AGGRESSIVE RESPONSES OF *P. SPINICOLA* TO NUMBERS OF INTRODUCED *P. FLAVICORNIS*

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Abstract: Pseudomyrmex spinicola, which form colonies in *Acacia collinsii* trees, use a variety of aggressive responses against heterospecific ants that come into contact with their host tree. We hypothesized that *P.spinicola* would tend to expel but not kill introduced ants when few ants were introduced, but would grapple with and kill ants when many heterospecific ants were introduced. Our data supported our hypothesis and suggests that *P.spinicola* has been under selection to respond with more effective, but more costly behavioral response only when the colony may be seriously threatened by invasion.

Key Words: invasion, aggressive response, P. spinicola, P. flavicornis

INTRODUCTION

Pseudomyrmex spinicola and *P.flavicornis* are two species of ants that have obligate mutualist interactions with *Acacia collinsii* at Palo Verde National Park, Costa Rica. The ants protect their host trees from invasion by other ant species, using several aggressive responses to repel the invaders (Janzen 1983).

In this study we examined a threat of invasion to *A.collinsii* trees inhabited by *P.spinicola* by introducing different numbers of *P.flavicornis* ants onto the host tree. We hypothesized that although prolonged attacks are more costly, they would be more efficient in disabling larger numbers of introduced ants. Rapid expulsions, which are less costly, would tend to occur when few ants were introduced. We therefore tested for a relationship between the type of aggressive reponse and the number of invading ants. Specifically, we identified two types of aggressive response that apparently differ in energy costs; 1) the rapid expulsion of intact introduced ant from the host tree (with the possibility of expelled ants returning to the host tree) and 2) prolonged attack on introduced ants which permanently disables them.

METHODS

We sampled *A. collinsii* along a belt transect of the main access road 5 km east of the OTS station in Palo Verde National Park, Costa Rica. The transect spanned 30 m on either side of the road and extended for ca. 1 km.

Using aspirators, we collected *P. flavicornis* from three *A. collinsii* trees and applied them in arbitrarily chosen numbers (1 to 10 individuals) to 16 *A. collinsii* trees, each with active resident colonies of *P. spinicola*. On each tree, the *P. flavicornis* individuals were placed simultaneously at a height of approximately 1.3 meters (or at the top for smaller trees), near the central trunk. We monitored each tree for five minutes after the introduction and recorded

the time of each expulsion and the start of each prolonged attack.

We performed all analysis in JMP 5.0.1.2.

RESULTS

The number of prolonged attacks per introduced ant increased significantly with number of introduced ants (multivariate, non-parametric Spearman's Rho, P=0.05). Neither the number of expulsions per introduced ant (Spearman's Rho, P=0.18), nor the average time to either expulsion or prolonged attack (Spearman's Rho, P=0.23), was influenced by the number of introduced ants.

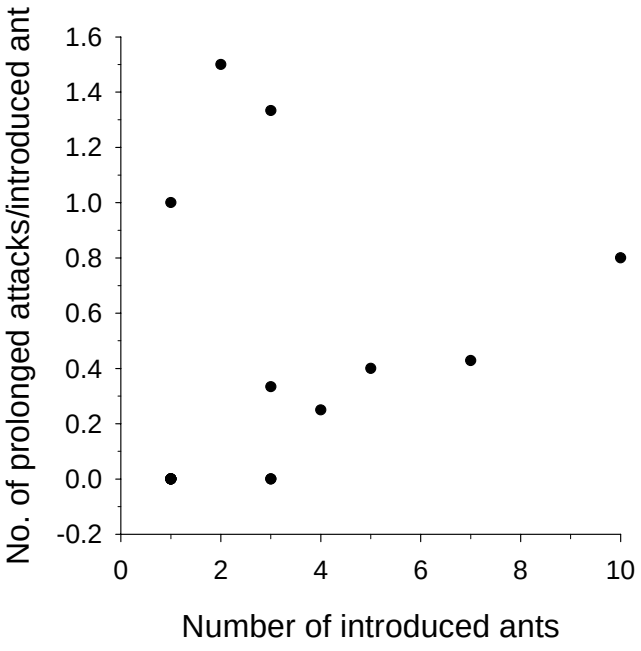

Figure 1. Number of prolonged attacks per introduced *P. flavicornis* ant by resident *P. spinicola* as a function of the number of ants introduced, in 16 *A. collinsii* trees in Palo Verde National Park (Spearman's Rho, P=0.05)

DISCUSSION

As hypothesized, *P.spinicola* tended to use the more energy-demanding, but more effective prolonged attacks when they encountered a large number of introduced ants. In contrast, when they encountered few *P.flavicornis* they tended to use the less demanding, but less effective expulsion response. *P.spinicola* has apparently been under selection to respond with the more effective but costly behavioral response only when the colony may be seriously threatened by invasion.

LITERATURE CITED

Janzen, D.H. 1983. *Pseudomyrmex feruginea.* in D.H. Janzen, ed. Costa Rican Natural History. University of Chicago Press: Chicago, IL. pp. 762-763.