The Effect of Different Soils on the

Tunneling Behavior of Ants

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Introduction

Evolution has allowed for species to adapt to their changing environment. Ants are one of the many species that are flexible with their environment, which brought up the question: how do different environments affect the tunneling behaviors of ants? The specific question was chosen after reviewing various articles that studied ant’s behavior in various types of soil. Changing the soil was found to be interesting due to the size of sediment changes in various soils, which could make it difficult for the ants to tunnel through.

In the project three kinds of environments will be studied. Tunneling sand, real sand, and soil will be used. This presents the hypothesis: If the ant’s environment is changed, then their tunneling behavior can adapt to that environment. The ants in the environment of the tunneling sand will form more elaborate tunnels, and ants in the sand from Virginia Beach will form moderately elaborate tunnels since the environment is similar to that of the tunneling sand. Ants in the soil will not form elaborate tunnels because the soil will be more difficult for them to dig through. A possible alternative to this hypothesis is if the sediment size is changed then the ant’s tunneling behavior will change with it.

Experimental Design

Ants bought from the internet will be used in this experiment to test their tunneling behavior in different environments with the environments as the independent variable. The ants will be separated between nine farms, with 10 ants in each. Three will contain the tunneling sand that comes with, another three will have sand from Virginia Beach, and the last three will contain soil. All nine farms will be left on the back counter in the lab, labeled, and separated based on the treatment group. They will be checked for tunnels and fed every week during lab time.

We will record the number of tunnels, as well as the length and width of each tunnel. The presence of branches, intersections, and curvature of the tunnels will be recorded for the qualitative data, and the location of the tunnels will be compared.

Constraints within this experiment are cost and time. Cost constraints how many replicates can be used and how many ants there can be. Since ant farms cost $30.00 each the experiment had to be scaled back from sixteen ant farms to nine. Ants are also an added expense so only ten ants will be used in each farm instead of the fifteen to twenty that was originally proposed. There will only be 10 ants in each farm if some of them do not survive, and that has the potential to skew the data collected. Time is the biggest constraint. There is only a set number of weeks that we can execute the experiment. This constraint makes it difficult to collect enough data to suffice for the statistical analysis.

To control extraneous variables the ants will be kept in the same place in the lab classroom for the whole experiment. The ants will be fed every week during lab and data will also be collected at this time. The same amount of food will be given every week in each farm based off the instructions that come with the farm.

The statistical analysis that will be used is a regression analysis. A regression analysis allows us to examine the relationship between two or more variables. We can use it to compare the relationship between the different environments and the number of tunnels and their length and width.

Potential Sources

1. Pielstrom S, Roces F. 2014. Soil Moisture and Excavation Behaviour in the Chaco Leaf-Cutting Ant (Atta vollenweideri): Digging Performance and Prevention of Water Inflow into the Nest. *PLoS ONE* 9 (4): e95658.
2. Gravish N, Garcia M, Mazouchova N, et. al. 2012. Effects of worker size on the dynamics of fire ant tunnel construction. *Journal of the Royal Society Interface* 9: 3312-3322.
3. Gautrais J, Buhl J, Valverde S, Kuntz P, Theraulaz G. 2014. The Role of Colony Size on Tunnel Branching Morphogenesis in Ant Nests. *PLoS ONE* 9(10): e10943
4. Espinoza D, Santamaria J. 2010. Ant Tunneling-a granular media perspective. *Granular Matter*.

Materials List

Our project is going to be conducted in our lab classroom. We plan to keep the ant farms on a counter somewhere out of the way of other classes, but still accessible to us each day. All the materials we need to conduct our study are listed below.

* 9 standard sized ant farms
  + We already have 8 in the classroom, so only one more will need to be purchased.
* 90 harvester ants
  + 10 ants for each farm.
* Ant food
  + This comes included with the ant farms.
* Tunneling sand
  + Also comes included with the ant farms.
* Beach sand
  + We have collected this from Virginia Beach.
* Soil
  + We will collect a soil sample from a flower bed on campus.
* Dropper
  + This will be used to add small amounts of water to the ant farms.
* Ruler
  + We will need to measure the length of each tunnel in the ant farms.
* Phone camera
  + Once a week, a member of the group will go into the classroom to collect data on each of the ant farms. We are going to take pictures to compare the progress.