

# THE AGGRESSIVE RESPONSE OF *ATTA CEPHALOTES* SOLDIERS TO TWO TYPES OF DISTURBANCE

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**Abstract.** We examined the behavioral responses of soldier leaf cutter ants (*Atta cephalotes*) to different intensities and types of disturbance. We found that for a pounding stimulus, a more aggressive response was elicited when pounding was more intense. A simulation of the presence of an anteater, by probing entry holes with a stick, resulted in a more aggressive response than the pounding stimulus. Our findings suggest that a colony will commit no more soldiers than is necessary for adequate defense of the nest. (EWG)

## INTRODUCTION (ABS)

*Atta cephalotes* is a highly social species of tropical ant that forms colonies with clearly delineated caste systems. Ants of the soldier caste (maximas) are the largest members of the colony and appear to be responsible for protection of the nest (pers. obs.). The nests have several exit holes from which soldiers emerge upon disturbance. Ants that emerge from the nest, however, are more likely to be injured or preyed upon.

We observed that striking the base of an exit hole with a stick (simulating the movements of an above ground organism) results in the emergence of soldiers. We predicted that striking the hole would initiate an aggressive response, and that the greater the intensity of the disturbance, the more aggressive the response. Furthermore, we predicted that probing the hole with a stick (an attempt to simulate the tongue of a foraging anteater) would produce a greater response than would repetitive strikes because it more closely mimics a natural threat. The assumption underlying these hypotheses is that the colony should commit the minimum number of soldiers necessary to defend the nest. If the disturbance constitutes a serious threat, the benefits of many

soldiers responding aggressively would outweigh the costs.

## METHODS (ABS)

We selected two colonies of *Atta cephalotes* for our study, both located in Corcovado National Park, Costa Rica. Colony 1 was a subterranean nest located at the juncture of Sendero Espaveles and Sendero Ollas and was observed from 0700 to 1100 on 24 January 1992. Colony 2 was partially aboveground and was located on the Naranjo trail ~100m from the Sirena field station; we observed it from 1300 to 1500 on the same day. The exit holes of each nest were located and flagged. Colony 1 had 17 exit holes and Colony 2 had 14.

Two disturbance treatments were used on the exit holes. Treatment 1 consisted of striking the base of each hole with a stick 50cm long and 8cm in diameter. This treatment had two levels of intensity: 2 strikes and 10 strikes, all of equal force. To avoid potential preconditioning of the soldiers, half of the holes were struck 2 times followed by 10 times, while for the other half this order was reversed. We recorded the maximum number of soldiers out of the nest at any one time, as well as the total time that they

remained patrolling outside (our estimates of aggressive response). If no ants had emerged 30sec after the disturbance, a zero was recorded for both data entries.

After these procedures were performed on all holes, the second treatment was administered. Treatment 2 consisted of probing each hole with a thin stick for 2-3 seconds. The same data, the maximum number of soldiers to emerge and the amount of time they spent patrolling, were recorded.

## RESULTS (ABS)

The number of soldiers that responded to 2 strikes of a stick, 10 strikes of a stick, and the probe was classified as either low (0-1 individuals), medium (2-4 individuals), or high (>4 individuals) for both colonies (Table 1). The number of soldiers responding to the two levels of the first treatment differed significantly in Colony 1 ( $\chi^2=6.0$ ,  $p<.05$ ) but not in Colony 2 ( $\chi^2=2.16$ ,  $p>.01$ ).

Table 1. Contingency tables showing the intensity of ant aggressive response to two disturbance treatments.

	Number of Ants Responding		
	Low (0-1)	Med (2-4)	High (>4)
Colony 1			
2 strikes	17	0	0
10 strikes	12	4	1
Probe	6	1	9
Colony 2			
2 strikes	13	1	0
10 strikes	11	1	2
Probe	4	5	3

Higher numbers of soldiers responded to the probe than to 10 strikes of a stick at both colonies (Colony 1,

$\chi^2=10.52$ ,  $p<.01$ ; Colony 2,  $\chi^2=6.15$ ,  $p<.05$ ).

The amount of time that soldiers spent investigating the two levels of the first treatment was not significantly different at either Colony 1 ( $\chi^2=3.3$ ,  $p>.01$ ) or Colony 2 ( $\chi^2=2.2$ ,  $p>.01$ ; Table 2). At Colony 1, soldiers spent significantly more time outside of the nest in response to a probe than they did to 10 strikes ( $\chi^2=9.25$ ,  $p<.01$ ). At Colony 2, these time differences were not significant ( $\chi^2=.51$ ,  $p>.9$ ).

Table 2. Contingency tables showing the amount of time ants spent patrolling after two disturbance treatments.

	Time (minutes)		
	Low (0-3)	Medium (3-3:50)	High (>3:50)
Colony 1			
2 strikes	15	0	2
10 strikes	12	3	2
Probe	4	1	9
Colony 2			
2 strikes	14	0	0
10 strikes	12	1	1
Probe	11	0	1

## DISCUSSION (EWG)

In Colony 1, the significant difference between soldier response to 2 and 10 strikes indicates that a more aggressive response is elicited by a stimulus of greater intensity. In contrast, the difference between the same levels of treatment in Colony 2 was not significant. A possible explanation for the lack of significance in Colony 2 is that the nest of Colony 2 was located on a walking trail where passersby might be causing a pounding stimulus similar to the stick strike. This similarity might have caused desensitization of the soldiers to this stimulus.

Comparisons between strike and probe treatments were significantly different in both colonies, indicating that soldier ants behave more aggressively in response to the simulated ant eater attack than to the more artificial stimulus of pounding.

Since all tests except one comparing patrol time among disturbance categories were insignificant, it seems likely that time could be an inappropriate measure of the aggressive behavioral response.

Morphological differences between the maxima of the two colonies (Colony 1 maxima were much larger) would be worth examining in more detail. A possible explanation for the different morphologies might be that in Colony 2, the mound structure re-

sulted in the center of the colony being more protected while the center of 1 was closer to the surface. If this is the case, the disturbances to Colony 2 could have posed less of a threat than to Colony 1. The soldiers might have remained in the center, because they were not necessary for defense of the nest. The ants we observed could have been enlarged media.

Because of this possibility and the result that soldiers responded more aggressively to a larger disturbance, it seems that the colony is committing only the number of soldiers that is necessary for defense. The benefits of greater protection afforded by a greater allocation of soldiers might be outweighed by the costs of energy expenditure and predation.