1-1-2018

Foraging Habits of Pogonomyrmex californicus: Invasive and Native Seeds

Max E. Meyers
Blaire Olivia Southmayd
Jenniluyn Thanh Nguyen
Any a Isabella Rosener
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**Introduction**

The California Harvester ant, *Pogonomyrmex californicus*, plays a key ecological role in the coastal sage scrub (CSS) ecosystem as a forager of seeds. Our experiment provides insight into *Pogonomyrmex californicus* foraging habits with respect to native and non-native seeds. Specifically, this study uses native *Phacelia campanularia* and exotic *Brassica Nigra* seeds. For our experiment, we gave ant colonies in both disturbed and (relatively) undisturbed habitats both species of seeds, and measured the ants’ preference of seed. Briggs and Redak (2016) observed that another species in the genus, *Pogonomyrmex rugosus*, consistently chose common exotic seeds over native seeds. With this in mind, we predicted that ants will prefer familiar seeds over less familiar seeds. We hypothesized that, in our case, the ants will overall prefer the native seeds over the non-native, but the ants in undisturbed habitats will show a stronger preference towards the native seeds than those in the disturbed habitats. If our hypothesis is correct, that could indicate that ants might act as a slight “buffer” to invasive plant growth by eating invasive seeds. Understanding the ants’ habits can supplement our understanding of how native Coastal Sage Scrub environments will respond to rising temperatures and human encroachment.

**Methods**

Six *P. californicus* colonies were located: three in areas of the Bernard Field Station denoted as disturbed grassland and three in undisturbed coastal sage scrub areas (see Figure 2). At each colony, a sample ant was collected to confirm its species. Twenty seeds each of *P. campanularia* and *B. Nigra* were placed in six petri dishes, one at each of the sites. *B. Nigra* seeds were sterilized by microwave prevent invasive plant growth. The dishes were situated into the soil with the tops made level with the surrounding soil to promote ant accessibility, and mesh was
placed on top to prevent larger scavengers from taking the seeds. The dishes were set up in the morning and checked at three hour intervals, three times. Each time the dishes were observed for approximately five minutes to determine, as much as possible, that our ant species was taking the seeds as opposed to another insect species. Two chi-squared “goodness-of-fit” tests were taken of the seed choice, grouped by habitat denotation, with a null hypothesis of no preference.

**Results**

The patterns of the final data, as seen in Figure 1, show that *B. nigra* seeds were on average less popular than their *P. campanularia* counterparts in both native and non-native habitats. The chi-squared test of the non-native habitat, however, shows that this pattern, for the non-native habitat, is statistically insignificant (p = 1, df = 1, $X^2 = 0$). The results of the native habitat chi-squared test, on the other hand, show a significantly greater preference of *P. campanularia* seeds than that of *B. nigra* (p= 0.0259, df = 1, $X^2 = 4.96$).

In Table 1, we can see that the pattern of *Phacelia* preference stayed relatively constant throughout our experiment and that the 9 hour mark was a reasonable expression of the pattern throughout the day. We also see higher average foraging activity of ants in the grassland than the CSS, and highest foraging rates between the 3 hour and 6 hour mark (11:00am to 2:00pm). While these latter data do not particularly provide evidence for our study, they could prompt further ant study in the BFS.

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>Average <em>Brassica</em> Seeds Taken</th>
<th>Average <em>Phacelia</em> Seeds Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grassland</td>
<td>CSS</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 1. Average number of seeds taken from each habitat by time since placement of dishes (mean, n=3)

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>Native CSS</th>
<th>Coastal Sage Scrub</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.33</td>
<td>1.33</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>2.67</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 1. Total seed preference of *P. californicus* ants in native CSS and non-native grassland habitats, out of 60 seeds per seed species per habitat
Discussion

The results partially support our hypothesis but still call for further study. As predicted, ants in the CSS displayed a significant preference for native, *P. campanularia* seeds. However, we initially predicted that ant colonies in both habitats would prefer the *P. campanularia* seeds, with the ants in the disturbed grassland habitat showing less of a preference. The data show only a slight, statistically insignificant preference of *Phacelia* seeds for ants in the disturbed habitat. Clearly, the grassland habitat ants have less of a preference, which supports our hypothesis, but further study is needed to understand grassland ants’ preference fully.

One possibility is that our hypothesis is correct, but our study scope was too small or erroneous to produce significant data for the grassland habitat colonies. Our sample size was small, and the non-native habitat ants might show a statistically stronger preference of seeds with more...
samples. Also, during our experiment, we noticed one dish near a CSS colony had occasional aphid visitors that may have been taking seeds. The chi-square test still showed no significant preference of seed in the native habitat with or without the disturbed dish’s data included, so we assumed that the aphids did not make a significant impact and included all the data in our figures and statistics for this paper. However, further studies could attempt to eliminate error with closer observation and intervention of competing insects.

Another possibility is that a more complete hypothesis is necessary. During our experiment, we realized how much more prominent than expected B. nigra was in the BFS. A more complete hypothesis might take into account the actual familiarity ants might have with the two seed species, perhaps with a survey of seed availability at the BFS. Also, the two different seeds are very different sizes and colors, which we initially were concerned might play into ants’ preference. Holder and Polis (1987) hypothesize that desert harvester ants would display a preference for smaller seed size in their foraging; however, their experiment showed no significant preference. We used their work to assume that size would not play a part in preference, but perhaps their data was incomplete and a more complete hypothesis for our study is needed, taking seed size into account for preference.

**Literature Cited**
