

# Can Specialists Generalize?

## Diets of Small-Town Texas Horned Lizards (*Phrynosoma cornutum*)

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### INTRODUCTION

- Texas horned lizards have declined throughout their native range.<sup>1</sup>
- Texas horned lizards are traditionally considered harvester ant (*Pogonomyrmex* spp.) specialists.<sup>1-3</sup>
  - Urbanization, pesticide use, and invasive fire ants (*Solenopsis invicta*) may indirectly contribute to horned lizard decline by reducing harvester ant availability.<sup>1</sup>
  - Specialization on harvester ants has defined captive breeding, management, and reintroduction efforts of Texas horned lizards.
- Increasing evidence suggests horned lizards opportunistically exploit numerous ant and arthropod species.<sup>2,3</sup>
- Based on the hypothesis that horned lizards are harvester ant specialists, we tested the following predictions in two small towns in Karnes County, Texas:
  1. Horned lizard density is positively related to harvester ant density.<sup>1</sup>
  2. Harvester ants account for more than 60% of diet.<sup>2</sup>
  3. Consumption of harvester ants is independent of availability, space, and time.<sup>2,3</sup>



Texas horned lizard.



Harvester ants at colony entrance.



Horned lizard eating harvester ant.

### METHODS

- **Sample Collection:** We surveyed 15 sites 8 times from May-August 2016. We captured, PIT tagged, DNA sampled, weighed, measured, and released all detected horned lizards and collected all undamaged scat (Fig. 1).
- **Horned Lizard Density:** we calculated horned lizard density as the number of unique individuals per hectare at each site.
- **Prey Abundance:** We assessed harvester ant abundance at each site as the number harvester ant colonies (Fig. 2), harvester ant density (colonies per hectare) (Fig. 3), and relative number of mounds per horned lizard.
- **Diet:** We dissected 133 scat from 7 study sites, and identified fragments of arthropod exoskeletons based on morphology, texture, and color (Fig. 4).



Figure 2. Harvester ant colony.



Figure 3. Distribution of harvester ant colonies at site 7.



Figure 1. Horned lizard scat.



Figure 4. Beetle fragments recovered from scat.

### RESULTS

Is horned lizard density related to harvester ant density? **NO**

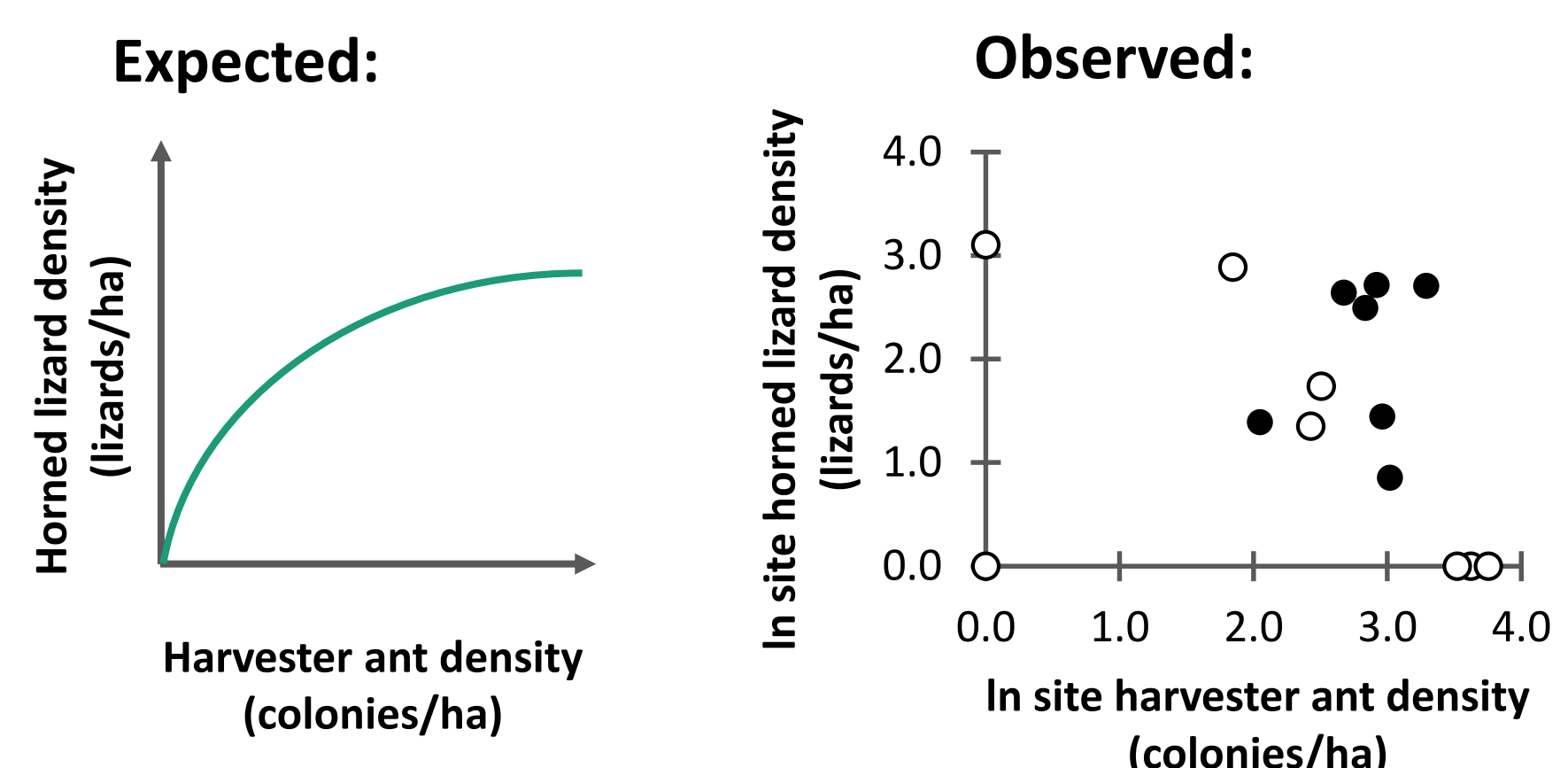


Figure 5. Predicted relationship between horned lizard and harvester ant density. Increasing prey availability should sustain larger predator populations.

Figure 6. Observed relationship between the natural log of horned lizard and harvester ant density at each study site. Dark circles indicate sites used in diet analysis.

- We captured 133 unique lizards and made 57 recaptures.
- Occurrences of horned lizards were independent of the abundance or density of harvester ant colonies.

Do harvester ants account for more than 60% of diet? **NO**

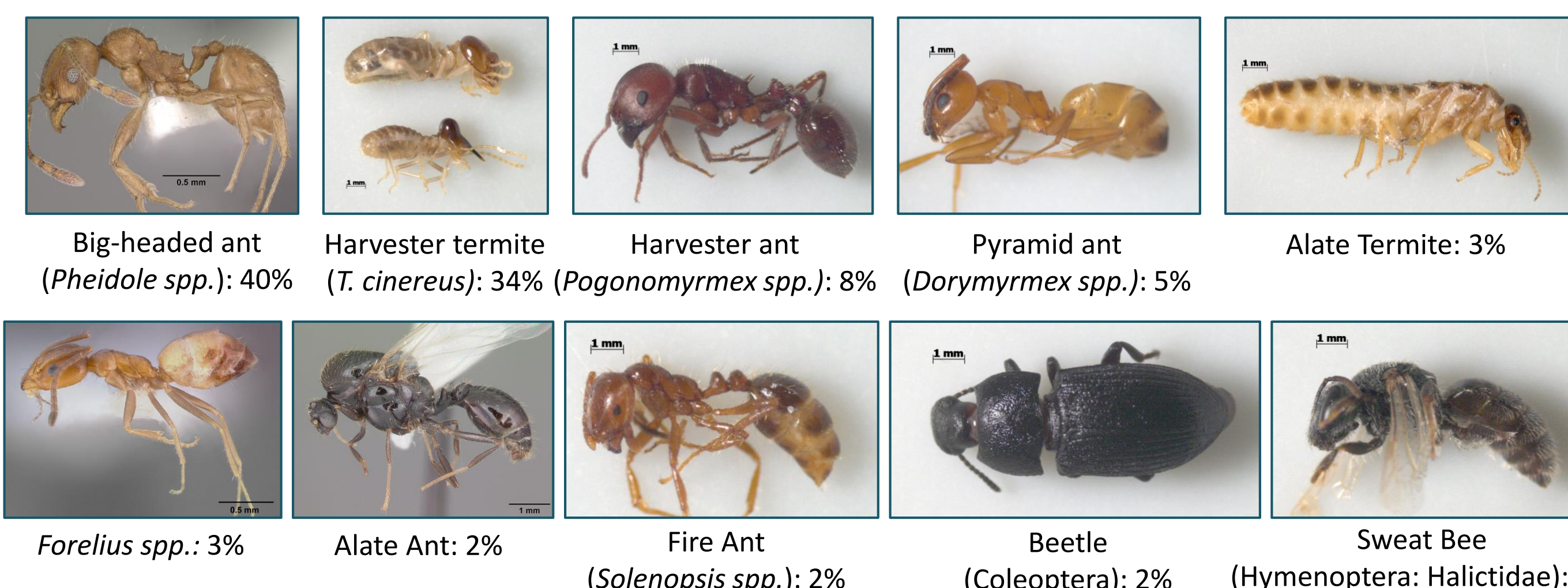


Figure 7. Commonly consumed prey (>1% of diet), ordered by contribution to overall diet.

Is consumption of harvester ants independent of location? **NO**

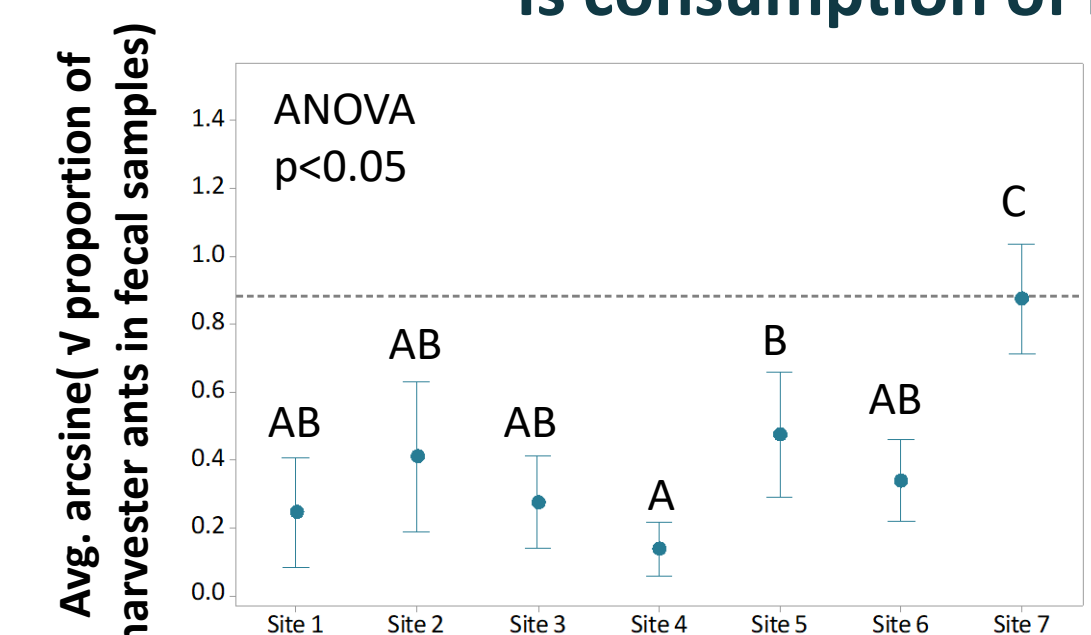


Figure 8. Average consumption of harvester ants at each site, relative to a reference line  $y = \arcsine(\sqrt{0.6})$ . Error bars indicate  $\pm$ SEM. Data points with different letters indicate significant differences (Tukey-Kramer Test,  $p < 0.05$ ).

- There were significant differences between the average proportion of harvester ants consumed between sites.
- Harvester ants were approximately 60% of diet at site 7, but far less at other sites.

Is consumption of harvester ants independent of time? **YES**

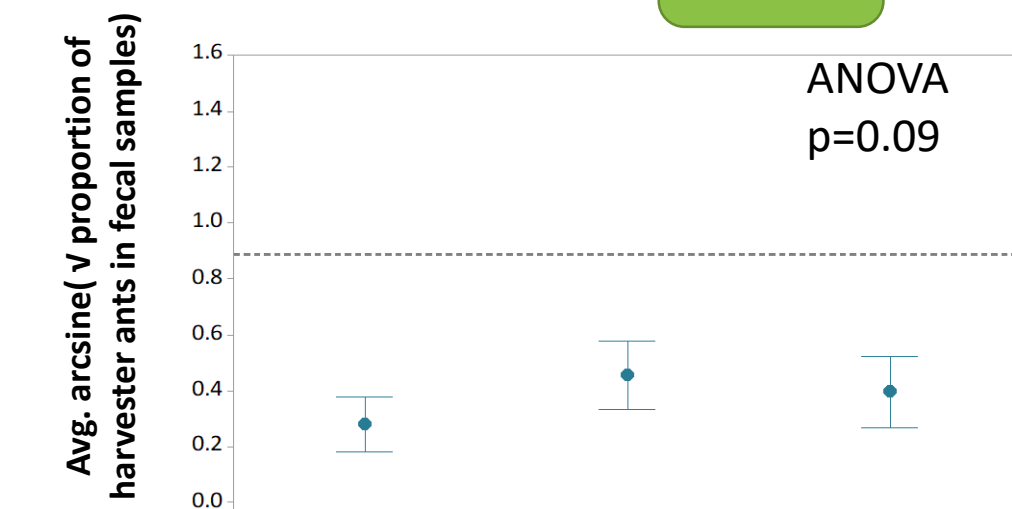


Figure 9. Average consumption of harvester ants during each collection period, relative to a reference line  $y = \arcsine(\sqrt{0.6})$ . Error bars indicate  $\pm$ SEM.

- There were no significant differences in average harvester ant consumption over time, but harvester ants never accounted for more than 50% of diet.
- There were significant changes in the dietary proportion of beetles, alates, and harvester termites over time (ANOVA,  $p < 0.05$ )

### RESULTS

Is consumption of harvester ants independent of availability? **NO**

**Expected:** average proportion of harvester ants is high, and independent of absolute or (number of colonies) or relative (number of colonies per horned lizard) harvester ant availability at each site ( $y > 0.60$ ;  $R^2=0$ ).

**Observed:**

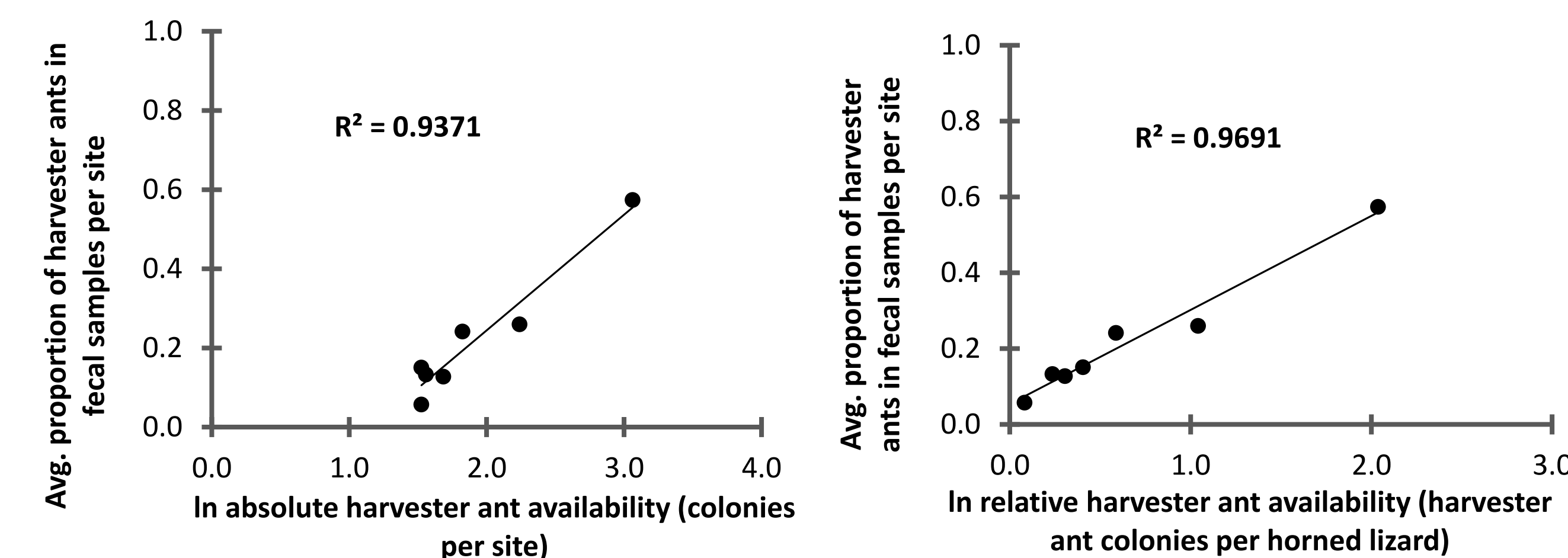


Figure 10. Observed relationship between harvester ant abundance and the average proportion of harvester ants in fecal samples at each site ( $y = -0.34 + 0.29x$ ,  $p < 0.005$ ).

Figure 11. Observed relationship between the ratio of harvester ant colonies per horned lizard and the average proportion of harvester ants in fecal samples at each site ( $y = 0.05 + 0.25x$ ,  $p < 0.005$ ).

### DISCUSSION

- Our results fail to support the hypothesis that horned lizards are harvester ant specialists.
- This is the first documented case of adult horned lizards eating large numbers of big-headed ants or harvester termites.
  - Big-headed ants are nutritionally inferior to harvester ants because of their small size (Fig. 12). They are normally eaten by hatchling horned lizards, but not adults.
  - Consumption of big-headed ants and harvester termites could indicate relaxed size-based prey preference.
- High dietary variation between sites and collection periods is likely due to differences in prey availability.
- High horned lizard densities may generate competition for food and contribute to reduced dietary specialization.
- The relative importance of harvester ants in horned lizard diets may be dictated by environmental factors like alternative prey quality, predation risk, soil types, and vegetation communities.<sup>2,3</sup>



Figure 12. Size of big-headed ant (top left) and harvester termite (bottom left) relative to harvester ant (right).



Hatchling horned lizard.

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