Seed harvester ant foraging behavior

The local species of seed-harvester ant is *Pogonomyrmex barbatus*, which are known in the business as “pogos,” and which I grew up calling “red ants.” This is the ant that makes the large mound or crater around the entrance to its nest. The craters may be a meter in diameter and several centimeters high. The craters around here consist of small pieces of rock which are bitten out of the bedrock to make the tunnels of the nest (observe the mandibles sometime!). One possible function of the crater is as a heat source, to help warm the upper regions of the colony; the small stones absorb solar radiation and transmit heat into the ground. Also surrounding the entrance is the refuse pile (for seed husks, dead prey parts, and the bodies of the living workers’ dead sisters). Pogo colonies are usually large (up to 30,000 workers) and deep (10 m in soft soil), and are generally haplometrotic and monogynous. The colonies are perennial and long-lived; the reported life-span of the queens of congeners *P. badius* and *P. owyheei* are 17 and 30 years (!!) respectively.

Pogonomyrmex barbatus workers are monomorphic and are about 6 mm long. They have a powerful sting but do not mob before stinging as do fire ants. They forage in what are called “trunk trails,” which means that many workers leave the colony and go out in a particular direction for a considerable distance before fanning out in search of food. The trunk trail is marked by pheromones, but is often visible near the crater because the ants remove vegetation and other obstacles to make their travel easier. You will see their little autobahns running away from the crater. A trunk trail can be recognized by the constant stream of ants running back and forth, although the number of foragers decreases as the distance from the colony increases. Trunk trails of 15 m or more in length are typical. I have seen trunk trails 65 m in length (this is approximately equivalent to a 5.5 ft human running 11 miles to the grocery store then running back, in some cases carrying 25% or more of her body weight in food). Trunk trails are a persistent feature of the topography around ant mounds; they last for months or even years. The foragers pick up seeds but also any animal matter that they find and can clip apart and carry back. The mass of the object that a worker carries does not seem to affect the velocity with which she can run. Sometimes workers will carry objects nearly equal in mass to their own.

Optimal foraging theory predicts that organisms will maximize the rate at which energy (or some other currency) is gathered. In other words, foragers should gather as much energy per unit time as possible while foraging. Seed-harvester ants lend themselves to an experimental test of optimal foraging theory. Seeds, because of their high lipid content, are high-energy food sources. We might assume that energy content is directly proportional to seed mass (how might we test this assumption?). Some data indicate that velocity of a running ant is unaffected by mass of cargo (this is another point that we might test observationally). Foraging ants leave the colony and run out into their habitat in search of seeds. They are capable of locating seeds and presumably of making choices about which seeds to carry back to the colony. What predictions might we make about preferences of foraging ants when presented with a choice of seeds of several different sizes? Would foragers tend to select larger seeds? Would distance from the colony affect seed preference?

The property of Alan Kainrad, which is located just north of Austin College’s Sneed Environmental Research Area, is home to several mature colonies of *P. barbatus*. Given the constraints on time available for lab exercises, we will concentrate on questions about ant foraging that can be answered with observational rather than experimental data. Additional questions could be addressed in individual research projects. The questions that seem to be most readily investigated concern the running velocity of foragers with and without cargo, and the relationship between worker mass and the mass of the cargo she carries.

The intuitive expectation for running velocity would be that a worker carrying a cargo would be slower than an unladen worker. We can test this expectation by simply comparing running velocities. The most straightforward way of doing this is to measure the time it takes to travel a set distance, for laden versus unladen workers. Generally, ants leaving the colony along the trunk trail are unladen, but those returning may or may not be carrying cargo. It is usually easy to tell whether an ant has a cargo.

We might expect larger foragers to carry larger cargoes. However, there is little variation in size among workers of *P. barbatus*. Data on size of workers and size of cargo could tell us both about size variation among workers and about the relationship between worker mass and cargo mass. The way to assess these parameters is to collect workers and their cargoes, preserve each worker separately with her cargo, and later weigh them. We can then compare statistically the masses of the workers with the masses of their cargoes, and can look for any polymorphism in worker body mass.