Aggressive responses of *Pseudomyrmex flavicornis* and *P. spinicola* to vine introduction on *Acacia collinsii*

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Abstract: *Pseudomyrmex spinicola* and *P. flavicornis* are two ant species that defend their host tree, *Acacia collinsii*, against encroaching vegetation. We hypothesized that *P. spinicola* would have a greater pre-disturbance activity level than *P. flavicornis*, and that *P. spinicola* would respond more vigorously to a vine segment placed on the tree. We compared the activity levels of the two ant species before and after the vine introduction. *P. spinicola* had a higher pre-disturbance activity level than *P. flavicornis*, and a more prolonged response to the disturbance. Immediately following the disturbance, *P. flavicornis* had a proportionately higher activity level than *P. spinicola*. These findings support previous conclusions that *P. spinicola* is more effective at clearing competing vegetation than *P. flavicornis*.

Key Words: Inga sp., *mutualism, defense*

Introduction

Acacia collinsii is a common pioneer tree in Costa Rican dry forests. A major factor in the success of *A. collinsii* is the mutualism between the tree and ants of the genus *Pseudomyrmex* (Gill, 1989). The ants provide defense against herbivory and competing vegetation, while the trees provide the ants with shelter and nutrition (Janzen, 1983).

Janzen noted that *P. spinicola* is more effective than *P. flavicornis* in eliminating foreign vegetation that touches the acacia. Vines, such as *Inga sp.*, pose a major threat to *A. collinsii*, for if overgrown and shaded, the health of the tree may quickly decline (Janzen 1983). We hypothesized that *P. spinicola* would have a higher activity level before experimental introduction of a vine segment, and would increase its activity more than *P. flavicornis* after that introduction.

Methods

Our study area, 4 km south of the OTS Biological Station at Palo Verde National Park, Costa Rica was grazed until 1994. We selected fourteen 3-6 m tall *A. collinsii* individuals— 7 inhabited by *P. flavicornis* and 7 by *P. spinicola*. We randomly chose one branch per tree 1-2 m above the ground, and monitored the number of ants entering a 20 cm segment of the branch, measured from the bole. Ant activity was quantified for one minute prior to introducing a 40 cm segment of freshly cut *Inga sp.* 10 cm from the bole. The segment was fashioned into a loop around the branch with minimal mechanical agitation to the tree. The number of ants moving into the segment was then recorded each minute for ten minutes.

Results

P. spinicola was more active than *P. flavicornis* both before and after the disturbance (Figure 1; MANOVA, $F=16.73$, df=1,12, $P=0.002$). Both species increased their activity in response to the application of the vine ($F=4.63$, df=2,11, $P=0.03$).

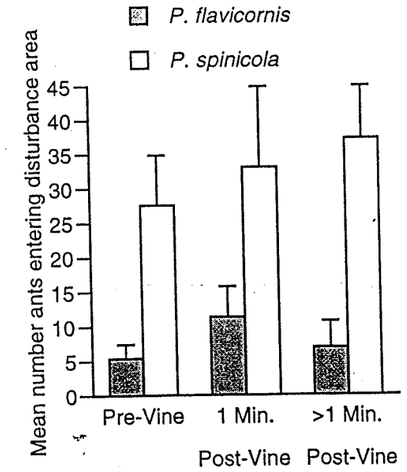

Fig. 1. *P. spinicola* and *P. flavicornis* activity before and after placement of *Inga sp.* vine segments on host *Acacia collinsii* trees at Palo Verde National Park, Costa Rica (means ±1 SE). The species differed in their patterns of response (see text for details).

P. flavicornis had a proportionally greater initial response to the disturbance than *P. spinicola*, though this trend was not significant (Kruskal-Wallis, Z= -1.54, P=0.12). *P. spinicola* maintained its higher post-disturbance activity level through the 10 minute trial, while the activity level of *P. flavicornis* decreased after the first minute (Kruskal-Wallis, Z=2.68, P=0.007).

DISCUSSION

The pre-disturbance activity level of *P. spinicola* was greater than *P. flavicornis*, supporting our initial hypothesis, and consistent with the suggestion of Gilmartin *et al.* (1991) that P. *spinicola* patrols host trees more than does *P. flavicornis*. However, this difference may result from higher population densities of *P. spinicola* on the trees we tested, rather than intrinsic behavioral differences between the species. Contrary to our hypothesis, the initial response of *P. flavicornis* was proportionally stronger than that of *P. spinicola*. The post-disturbance activity level of *P. spinicola* was sustained for the duration of the trial. This result supports the conclusions of previous studies that *P spinicola* removes encroaching vegetation more effectively than *P. flavicornis* (Bansak et al., 1993; Cook et al., 1993).

It would be useful to extend the duration of the trial to observe the long-term response to the disturbance. Additionally, the use of non-lignified vine segments could provide the ants with a more realistic simulation of a growing vine.

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