

MURDER BY NUMBERS: THE EFFICIENCY OF ARMY ANT CASTES

YIRAN GU, THOMAS J. LOBBEN, TIFFANY D. CHANG, AND LIA M. CHEEK

Faculty editor: David R. Peart

Abstract: We manipulated prey availability *in situ* for the army ant *Eciton burchelli* (subspecies *parvispinum*) at Palo Verde National Park, Costa Rica. We investigated how the colony allocates the heterogeneous worker resources arising from the evolutionarily conserved caste polymorphism in army ants. We measured the frequencies at which minor and major workers attack and carry prey of different sizes. Both prey size and worker task (killing or carrying) significantly affected the numbers of major and minor workers recruited. This allocation of resources apparently contributes to the optimization of foraging strategy previously demonstrated for army ants.

Keywords: Division of labor, *Eciton burchellii parvispinum*, social insect

INTRODUCTION

Many social insects are polymorphic. Major and minor workers of the army ant *Eciton burchellii parvispinum* each have a role within the colony to maximize foraging efficiency (Franks 2001). We explored the allocation of *E. burchellii parvispinum* castes to different foraging tasks. We hypothesized that the combination of major and minor workers recruited would vary according to prey size and type of foraging behavior (killing or carrying prey). Specifically, we predicted that major workers would kill and carry larger prey more than minor workers.

METHODS

At the Palo Verde Biological Station, Costa Rica, we trapped terrestrial arthropods (grasshoppers,

katydids, crickets, spiders) and sorted them into distinct size classes: small (< 1cm), medium (1-3cm), and large (> 3cm). All insects were alive but immobilized by leg removal at the beginning of each experimental trial.

We conducted our experiment during natural foraging cycles of *E. burchellii parvispinum*, from 1650-1800 on 16 Jan 2008 and 0400-0600 on 17 Jan. We selected a random column or swarm for prey introduction, at a random distance (1-5 cm) from the column or swarm. For each trial, we measured the time from placement of prey item until the arrival of the first ant and the time to first attack (bite or sting). We also noted the caste (major, minor, soldier) of the attacking ant. For the next 5 minutes, we recorded the numbers of minor workers, major workers, and soldiers that contacted the prey, at 20 second intervals.

From 0630-1000 on 17 Jan we observed the colony returning to its underground nest site. We randomly selected a column to watch for each 10 minute period. We recorded the identity and size class (small, medium, large) of each prey item carried into the nest, as well as the numbers and castes of the ant(s) carrying each item. We classified foraging activity as killing or carrying prey.

No soldiers were seen in direct contact with prey, so they were excluded from analyses. Three experimental trials were excluded (all with small beetles) because no ant attacked. All counts of ant numbers were square-root transformed for normality in multivariate variance analysis (MANOVA). All analyses were performed in JMP 7.0.

RESULTS

As hypothesized, prey size and task type significantly affected the number and type of workers recruited (MANOVA Wilks' $\lambda = 0.378$, $df = 6, 86$, $P < 0.0001$). The numbers of major and minor workers differed significantly depending on prey size (Wilks' $\lambda_{\text{prey size}} = 0.457$, $df = 4, 86$, $P < 0.0001$) and task (Wilks' $\lambda_{\text{task}} = 0.668$, $df = 2, 43$, $P < 0.0001$). More major and minor ants attacked and carried large prey than small and medium sized prey (Figure 1 & 2). However, more minor ants attacked large prey than

major ants ($t = 3.76$, $df = 18$, $p = 0.0014$).

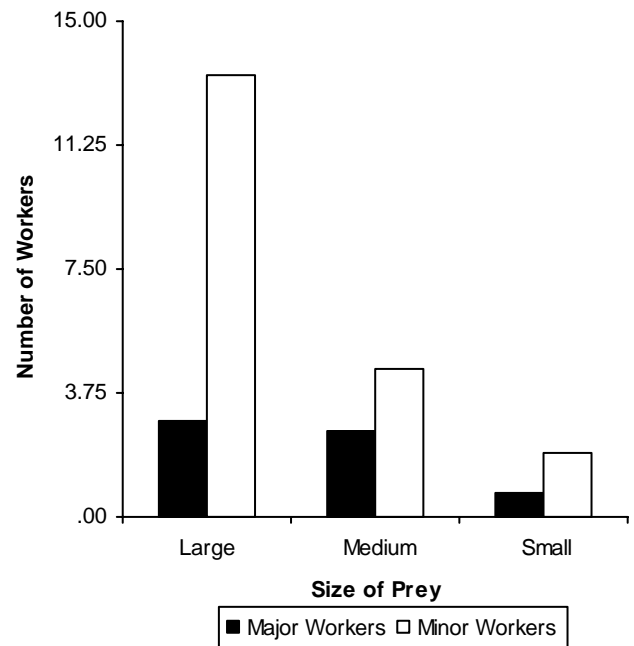


Figure 1. Number of *Eciton burchelli* workers recruited to kill different size prey at Palo Verde, Costa Rica. Mean \pm SD.

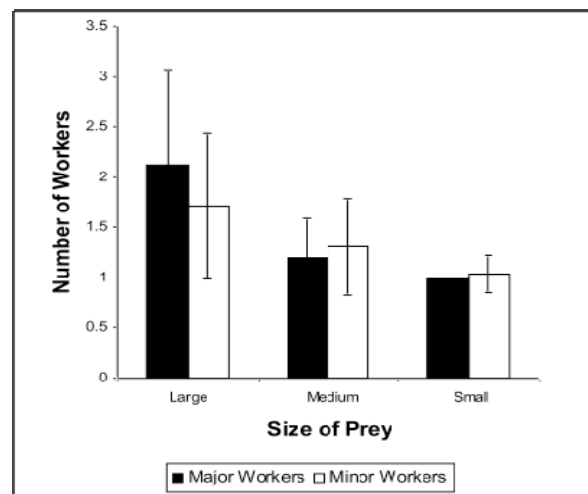


Figure 2. Number of *Eciton burchelli* workers carrying different size prey at Palo Verde, Costa Rica. Mean \pm SD.

DISCUSSION

Prey size and task affected the number of major and minor workers recruited. Contrary to our hypothesis, more minor than major workers killed large prey items. This may be simply because minor workers are most abundant. Alternatively minor workers may be specialized in killing prey, and selectively recruited for this task. This allocation of resources apparently contributes to the optimization of foraging strategy previously demonstrated for army ants (Franks 2001).

LITERATURE CITED

- Franks, N., A. Sendova-Franks, and C. Anderson. 2001. Division of labor within teams of New World and Old World army ants. *Animal Behavior*, Vol. 62, pp 635-642.