EFFECTS OF LITTER DEPTH ON TRAIL PRODUCTIVITY AND TRAVEL RATES OF THE LEAF-CUTTING ANT ATTA CEPHALOTES

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ABSTRACT (DKS)

Leaf-cutting ants Atta cephalotes use extensive foraging trails, cleared to varying degrees. Trails undoubtedly differ in the quality of the food resource to which they lead. If so, travel rates and productivity should differ on various trails. We suggest that shallow litter not only facilitates faster movement and therefore higher productivity, but that trails leading to more abundant or useful trees are cleared to a greater degree. It is also possible that higher productivity is the result of higher clearing, and further study is needed to test this alternative explanation of our findings.

Key Words: Atta cephalotes, leaf-cutter ant, leaf litter depth

INTRODUCTION (EHA)

Leaf cutter ants (Atta cephalotes) in Corcovado National Park, Costa Rica, maintain extensive foraging trails that are highly variable in the degree to which they are cleared of leaf litter. Some trails are completely cleared to bare ground, while others appear no different from the surrounding ground cover of leaves and debris. From these observations we hypothesize that the level to which trails are cleared reflects the importance of these trails to the ant colony. From this hypothesis we offer two major predictions. Firstly, ants travelling on highly cleared trails will exhibit higher travel rates than ants on trails with litter cover. Secondly, more highly cleared trails will exhibit higher rates of productivity, or the amount of leaf biomass passing into the colony in any given time period. We assume greater leaf biomass entering the colony will result in greater productivity of fungal gardens.

METHODS (DKS)

We conducted this study on the Sirena and Espeveles trails near Estacion Sirena, Corcovado National Park, Costa Rica on 28 January, 1994.

Using hiking trails as transects we selected a 3m section along the trail for each of 12 different ant trails from different colonies of the leaf-cutting ant Atta cephalotes. Starting at the head of the trail, we selected the first six such ant trails that we encountered on each of the two hiking trails.

We measured litter depth every 20cm along the 3m section. We also took three replicate measurements of time for leaf-carrying ants to travel 3m, and the number of pieces passing a fixed point within 60s. We took all measurements between 12:00 and 14:00.

We analyzed our data using simple linear regressions.

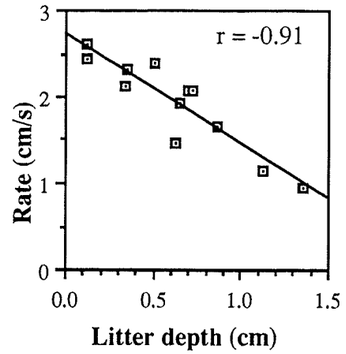

Figure 1. Rates of travel of leaf-cutting ants A. cephalotes in varying litter depths.

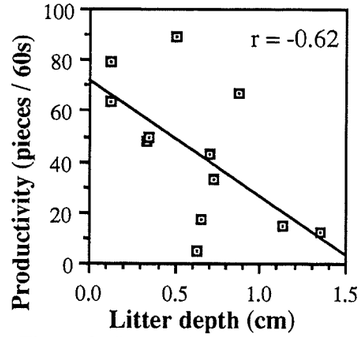

Figure 2. Productivity, in pieces passing a point along leaf-cutting ant trails, of varying litter depth.

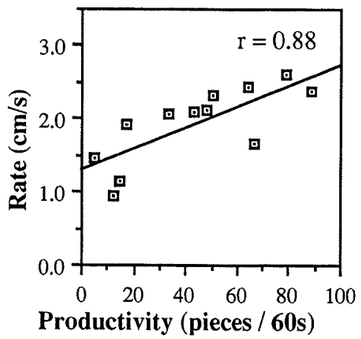

Figure 3. The correlation between rates of travel of leaf-cutting ants and the productivity of the trail.

RESULTS (DKS)

As litter depth increased, ants moved significantly more slowly ($y = -1.272x + 2.724$, $r^2 = 0.833$, $df = 10$, $p < 0.01$; Figure 1).

With increasing litter depth, the productivity, or number of leaf-carrying ants passing a point within 60s likewise decreased significantly ($y = -45.62x + 71.9$, $r^2 = 0.380$, $df = 10$, $p < 0.05$; Figure 2).

We also found a strong ($r = 0.766$) positive correlation ($p < 0.01$; Figure 3) between rates of movement and productivity of the trail.

DISCUSSION (DKS)

Our results suggest that litter depth determines travel rates of leaf-carrying Atta cephalotes and productivity of the trail in terms of number of leaf pieces passing per unit time. It is possible that trails are differentially cleared based on the value of the trail to the ants. This would mean that ants invest more heavily in trails leading to more abundant or preferred resources. Alternatively, trails highly cleared by A. cephalotes may not be chosen on the basis of resource abundance or preference. If so, higher trail productivity and faster rates of travel are the results of this clearing. This alternative could be tested by placing an impediment and measuring whether or not more productive trails are cleared faster.

In addition to clearing rates, the benefit of clearing could be calculated by measuring the length of the ant trail and calculating costs based on number of trips lost by either being

slowed down or clearing the impediment.

Perhaps deeper litter also results in smaller leaf pieces being carried. If so, then this is an additional cost of a less cleared trail that we did not consider. However, it is also possible that ants are carrying larger pieces to compensate for slower movement on deeper litter.