

# LOCAL AND SYSTEMIC DEFENSES OF *ACACIA COLLINSII* BY *PSEUDOMYRMEX SPINICOLA* COLONIES

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*Abstract:* *P. spinicola* defends its host *A. collinsii* in return for food and shelter. We hypothesized that *P. spinicola* would intensify its response after a second disturbance made on *A. collinsii*, regardless of whether the second disturbance was applied on the same branch as the first. However, our hypothesis was not supported; there was no evidence of induction in *P. spinicola*'s defensive behavior.

*Key Words:* Local induction, systemic induction, mutualism

## INTRODUCTION

In the mutualism between *Acacia collinsii* and *Pseudomyrmex spinicola* (Janzen 1983), *A. collinsii* provides food and protection for *P. spinicola*, which defends the acacia against herbivores (Janzen 1983).

Plant chemical defenses are often induced rather than constitutive, which can reduce costs to the plant, because defenses are produced only when needed. We hypothesized that ant defenses against herbivory in the ant-acacia mutualism may be analogous to inducible chemical defenses. This leads to the prediction that ant recruitment will be greater after a disturbance that follows a previous disturbance.

We tested for induction in two ways. First, we determined whether ant recruitment increased from a first to a second disturbance

on a single branch, measuring recruitment on that same branch. In the second test, we disturbed the first branch in the same way, but made the second disturbance (and measured consequent ant recruitment) on a different branch of the same tree.

We performed both tests to learn whether induced ant responses are localized to the area of disturbance ("local"), or generalized to cover the entire tree ("systemic").

## METHODS

We conducted our study on January 12, 2007 in an early successional forest in Palo Verde National Park, Costa Rica. Twenty-eight *A. collinsii* trees were sampled, on both sides of a dirt track ca. 6 km SE of the OTS field station (4 km E along the entrance road and then 2 km down the La Carreta Rd). We

randomly selected 1/3 of *A. collinsii* trees encountered along a series of systematically placed transects.

We measured *P. spinicola* recruitment after a standardized disturbance (tapping on the center of the branch for 10 sec). We counted all ants for a 30 sec period, crossing an imaginary line placed at least 10 cm away from any branch nodes, on the disturbed branch. Recruitment was measured beginning ca. 5 sec after each of the first and second disturbances. The second disturbance was made 15 minutes after the first, on the same (local treatment) or a different branch (systemic treatment) on the same tree. Before each disturbance, we measured the rate at which ants crossed the imaginary line, so we could calculate (by difference) the increase in ant recruitment over a baseline level. Hereafter, we refer to this increase in recruitment as simply “recruitment” after a disturbance.

To compare ant recruitment between the first and the second disturbances, we used paired t-tests for each of the systemic and local treatments. All statistical analyses were in JMP 7.0.

## RESULTS

Recruitment did not differ significantly between the first and second disturbances for either local (paired- $t=0.64$ ,  $df=13$ ,  $P=0.27$ ) or

systemic treatments (paired- $t=1.33$ ,  $df=13$ ,  $P=0.10$ ). However, there was a non-significant trend for recruitment to be higher for the second disturbance, in both treatments (Fig. 1). Recruitment on the same branch was  $18.9 \pm 4.4$  after the first disturbance and  $21.1 \pm 5.5$  after the second disturbance. Recruitment measured on different branches was  $25.7 \pm 6.3$  after the first disturbance and  $33 \pm 6.8$  after the second disturbance.

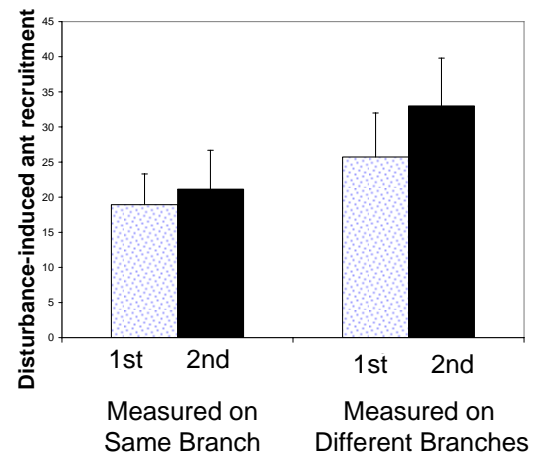


Figure 1. *P. spinicola* recruitment following standardized disturbances (see text for details) on *Acacia collinsii* at Palo Verde, Costa Rica (means  $\pm 1$  SE). Recruitment was measured after each of two disturbances, separated by 15 min, in each of two treatments (recruitment measured either on the same branch as the disturbance, or on a different branch). 1<sup>st</sup> and 2<sup>nd</sup> refer to recruitment measured after the first or second disturbance, respectively.

## DISCUSSION

Contrary to our prediction, there was no evidence of local or systemic induction in the response of *P. spinicola* to repeated disturbances.

Induction may have occurred, yet we could have failed to detect it, if the effects of induction dissipated before the second disturbance was applied. Another possibility is that the duration, rather than the rate of recruitment, may increase with subsequent disturbances. Prolonged responses in acacia ants have been reported by Schwartz et al. (2006); such an induced response would not have been detected with our sampling methods.

In future work, it would be useful to evaluate duration of ant responses, as well as rates of recruitment, and to test responses to successive disturbances over a range of time intervals.

#### LITERATURE CITED

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