FOOD ITEM PREFERENCE IN *PARAPONERA CLAVATA* AND THE EFFECTS OF CHANGING RESOURCE ABUNDANCES ON FOOD ITEM PREFERENCE .

JOANNA M. HUBBARD

Abstract. I examined preference between two types of food items utilized by the giant tropical ant (*Paraponera clavata*), and how changing abundances of the specific resources (nectar and insects) affected preference. I measured time spent by 15 *P. clavata* individuals at each food item over a 15 minute period in three separate lab treatments. No statistical difference was found between the time ants spent at the nectar vs. insect forage, but an overall trend towards a preference for nectar was detected. The results indicate that preference for a specific forage item can be created by changing an individual ant's physiological condition.

INTRODUCTION

The giant tropical ant, *Paraponera clavata*, has been observed to forage on low vegetation (pers. obs.), on the ground, and high in the canopy (Janzen and Carroll, 1983). Therefore, it appears to have access to many types of food resources.

Although these ants have been observed bringing insects to the nest (Janzen, 1983 and pers. obs.), it is unclear whether they scavenge or actively hunt insects. When returning to the nest, they most often are seen carrying nectar (Janzen and Carroll, 1983). Because of this and the fact that they have been seen guarding and collecting nectar from extrafloral nectaries on *Pentaclethera* and *Costus*, Janzen and Carroll (1983) and Schrot (1991) suggest that nectar is the primary food source. It was unclear from these previous studies, however, whether *P. clavata* has a preferred food item or if the composition of food resources brought to the nest is a result of chance encounter by individual ants with various forage items.

These two main food resources utilized by *P. clavata*, nectar and insects, are composed of very different compounds. Nectar has a high concentration of sugar and moisture, while insects have more protein. Since the ants need all three components in some quantity and, presumably, the first forage item of either type encountered would be the one closest to the nest, they should pick up the first encountered food item to maximize foraging efficiency. If so then they should exhibit be no preference between nectar and insect food items, i.e., *P. clavata* individuals should choose food as they encounter it and the wide distribution of the two resources make overall ant choice appear random.

Following from the above reasoning, if one necessary food item is abundant and the other becomes very scarce, a preference for the scarce resource will develop so the ants get the required level of the scarce food item.

METHODS

I examined *P. clavata*'s preference for two main food resources (nectar and insects) at La Selva Biological Station, Costa Rica on 12 and 14 of February 1995.

On 12 February I collected 15 *P. clavata* individuals and placed them in separate glass jars. I prepared an experimental area by covering a large plastic tub with a piece of fine netting. Two small petri dishes were placed on opposite sides in the bottom of the tub for nectar forage (A) and insect forage (B). I collected dead insects (flies and moths) and killed fresh ones (ants and grasshoppers) for the insect forage. In preliminary laboratory and field trials in the arboretum, I observed that *P. clavata* individuals appeared to be mainly scavengers. As a nectar substitute I used

honey and water which Schrot (1991) indicated was accepted by the ants.

I set up three treatments: (1) equal proportions of both food types; (2) a high abundance of one food type, insects, in dish B and a low abundance of the other food type, nectar, in dish A; and (3) a low abundance of insects in dish B and a high abundance of nectar in dish A. Fifteen ants were used in separate trials of treatment 1. Due to a high, unintentional mortality rate of test subjects, by the time treatments 2 and 3 were tested, only four individuals remained in the sample.

For all three treatments I placed one ant per trial in the tub and recorded time in seconds spent touching each forage dish during a 15 minute trial. Before starting each treatment 1 trial, I gave the ant five minutes to explore its environment, or until it had touched both dishes (whichever occurred first). For treatments 2 and 3, since I was using experimental subjects with experience in the tub environment that "knew" there were two resource dishes, I did not give them the exploration period before the start of the trial. Supporting the assumption that they were still acquainted with the tub, during these two treatments the individuals did not explore their environment, but went directly to a resource dish.

TABLE 1. Total time in seconds spent (n=2100 seconds) at each food presentation dish for each ant in three treatments, and when the exploration period ended in Treatment 1 trials. * indicates most time spent at insects. ° indicates most time spent at nectar.

Ant Number	Tot. Time at Insct. (sec)	Tot. Time at Nect. (sec)	End of Pretrial Expl. Period	Foraging Behavior
Treatment 1				
1°	0.75	92.0	touched both dishes	
2°	4.0	639.0	touched both dishes	
3°	0.0	6.0	touched both dishes	
4°	4.5	226.0	5 minutes	carried nectar
5*	66.0	34.0	touched both dishes	
6°	3.0	14.0	touched both dishes	
7°	5.0	86.0	touched both dishes	
8°	0.75	346.75	5 minutes	carried nectar
9°	1.75	48.0	5 minutes	
10*	224.0	7.75	5 minutes	carried lg insect
11°	0.75	1.0	5 minutes	
12*	36.75	13.0	5 minutes	
13°	9.0	49.0	touched both dishes	
14*	72.0	1.0	touched both	carried insects
15°	0.0	0.0	5 minutes	no movement
Treatment 2				
9°	0.5	240.0		carried nectar
10*	0.5	769.0		carried nectar
12*	0.5	144.0		carried nectar
14*	1.0	544.0		carried nectar
Treatment 3				
9°	2.0	299.0		carried nectar
10*	0.5	96.0		carried nectar
12*	1.0	280.0		carried nectar
14*	1.0	50.0		died after trials

I compared time spent at each resource dish for all treatments with a Wilcoxon matched-pairs signed-ranks test that indicated the direction of differences of matched pairs of data.

RESULTS

During the pre-trial exploration time, most ants explored the entire tub, spending most of their time on the sides of the tub, both at the top (by the mesh) and at the edge of the tub bottom. Approximately half of the trials started when the ant touched both presentation dishes and half started after the ant had five minutes of exploration time (End of Pretrial, Table 1).

In treatment 1, 10 ants spent more time at nectar (104.2±45.7 [mean±SE], Table 1) and four spent more time at insects (28.6±15.3, Table 1). The difference, however, was not statistically significant (Z=1.54, n=15, P=0.12). In treatments 2 and 3, all four ants spent more time at the nectar forage dish (Table 1). However, ant time spent at low nectar (458.3±123.6) and high insect abundances (0.5±0.1) did not differ statistically (Z=1.83, n=4, P=0.07). Neither were ant time spent at high nectar (181.3±63.3) and at low insect abundances (1.1±0.3) significantly different from one another (Z=1.83, n=4, P=0.07).

DISCUSSION

P. clavata will forage on both resources offered. In all three treatments I found that there was no statistical difference between time spent at the two resources, indicating that there is no real preference for one or the other. My results also indicate that an individual ant did not spend equal time at each resource when given the opportunity to do so, but foraged on one or the other, showing individual choice. If all ants "choose" the food item on independent criterion, it would make overall ant preference appear random.

Individual ant choice may be based on the resource encountered first (although the experimental ants in treatment 1 did not stay at the first resource dish encountered), on their current physical needs, or some "experience" bias for one resource over all others. In the treatments, individual preference is likely to be determined by only physical need or an "experience" bias (unlikely as the preferences of individuals changed in three out of four cases). Both forage items were in relatively close proximity to one another and became apparent to the ant roughly at the same time. In nature, because of more widely dispersed resources, food items are likely to be encountered one at a time and individual ant preference would then also be influenced in food item choice by first resource encountered.

In treatments 2 and 3, the resource abundance manipulations, the P values were fairly close to 0.05 (0.07 in both treatments), indicating a strong trend towards a preference for nectar in both treatments. This trend could occur because sample size is very small (N=4) or it could occur in the sample population due to the fact that these four individuals, after two days in a glass jar with some food, no water, little air, and high stress, were no longer representative of the normal *P. clavata* population. This might indicate that for moisture stressed ants, the trend is towards a preference for nectar. Three of these four ants originally preferred insect forage items. Over 24 hours in captivity, their preference changed to nectar, a resource high in liquid and quick energy. The other possible explanation, that the change was due to the manipulation of resource abundance, is unlikely as their preference did not change from treatment 2 to treatment 3, which would have occurred had their preference motivation been based on the relative abundances of specific resources.

From the results of treatments 2 and 3, although they both support the overall trend of preference for nectar. I can not make any predictions for healthy ant response to changing abundances of forage items. These two treatments were not good tests for predicting normal, field *P. clavata* behavior because the negative effect of captivity on ant condition seems to result in preferential selection of the food item with the absent or scarce compound.

The idea that, when there are large temporal changes in abundance of major ant food items, ants may exhibit a preference for a scarce food item, remains unanswered and warrants more study. A more definitive test using non-stressed ants is needed to examine these points further. In the future it would be interesting to look at two ways of creating preference in *P. clavata*: (1) high physiological stress, and (2) scarcity of a resource.

In summary, it seems that condition of ants will impact on whether they have a preferred food item or not. Ants in nature, when both major food items are not scarce, are more likely to take the first randomly encountered forage. However, with yearly variation in resource abundance, scarcity of one or the other major ant food items could easily develop.

LITERATURE CITED

Janzen, D. H. and C. R. Carroll. 1983. *Paraponera clavata* (Bala, Giant Tropical Ant). Pages 752-753 *in* D. H. Janzen, editor. Costa Rican Natural History. University of Chicago Press, Chicago, USA.

Schrot, A. 1991. Recruitment in *Paraponera clavata* to a Food Source. Pages 137-140 *in* T. Grabowsky and G. York, editors. Dartmouth Tropical Biology. Dartmouth College, Hanover, NH, USA.