FORAGING PREFERENCES OF LEAF CUTTING ANTS BETWEEN *SAPIUM JAMAICENSE* AND *SPONDIUS MOMBIN*

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Abstract . Leaf cutter ants, *Atta cephalotes,* may be specialized to collect leaves of only certain tree species. We examined whether ants foraging upon one species of tree prefer leaf fragments from that species over fragments from another tree species being foraged on by other ants of the same colony. To test this, we presented ants on trails leading to specific trees with leaf fragments from their own resource species and a resource species being collected on another trail. Both trails were approximately the same distance from the colony's nest. We found that ants did not necessarily prefer leaf fragments from the tree upon which they were foraging, since ants on both trails preferred leaf fragments of one species, (*Sapium jamaicense*) over that of the other (*Spondius mombin*). Our study suggest that a leaf's favorable physical and/or chemical characteristics may be a more important factor in determining ant selectivity than transport distance or ant trail specialization.

Key words: Atta cephalotes, leaf characteristics

INTRODUCTION

Leaf-cutter ants, *Atta cephalotes,* of lowland tropical rain forests collect and compost leaf material and then harvest fungus that grows on the compost for food (Stevens 1983). Some *A. cephalotes* colonies have target trees at varying distances from their nest upon which they primarily forage. These ants may prefer foraging on particular tree species because they have characteristics that enhance fungal growth (Hubbell et al. 1979). A single ant colony may build trails leading to several target trees of different species. Marking and transfer experiments have shown that individuals on a trail foraging on one particular tree species will select leaf fragments from that species over foreign leaf fragments not being foraged on by that colony when given a choice (Hubbell 1979). We were interested in determining whether ants on one trail would prefer their own resource species to a resource species being foraged upon on another trail of the same ant colony. To do so, we presented ants with a choice of their own leaf fragment and one harvested on another trail. Although both leaf fragment types were being harvested by members of the colony, we predicted that ants on a particular trail may better recognize their own leaf type and transport it preferentially. We expected ants to pick up both types of leaf fragments, but pick up their own leaf fragment faster than that being harvested on another trail.

METHODS

On 2 February 1997, near the Estación Biologica in Corcovado National Park, we located a large leaf-cutter colony nest with several trails leading from it. We selected two branches on one of the trails (hereafter A and B), each of which led to a single tree of a different species (Fig. 1). Ants moving along trail A were feeding on *Sapium jamaicense* (Euphorbiaceae), whereas those on trail B were feeding on *Spondius mombin* (Anacardiaceae) (S. Zens, pers. comm.).

We collected 60 leaf fragments of approximately equal size from ants along branch A and from ants along branch B. Forceps were used when handling the leaves to avoid marking the fragments with human scent.

Once we had obtained leaf fragments, we set up three observational points along each branch at 25, 50, and 75% of the distance between the tree and the branch junction (Fig. 1). At each observation point, we placed a *S. jamaicense* leaf fragment and *S. mombin* leaf fragment in the middle of the trail. We then measured time until an ant first attempted to pick up each fragment, and the time until an ant actually began carrying the fragment toward the nest (defined as movement of >20 cm in that direction). Observation at each location was continued for 3 min. We did 10 replicates at each of the six observation points.

RESULTS

On both trails, ants initiated contact with *S. jamaicense* leaf fragments before they initiated contact with *S. mombin* leaf fragments (Table 1). Additionally, they removed *S. jamaicense* leaf fragments sooner than they removed *S. mombin* leaf fragments (Table 2). All leaves that were removed, regardless of leaf type or trail, were carried in the direction of the colony's nest. On trail A, ants picked up 27 of 30 *S. jamaicense* leaf fragments and 20 of 30 *S. mombin* leaf fragments in the allotted time of 3 min. On trail B, ants picked up 28 of 30 *S. jamaicense* leaf fragments and 19 of 30 *S. mombin* leaf fragments in the allotted time.

DISCUSSION

As predicted, ants on both trails picked up both leaf types. On both trails, fragments of *S. jamaicense* were preferred over *S. mombin.* Thus, our prediction that a leaf fragment would be picked up faster on the trail where that leaf species is foraged was supported on one trail but not on the other. This raises the question of why *S. mombin* is harvested at all. Possible explanations include (1) that *S. jamaicense* may not be abundant so the ants have to harvest less-preferred species in addition to it, (2) that the *S. jamaicense* tree on which the ants were foraging may have been running out of leaves, or (3) that ants may require a mixture of several types of leaves to optimally harvest the fungus.

In a similar study, Glennon et al. (1995) found that ants showed no preference for their own resource species over a resource species being harvested on another trail when their own target tree was near the colony's nest, whereas at a more distant tree, ants carried only leaf fragments of their own resource species. These results may be explained by the findings of Kunz et al. (1994), who reported that ants were more selective in their choice of leaves when they were farther from the nest. In our experiment, the target trees were at approximately equal distances from the nest (92 and 104 m), so transport distance was not the major factor in determining ant selectivity.

It seems more likely that *S. jamaicense* may be the preferred leaf type because of its favorable physical or chemical characteristics (Stevens 1983), and that ants on different trails can recognize it. Since Hubbell et al. (1979) have found that workers in a multi-trail colony are not locked into one trail system, a mechanism may exist by which ants currently working on one trail could recognize a leaf fragment being harvested on another trail. Thus, leaf type rather than transport distance or ant specialization to a particular trail may be the more important factor determining which leaves are preferentially picked up by the ants.

In conclusion, we found that *A. cephalotes* did not necessarily prefer leaves of each target tree when given a choice. Further studies of the possible relationship between ant selectivity, distance from colony and leaf type are needed. Such studies should be based on larger sample size and different kinds of trails because monospecific harvesting trails make up only one component of the *A. cephalotes* extensive trail network.

LITERATURE CITED

Glennon, M.J., C.D. Carson, M.A. Ginsburg, V.R. Levesque, and C.D. Wray. 1995. Selection of target versus non-target leaves by leaf-cutter ants (*Atta cephalotes*). Pages 74-75 in Carter D. Wray, editor. Dartmouth Studies in Tropical Ecology. Hanover, N. H., USA.

Hubbell, S.P., G.C. Stevens, B.R. Wilson, S. Hewitt, D.J. Leaman, J. Klahn, D. Roper, and S. Budilier. 1979. Foraging behavior of the leaf-cutting ant, *Atta cephalotes* in a tropical dry forest of Guanacaste, Costa Rica. (As cited in Janzen 1983).

Kunz, P. A., D.M. Larsen, and D.B. Zug, Jr. 1994. The effect of distance on foraging selectivity of leaf-cutter ants (*Atta cephalotes*). Pages 74-75 *in* J. L. Bykowski, editor. Dartmouth Studies in Tropical Ecology. Hanover, N.H. , USA.

Stevens, G.C. 1983. *Atta cephalotes.* Pages 688-691 *in* D. H. Janzen, editor. Costa Rican Natural History. University of Chicago Press. Chicago, Illinois, USA.

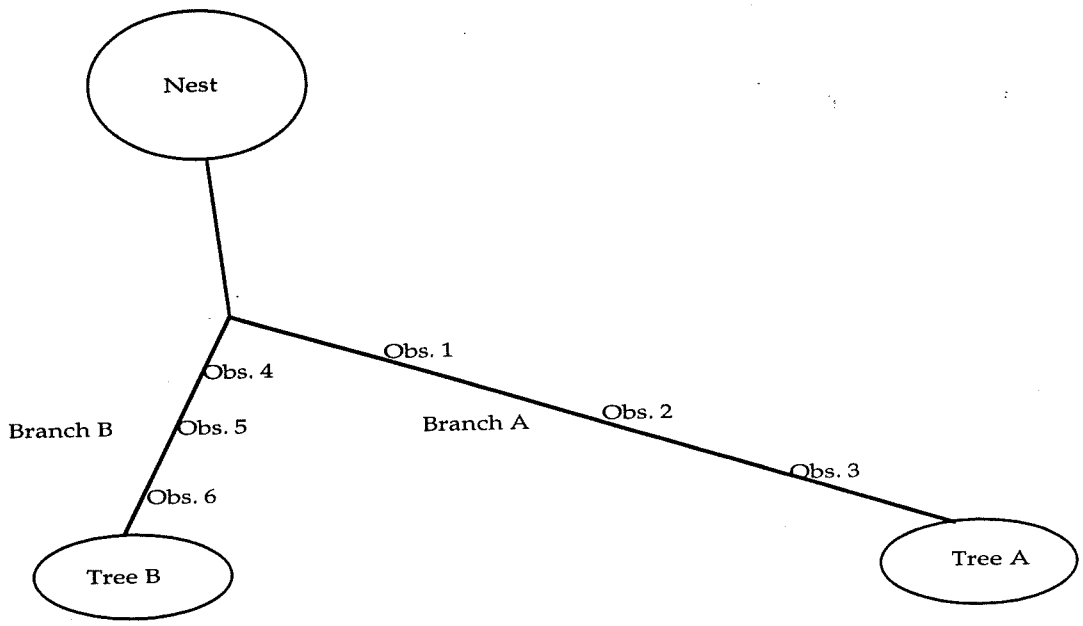

FIG. 1 Diagram showing testing site of a leaf-cutter ant colony in Corcovado National Park, Costa Rica. Obs. = observation points. Branch A was 24 m long, while branch B was 12m long. Distance from the branch junction to nest site was 80m.

Table 1: Time(mean + 1 S.E.) taken by Atta cephalotes to initiate contact with a leaf from its own trail and a more distant branch trail. N= 30, based on 10 pairs of A and B leaves placed at each of three evenly spaced locations on trails A and B.

Trail type	Time to initiate contact for A leaves ± S.E.	Time to initiate contact for B leaves ± S. E.	tpaired	df	P
Trail A	43.3 + 8.5	73.3 + 11.2	2.11	29	0.044
Trail B	30.0 + 5.5	61.3 + 10.3	2.61	29	0.014

Table 2: Time (mean + 1 S.E.)taken by Atta cephalotes to begin carrying an introduced leaf in the direction other leaves were being carried ("pick up time"). N=30, based on 10 pairs of A and B leaves placed at each of three evenly spaced locations on trails A and B.

Trail type	Pick-up time for A leaves (s) + 1 S.E.	Pick-up time for B leaves (s) + 1 S.E.	tpaired	df	P
Trail A	78.0 + 10.7	117.3 + 12.4	2.71	29	0.011
Trail B	60.0 + 8.1	188.7 + 12.7	3.81	29	0.0007