SITE DESCRIPTIONS

Costa Rica is renowned for the tremendous diversity of habitats within its borders, and each field site provided us with a new and different ecosystem to explore. Our first research site, The Palo Verde National Wildlife Refuge and National Park, is a 4,757 hectare area containing wetlands and tropical dry forest. Both Palo Verde and our second stop, Santa Rosa National Park, are located in the northwest (Guanacaste) region. Santa Rosa National Park is a 10,300 hectare tropical dry forest; sea turtles and powerful ocean waves are among its other natural attractions. In the Osa Peninsula in the southwest, Corcovado National Park is a 35,000 hectare tropical wet forest that experiences some of the seasonality characteristic of Palo Verde and Santa Rosa, but with a much less extreme dry season. Corcovado is perhaps our wildest site, made remote due to the lack of passable roads. The Monteverde Cloud Forest Reserve was a haven for those of us who never really acclimated to tropical temperatures. A 2,500 hectare tropical cloud forest owned by the Tropical Science Center and located on the continental divide, Monteverde was a great contrast to both Corcovado and our final major research station, the La Selva Biological Reserve. La Selva, a 730.5 hectare tropical wet forest located in the Caribbean lowlands, is one of the most active research sites and provides unusual opportunities to meet scientists from other universities, colleges, and research institutions.

Our travels through Costa Rica also included short visits to two special research stations. The Wilson Botanical Garden at Las Cruces, located in the southern mountains near the Panamanian border, harbors thousands of species of plants and will serve as a reservoir for plant genetic diversity in the face of tropical deforestation. Finally, the Centro Agrinòmico Tropical de Investigaciòn y Enseñaza (CATIE) in Turrialba, not far from San Jose, is an agricultural and forestry research facility dedicated to improving techniques and increasing crop yields in tropical countries.

In Jamaica, we stayed at the University of the West Indies Discovery Bay Marine Lab. The reef at Discovery Bay had long been considered safe from hurricane damage, due to its protected location, until two hurricanes struck in the past two decades, causing immense destruction to the reef but providing researchers (including us) with the opportunity to conduct studies of the recovery process.

AGGRESSIVE RESPONSES OF ACACIA ANTS TO NATURAL AND ARTIFICIAL VINES

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Abstract (C.G.)

Both Pseudomyrmex ferruginea and P. belti were examined for their responses to the introduction of both a string and a vine to their respective Acacia collensii trees. Two types of responses were recorded on 3 trees of each ant type: 1) changes in the numbers of ants in the region of the introduction, and 2) the numbers of attacks.

More ants surrounded the area around the string than at the vine, but their number of aggressive attacks were not different. Nor was there a difference in aggressive attacks of P. ferruginea and P. belti. There was a decrease in the number of aggressive attacks later in the morning than earlier.

Introduction (A.S.)

Acacia ants have a symbiotic relationship with the Acacia tree (Acacia collensii) in which the tree provides the ants with all nutritional needs and shelter. In return, the ants aggressively defend the tree from herbivores and competition from other plants. The ants clear an area 1-4m in diameter of most vegetation, decreasing competition for the acacia tree (Janzen, 1983).

Our research questions where (1) do acacia ants respond aggressively to foreign materials in contact with the acacia, (2) is there a stronger response to naturally occurring compared to artificial materials, and (3) do the two common species of acacia ants respond differently to these materials?

We therefore tested experimentally the aggressive response of the acacia ants to (1) a nylon string and (2) a vine collected nearby (species unknown), using both red ants (Pseudomyrmex ferruginea) and black ants (P. belti).

Aggressive response to foreign materials, especially vines, would reduce competitive inhibition of acacia trees. Such behavior would be expected if ants act to increase acacia fitness. We included treatments with both natural vines and string to test whether the aggressive response (if any) was stereotyped or specific to naturally occurring vegetation.

Methods (J.K.)

We examined acacia ant colonies within 15 meters of an infrequently used road in Palo Verde National Wildlife Refuge, Guanacaste Province, Costa Rica. Starting at 8:50 am, each three-person group tested either a P. belti or P. ferruginea colony on A. collensii. We used the following protocol for each species of ants.

We selected such colonies with the following considerations: a) appreciable level of ant presence, b) similar tree size assuming this implies similar colony size, and c) similar light conditions.

We recorded ant activity over eight continuous five minute intervals (forty minutes total elapsed time) for a) 10-centimeter strip along a control branch, b) a 10-centimeter strip of branch surrounding the point where a local vine (species unknown) was draped over a branch, and c) a 10-centimeter strip of branch surrounding the point where a nylon string was draped over a branch.

At the initial time, we recorded the number of ants within the 10-centimeter strip of the control branch, vein, and string, and then again at the termination of the following eight rounds. During each interval, we recorded the number of ant attack efforts-defined as any distinct, continuous series of bites and strings by a single ant on the string and vine.

We repeated the above protocol three times in succession.

Results (G.Y.)

Table 1 contains the raw data concerning attacks. The number of attacks of P. ferruginea and P. belti was not significantly different ($U=5$; $n_1 = 6$; $n_2=6$; $p > 0.10$). When both species were considered together there was no significant difference between the response of any species to vine and their response to string ($U=25$; $n_1=6$; $n_2=6$; $p>0.10$). When all attacks made within a time trial were considered together, and then comparisons between trials were made, there was a significant difference among the three time trials (Kruskal-Wallis $H=6.96$; $n_1=4$; $n_2 = 4$; $n_3 = 4$; $p < 0.05$).

There was a significant increase in the number of individuals near the string compared to the vine when both species are considered together. ($t=2.67$; $df=47$; $p < 0.02$). We also noted that sometimes only one individual attempted the task of ridding the A. collensii of the vine. The number of P. ferruginea increased significantly around the string as compared to the vine ($t=2.50$; $df=23$; $p = 0.02$) and compared to the control ($t=2.96$, $df=23$; $p < 0.01$). The null hypothesis that the number of P. ferruginea approaching the vine was the same as that approaching the control could not be rejected ($t=0.368$; $df=23$; $p < 0.90$). Nor could we reject the null hypotheses that there were no

differences in the increase in the number of ants: 1) around the vine compared to the control ($t=-0.135$; $df=23$; $p < 0.90$); 2) around the string compared to the control ($t=1.69$; $df=23$; $p < 0.20$), 3) around the vine compared to the string ($t=1.82$; $df=23$; $p < 0.10$).

Discussion (D.G.)

The hypotheses that there was no aggression differential between species or treatments could not be rejected. However, aggressive encounters with the introduced objects were more significant than only the absolute change of numbers of ants in the immediate vicinity. Gnawing, stinging, or biting was a positive aggressive action by the ants to groom the tree. The change in numbers of ants in the area was subject to many influences, including the presence of nectaries thorns, beltian bodies, and the time of day. The major inter-tree variation may have been due to differential levels of activity throughout the day.

We observed that one ant of P. ferruginea would remain at the vine where it could work to remove the foreign vegetation. All other ants would pass by; this aggressive activity is localized to the small area where the vine is in contact with A. collensii. This also applied to the unexpected result that both ant species were more dense near the string rather than in the vine. This study brought these variables to our attention, and they must be controlled in future studies.

Table 1 Aggressive encounters by Pseudomyrmex belti and P. ferruginea towards treatments of vine and string.

	Trial 1	Trial 2	Trial 3
P. ferruginea			
string	58	2	9
vine	18	0	1
P. belti			
string	88	19	0
vine	41	3	0

Table 2 Change in number of ants within 10cm after treatments on three individuals of Acacia collensii.

Pseudomyrmex belti

Time(min.)	Vine			String			Control		
0	-	-	-	-	-	-	-	-	-
5	+6	-3	-3	+6	+2	-2	-1	+1	-4
10	+2	-2	-3	+7	+2	-5	0	0	-4
15	-1	-4	-3	+1	0	-5	+1	-1	-5
20	-2	-3	-3	+1	0	-5	-2	0	-5
25	-2	-4	-3	+3	+2	-5	-3	0	-5
30	-2	-5	-3	0	0	-5	-1	-2	-5
35	+2	-4	-3	-2	-1	-3	-2	-1	-5
40	-2	-5	-3	-1	0	-5	0	-1	-4

Pseudomyrmex ferruginea

	Vine			String			Control		
0	-	-	-	-	-	-	-	-	-
5	-2	+1	-2	0	+7	+1	0	0	+2
10	-1	+1	-2	0	+7	+1	0	0	-1
15	+1	0	0	+1	+6	-1	0	0	-1
20	+3	+2	-2	+6	+4	0	0	0	-1
25	+3	+1	-1	+8	+3	-2	+2	+2	-3
30	+5	0	-1	+12	+1	-1	+2	+1	-2
35	+6	0	-5	+11	+1	-3	+2	0	-1
40	+12	0	-4	+10	-2	-3	+2	+1	-1

Literature Cited

Janzen, D.H. Costa Rican Natural History. University of Chicago Press, 1983. P. 762-764.