The Girls Are Fighting!
Impact of Competing Ant Colonies on Nest Choice

Marissa Douglas, Tito Cuchilla, and Matina Donaldson-Matasci
Department of Biology, Harvey Mudd College
mdonaldsonmatasci@hmc.edu

Introduction

Within a habitat, structural constraints influence the way resources are distributed [1]. For example, arboreal ants coexist on individual trees, creating competition for nest sites between colonies [1]. Our species of interest, Northern Caribbean Turtle Ants (*Cephalotes varians*), lives in the beetle-produced cavities of trees in the Florida Keys, causing competition between colonies for both tree space and ideal cavities within a tree [2].

Question:

Are turtle ant nesting choices impacted by the presence of conspecific competitors?

Methods

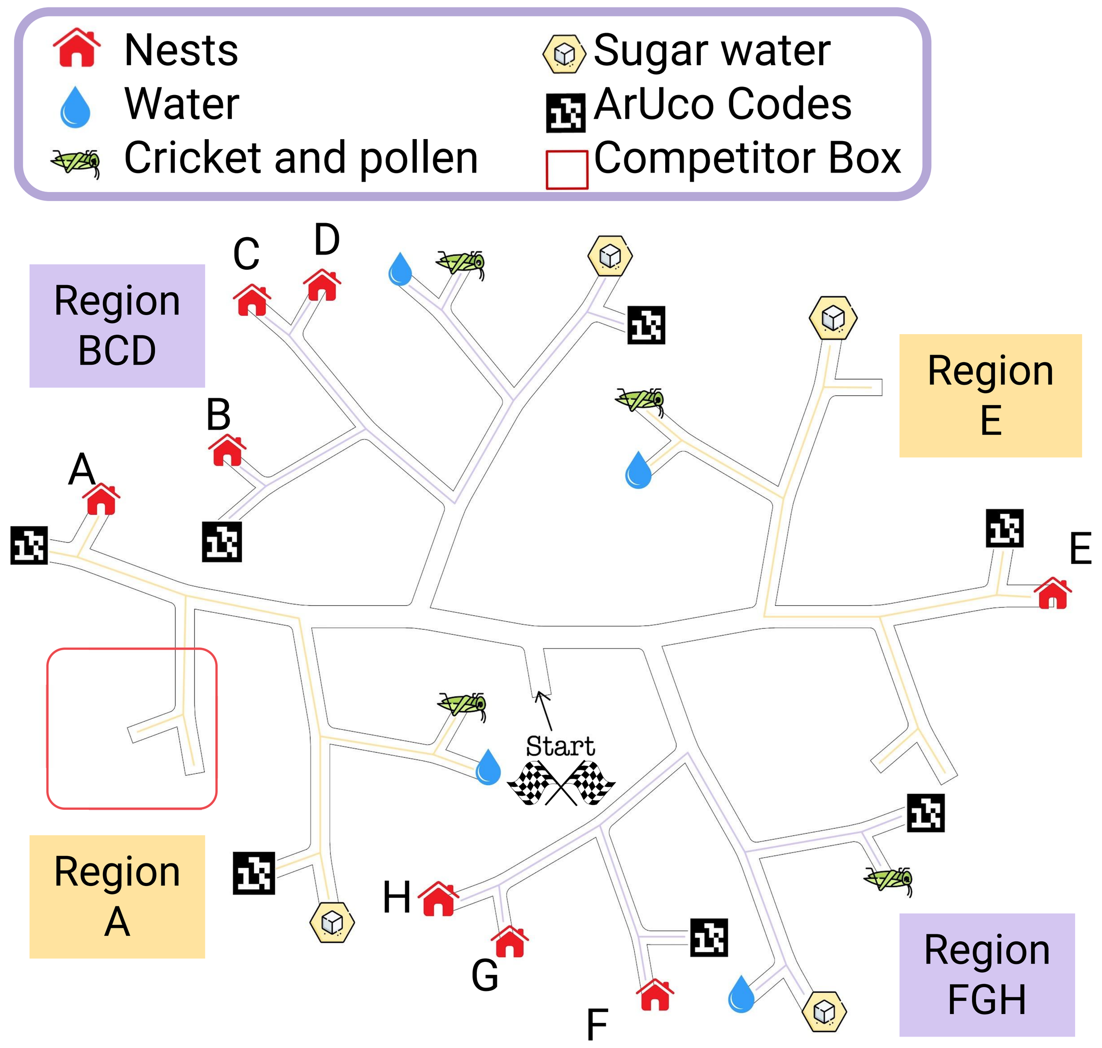

Fig. 1. Tree Layout: The tree was set up so there are 4 regions, each having equal access to resources. There are two configurations of regions, 1-cavity (A/E) and 3-cavity (BCD/FGH). Each cavity (A-H) is equally far from resources and the start node. A is closest to the competitor box.

Experimental Design:
Four focal colonies experienced the tree with no competitor in the box (control) and with a competitor (treatment). Two colonies experienced the control arena first and the other two experienced the treatment first.

Measurements:

- For 3 days, twice daily observation and video recording.
- Censused at end of 3 days
  - counted the ants in each nest, outside of nests, and the dead.
  - For each nest, counted how many workers, soldiers, and if queens or brood were present.

Fig. 2. Experimental Setup: The branch was placed into a bin, resting on slippery stands and a wooden block trunk. A camera and lights were set up for recording.

Results

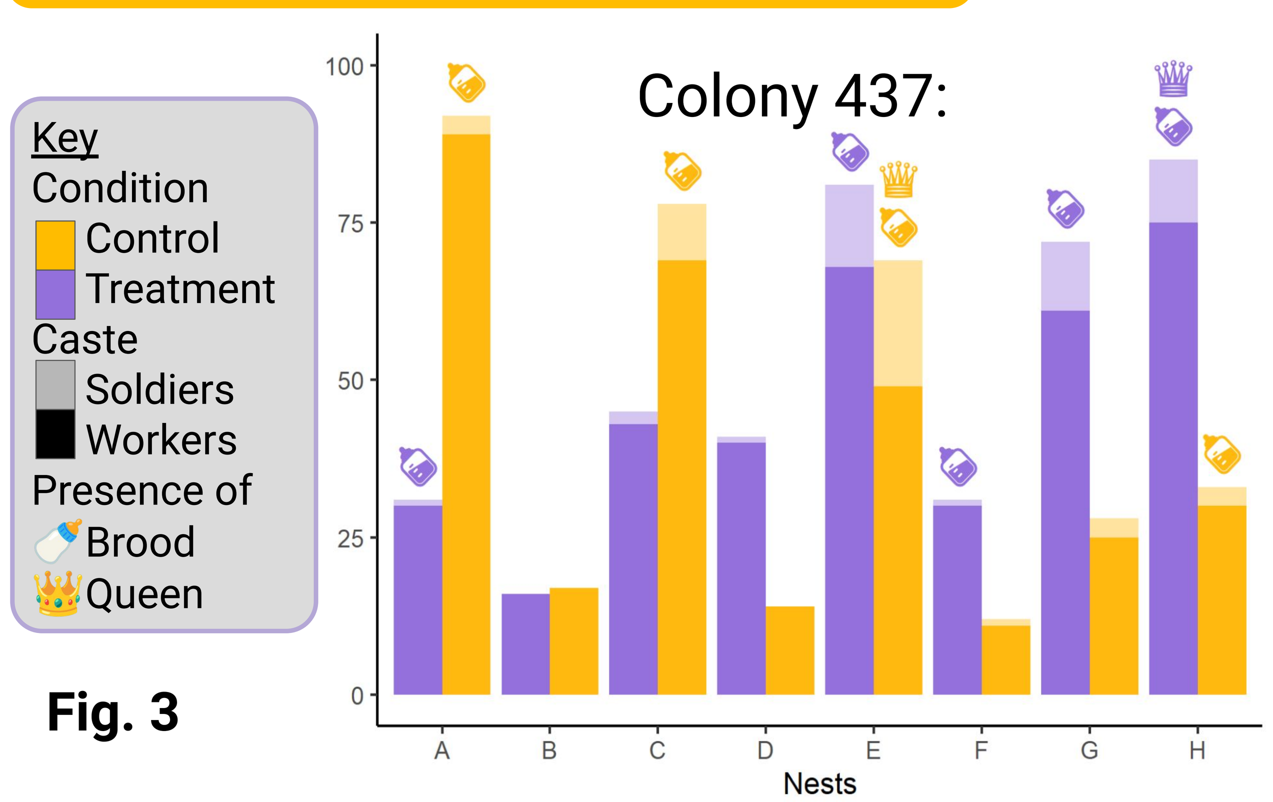

Fig. 3

- All colonies had soldiers, brood, and/or queen nest in cavity E during control.
  - 400 and 437 shifted these members to region FGH in competitor treatment.
  - 398 and 399 kept these members in cavity during treatment.
- In the presence of competition, brood tended to be more concentrated in G and H.

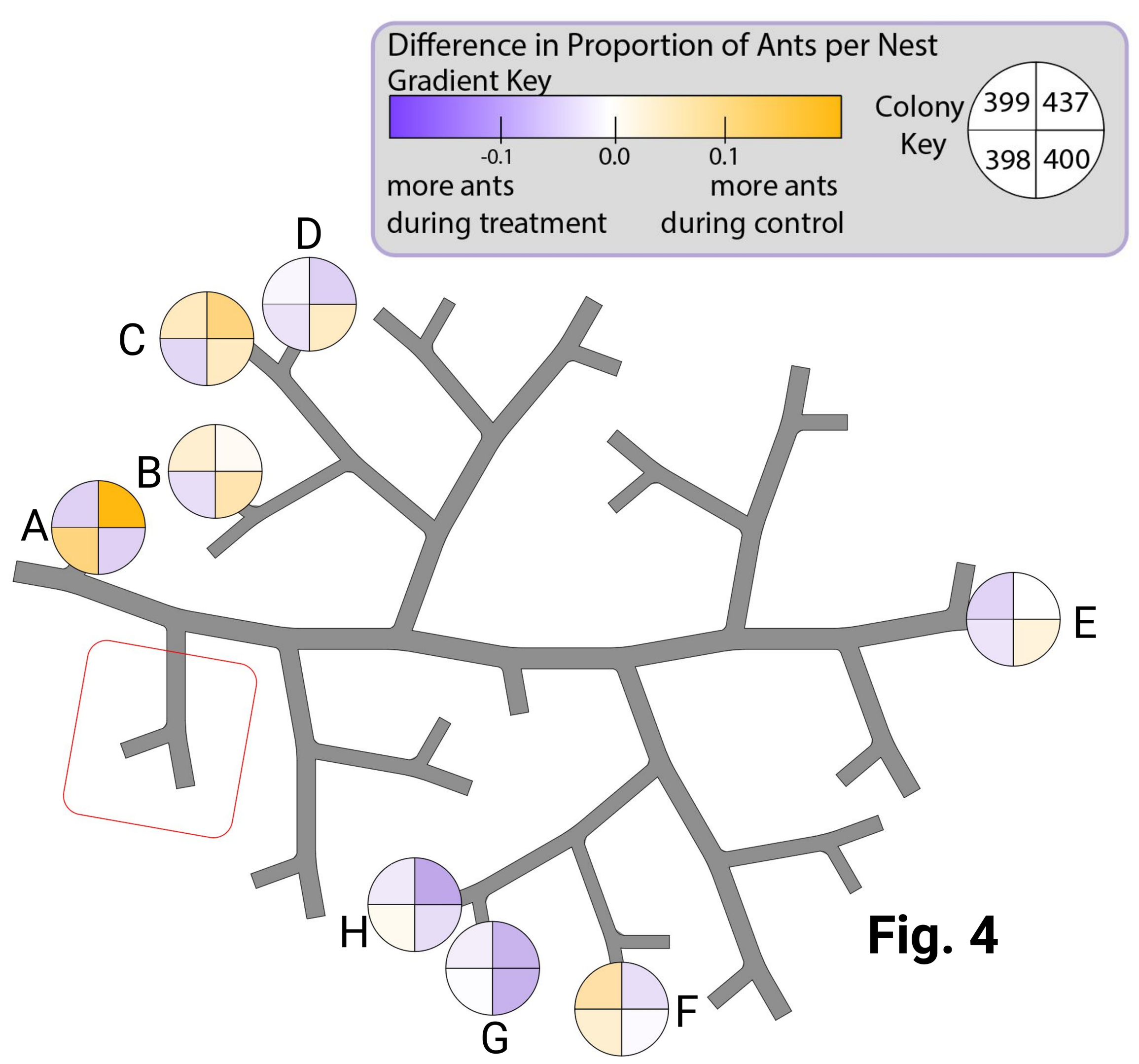

Fig. 4

- Soldiers were found to congregate around the brood and queen.
- In all treatments, workers initially nested with brood and soldiers, then dispersed into other cavities by the end of the experiment (with the exception of colony 398).

- The change in proportions is most extreme in A, while E was densely inhabited in both conditions (**fig. 4**).
- G and H were consistently occupied in higher proportions under competition (**fig. 4, 5**).
- There was no significant change in nest occupation due to competition. However, trends suggest movement away from A (**fig. 5**).
  - Colony 437 displayed the clearest avoidance of the competing colony (**fig. 3**).

Fig. 5. Neg. binom. GLMM. Response: workers+soldiers. Fixed effects: nest, treatment. Random effect: colony.

Nest	Incident Rate Ratio (treatment vs control) (compared to 1)	CI	*p*
A	0.70	0.34 – 1.42	0.321
B	0.79	0.27 – 2.35	0.674
C	0.93	0.34 – 2.60	0.897
D	1.94	0.67 – 5.59	0.221
E	1.33	0.49 – 3.67	0.576
F	0.96	0.34 – 2.75	0.947
G	2.31	0.83 – 6.45	0.109
H	1.64	0.60 – 4.52	0.339

Discussion

We hypothesized turtle ants' nest choice and caste allocation across nests would change in the presence of a conspecific competitor compared to without (control).

In previous, noncompetitive experiments, A and E were preferred nesting sites. Under control conditions, we continued to observe this, however under competitive conditions, we saw a shift away from A, but not E.

In the presence of competition, brood was often more clustered in adjacent nests far from the competitor, but without a nearby competitor, brood was more widely dispersed.

We suspect that by quarantining the competitor to a box, and using large focal colonies, we minimized the impact of competition.

Our results were not significant, but suggest that turtle ants avoid nesting near competitors. With further replicates and additional experiments, we hope to gain more insight into turtle ant nesting behavior in response to competition.

Acknowledgements
Thanks to Dr. Morgan Carr-Markell and Brian Cha for assisting us through experimental design and execution, to Scott Powell and Max Adams for help from collection to experimentation, to Kenneth Mitchell, Carter Moyer, Simon Woodside for designing and creating the physical tree pieces and producing motivating results, to the HMC makerspace and machine shop proctors for aiding in experimental setup and construction, and to Tom Fu, Kate Lord, Marylin Roque for inspiring our poster. Funding for this work was provided by Harvey Mudd College and the National Science Foundation award IOS-1755425.

References
[1] Adams B. J., Gora E. M., Donaldson-Matasci M. C., Robinson E. J. H. and Powell S. 2023 Competition and habitat availability interact to structure arboreal ant communities across scales of ecological organization. Proc. R. Soc. B. 290: 20231290. http://doi.org/10.1098/rspb.2023.1290
[2] Powell, S., Donaldson-Matasci, M., Woodrow-Tomizuka, A., & Dornhaus, A. (2017). Context-dependent defences in turtle ants: Resource defensibility and threat level induce dynamic shifts in soldier deployment. Functional Ecology, 31(12), 2287–2298. https://doi.org/10.1111/1365-2435.12926