Effects of Antennae Alteration on Ant Behavior

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Background/Abstract

Ants are master communicators. They send and receive messages by releasing chemicals (called pheromones) from specific glands, making sounds with different body parts, "dancing" messages, and touching each other with their antennae. These chemical, audial and physical modes of communication allow for complex and cooperative behaviors in colonies. From aphid farming to fungi-breeding, slavery, leaf-weaving and mass invasions, complex ant behaviors take root from effective communication which is rooted in one major body part: the antennae.

Ants use antennae as tools not just in interpersonal communication, but in perceiving the world around them. Researchers discovered decades ago that the loss of antennae equals a loss not only in communication, but in the general functioning of ants individually and collectively. More recent studies have shown that ants use their left and right antennae for different roles while foraging for food. These studies, among others, demonstrate the integral roles antennae play in the success of ant colonies, as well as the distinct, non-redundant nature of these roles. We hoped to further explore these findings and examine the different roles the antennae play in other ant behaviors, specifically tunnel-digging, food identification and social dynamics.

We achieved this by making alterations to antennae - mutilating the left, right and both antennae - and observing the consequent changes in and loss of normal behaviors, using Formica Rufa (Red Wood Ants). We believe this experiment can inspire research into animal communications with far-reaching implications for neuroscience.

Question

What are the distinct roles do ant antennae play in other ant functions?

Materials/Methods

Materials in bold

Antennae Manipulation

Using tweezer, grab 15 ants from nest and place them in a container. Place container in freezer or ice pack for about 10 minutes. After 10 mins, take out an ant and cut out the desired antenna(e) using a scalpel. After surgery, place ant in a separate jar. Repeat process for remaining ants.

Experiment

Fill a jar halfway with sand. Set a timer for desired time frame. Place desired stimulus in jar. Gently place ants in jar (15 per group). Observe. Repeat process for each experimental group.

Groups

Experimental groups: Control, left A. off, Right A. off, Both A. off.

Stimuli Sand, jello, sugar, Vinegar, termite nymph

Discussion/Future Directions

In the absence of the left antenna, basic physiological functions were affected. Behaviors such as tunnel digging, sound perception, spatial awareness and identification were lacking. The group with the left antennae intact behaved most similarly to the control group. Without the right antenna, social functions, including trophallaxis and unity, were absent. A probable conclusion is that the left antenna serves as a physiological guide to the ant, while the right antenna enables social and interpersonal functions. It is also possible that the left antenna plays a more dominant role, while the right antenna serves as its helper, similar to right-handedness in humans. Further research focused on interchanging the left and right antennae, such as by physically cross-linking them, and studying other functions over extended periods, would be helpful in testing this conclusion.

Resources

Robert Frawley, Ph.D., Barbara Noro. Ph.D.


Journal of Environmental Biology, Rockefeller University