FORAGING PREFERENCES OF THE LEAFCUTTING ANT, ATTA CEPHALOTES

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ABSTRACT (MEB & DBZ)

We examined foraging preferences of an A. cephalotes colony at Estacion Sirena, Corcovado National Park, Costa Rica. We placed leaf disks of three tree species at two sites on a foraging trail, one proximal and one distal to the nest. In a second experiment, leaf disks from young, mature, and old leaves of the tree on which the ants were foraging were placed proximal to the nest. A. cephalotes showed a strong preference for disks from the forage tree and selected leaf disks of different species in proportions that were the same at proximal and distal sites. Contrary to optimal foraging models, amount of time invested in a foraging trip did not affect the degree of selectivity shown by ants. When offered leaf disks of different age classes, ants strongly preferred young leaves over mature leaves, and mature leaves over old leaves, possibly because young leaves are a better growth substrate for the ants' fungal garden.

Key Words: Atta cephalotes, leaf-cutter ant, foraging preference, selectivity

INTRODUCTION (MEB)

The leafcutting ant A. cephalotes forages on a small percentage of the total available plant species in a Costa Rican tropical wet forest (Hölldobbler and Wilson, 1990). Previous studies have demonstrated that ants will show preferences among fragments of leaves of different species placed on their foraging trail (Kunz, P.L. et al, this volume). Because ant investment in a foraging trip increases with distance travelled, optimal foraging theory predicts that ants will be more selective further from the colony. We gave ants a choice between leaf disks of the species on which the ants were foraging and two other species, and predicted that ants would be less likely to accept leaf disks of non-preferred species further from their nest.

Within selected plant species, leaf-cutter ants have been shown to prefer new growth (Hölldobbler and Wilson, 1990). We gave workers on the trail a choice between disks cut from young, mature, and old leaves. Based on our observations of the forage tree, we predicted that workers would prefer young and mature leaves to old leaves.

METHODS (MEB)

We performed this study on a single foraging trail (length = 28.1m) of A. cephalotes in Corcovado National Park, Costa Rica. The nest was located 30m east of the Estacion Sirena kitchen, and the target tree of the foraging trail was a five meter tall citrus located 4m from the building.

Using a hole punch, we cut disks (diameter = 6mm) from leaves of three tree species: the citrus (Rutaceae), Inga sp., and a cyclanth (Cyclanthaceae, probably Cardulovica palmata). Disks were placed at two sites on the trail, one proximal to the nest (1m away), and one distal to the nest (1m from the target tree). We placed 60 disks at each site, 20 disks of each of the 3 species alternating among species. We initated trails on 1 February, 1994 at 16:40 and 17:10, and on 2 February at 09:25, 09:55, 10:25 and 10:50. When a disk was carried 50cm toward the nest, we identified it and recorded it as accepted. We terminated each trial when 40 of the total 120 disks at the two sites had been accepted.

To test preferences for leaves of different ages, we cut disks from young, mature, and old leaves of the citrus target tree. Young leaves were near the shoot tips and light green; mature leaves were darker green but lacked epiphylls; old leaves were a very dark green and heavily coated with epiphylls. In each trial, we placed 20 disks of each age class proximal to the nest, and terminated trials when 30 of the total 60 disks had been accepted. We initiated trials on 2 February at 15:15, 15:30, 15:40, 15:55, 16:15, and 16:30.

We used Chi-square analyses to test for patterns in preference and distance effects. Results from replicate trails within an experiment were pooled.

RESULTS (DBZ)

Ants accepted leaf disks of three tree species (citrus, Inga and cyclanth) in similar proportions at proximal and distal sites (X^2 = 2.30, df = 2, p = 0.40; Figure 1). The total number of leaf disks accepted was greater at the proximal (n = 146) than the distal (n = 94) site (X^2 = 11.27, df = 2, p < 0.001), although a large part of this difference was due to a single trial. Ants showed a strong preference for citrus disks (over 70% of those accepted) (X^2 = 174.4, df = 2, p << 0.001; Figure 1). The ants selected Inga more than cyclanth (X^2 = 4.00, df = 1, p < 0.05).

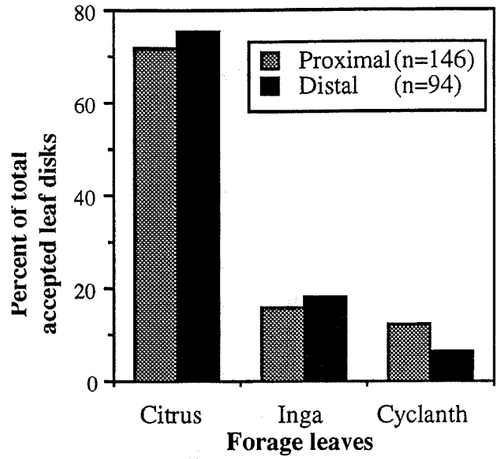

Figure 1. Preference for leaf disks of three species placed at sites proximal and distal to the colony.

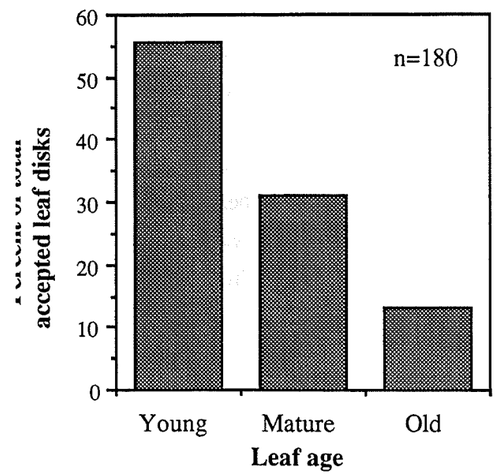

Figure 2. Preference for citrus leaf disks of three age classes.

When offered citrus leaves of three different age classes, ants strongly preferred young leaves over mature leaves, and mature leaves over old leaves (56% vs. 31% vs 13%, X^2 = 48.5, df = 2, $p < 0.001$; Figure 2).

DISCUSSION (DBZ)

Although we hypothesized that ants would be less likely to select for non-target leaf species at a greater distance from their nest, the ants selected citrus, Inga, and cyclanth in proportions that did not differ between proximal and distal sites. Contrary to optimal foraging models, the ants did not appear to make selection decisions based on the amount of time invested to travel to the encounter sites. Ants were just as likely to pick up a disk of target leaves (in this case, citrus) near or far from their nest.

Ants accepted a greater total number of disks at the proximal site than the distal site. Although this difference was statistically significant, the effect was mostly due to a single trial in which the number of disks accepted at the proximal site (34) was much greater than at the distal site (6). This trial occurred at 10:50 when we observed a decrease at the distal site in the number of ants not carrying leaf fragments. The lower number of ants that could pick up disks at the distal site may explain the apparent difference in acceptance.

Ants selected among leaf species. These preferences may be determined by differential nutritional or chemical defense content in the leaves. In addition, high acceptance of citrus suggests that ants may prefer disks of what is currently their target tree.

Ants selected among leaves of different age classes of the target tree species. The ants may prefer young leaves due to lower chemical defense and filter content, which makes a better growth substrate for the ants' fungus colony. The high acceptances of both young and mature leaves as opposed to old is consistent with our observations of the target tree, on which old leaves appeared to be avoided. This avoidance may also be due to the presence of epiphylls.

Future studies should include the entire foraging sequence to assess ant preferences. Although our preference selection tests did not include the costs of leaf cutting, our results show that individual ants have an ability to make foraging decisions. Ants did not appear to alter foraging preferences with distance, as predicted by optimal foraging models, however they did differentiate among tree species and among different age classes of leaves within a single species.

LITERATURE CITED

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