Response of litter-dwelling ants to experimental removals of white-tailed deer and Amur honeysuckle in eastern deciduous forest

Michael B. Mahon, Kaitlin U. Campbell & Thomas O. Crist
Department of Biology, Miami University, Ohio 45056 USA

Introduction

Deciduous forest ecosystems in the Eastern United States are strongly influenced by the overabundance of White-tailed Deer and the presence of non-native, invasive plants, such as Amur Honeysuckle. Deer and Amur honeysuckle decrease abundance and richness of seedlings, saplings, and herbaceous plants in the forest understory (Côté et al. 2004, Hartman and McCarthy 2008). They also have cascading effects on various trophic levels (Bressette et al. 2012, Poulette and Arthur 2012). However, few studies have examined how they alter litter-dwelling arthropods.

Ants (Formicidae) play key functional roles in forest ecosystems, which allows for the visibility of changes through various functional groups. Therefore, any changes in richness, abundance, or composition of the ant community could result in changes in ecosystem functions. To measure potential direct and cascading effects of deer and Amur honeysuckle, we utilized ants as a bioindicator taxa.

Question and Predictions

How does the litter-dwelling ant community respond to the experimental removals of Deer and Amur Honeysuckle?

	Deer Presence	Honeysuckle Presence	Reasoning
Standing Litter Biomass	↓	↓	↑ Decomp.
Ant Rich & Abund	↓	↓	↓ Litter
Ant Composition	**SHIFT**	**SHIFT**	Resources

Materials and Methods

- 5 study sites located in Miami University's Natural Areas in southwestern Ohio
- Each site consisted of a 20x20-m deer exclosure paired with a control plot, each contained a split-plot removal of Amur honeysuckle (Fig. 1)
- Leaf Litter was collected (May-June, 2011-2015) from 0.25m² quadrats (Fig. 1) and was placed in Winkler extractors to sample for ants
- Ant richness, ant abundance, and standing litter biomass were recorded from each sample
- We utilized Generalized Linear Mixed Models and AIC selection to examine effects of :
  - Standing Litter Biomass
  - Deer (present/excluded)
  - Amur Honeysuckle (present/removed)
- Used MDS ordination for species composition analysis to test effects of Deer and Honeysuckle treatments

Results

- 3844 workers were collected, representing 30 species
- Common species included
  - *Aphaenogaster rudis*
  - *Temnothorax curvispinosus*
  - *Myrmica punctiventris*
- There was no direct effect of treatment on ant abundance, richness, or community composition across all years (Fig. 2a & 2b)
- Ant richness (e.g. Fig. 3a) and abundance (e.g. Fig. 3b) were positively related to standing litter biomass in 2012, 2014, & 2015
- Standing litter biomass was positively related to Deer exclusion across all years and was negatively related to Honeysuckle removal in 2012 & 2013 (Fig. 2c)

Figure 1. Paired plots with split plot design. Flags indicate sampling locations of leaf litter from 0.25m² quadrats.

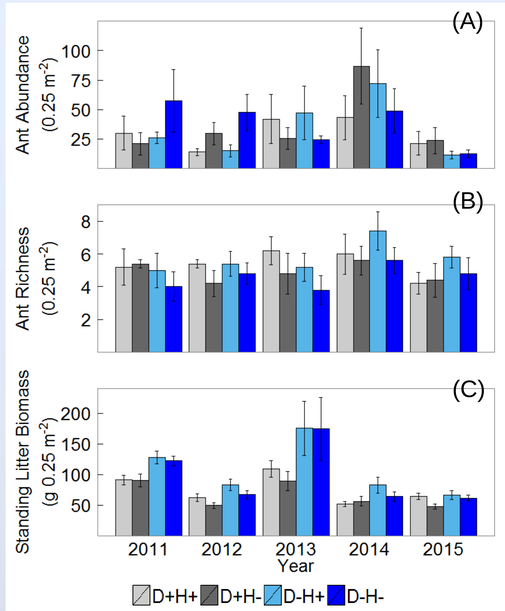


Figure 2. Yearly treatment breakdown of mean (A) Ant Abundance (individuals 0.25m^{-2}), (B) Ant Richness (species 0.25m^{-2}), and (C) standing litter biomass (g 0.25m^{-2}).

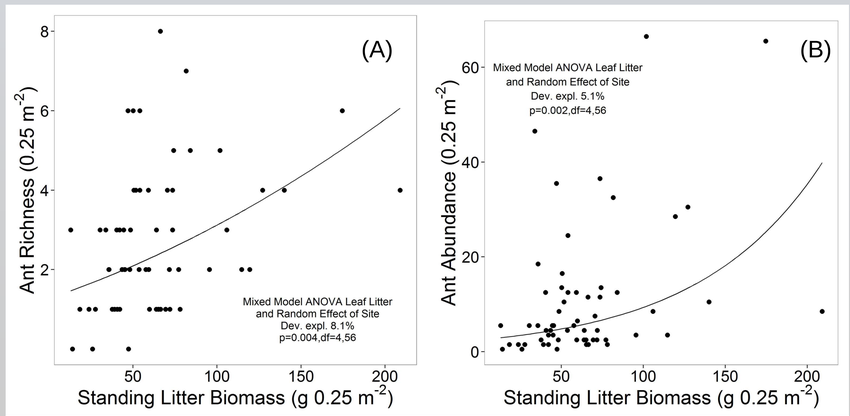


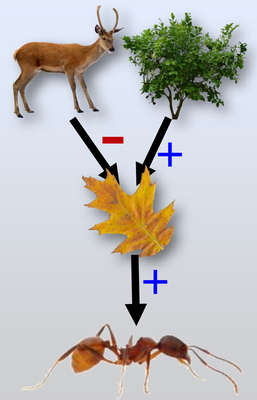
Figure 3. Relationship between standing litter biomass (g 0.25m^{-2}) and (A) Ant Richness (species 0.25m^{-2}) and (B) Ant Abundance (individuals 0.25m^{-2}) in 2014.

Summary

	Deer Presence		Honeysuckle Presence	
Standing Litter Biomass	↓	✓	↓	✗
Ant Rich & Abund	↓	✓	↓	✗
Ant Composition	**SHIFT**	✗	**SHIFT**	✗

Conclusions

- Leaf litter ant abundance and richness was positively related to the amount of standing litter biomass
- Standing litter biomass was strongly negatively related to Deer presence and weakly positively related to Honeysuckle presence
- Deer have an indirect negative effect on leaf litter ants
- Honeysuckle has an indirect positive effect on leaf litter ants
- There were no effects of either treatment on the ant community within or across years
- Deer presence appeared to increase leaf litter decomposition rates
- There was no interaction of the treatments



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Further Information

For further information please request a handout and/or email Michael Mahon at: mahonmb@miamioh.edu

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