you tell from Figure 2 about the most recent common ancestor of ant-mimicking beetles?

5. What other patterns do you notice in the Figure 2 diagram? What do you think might explain those patterns?

6. If you could examine individuals of the army ant species parasitized by the pictured beetles in the upper right of Figure 2, what would you expect to find?