

Influence of Host Preference on Size of *Xylotrechus colonus*



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INTRODUCTION

- Cerambycidae a diverse family (35,000+ species worldwide)^{1,3}
 - Spend majority of life cycle within trees
 - Variety in diet (specialist/generalist strategies) and life cycle strategies^{4,5}
- Insects exhibit host preference
 - High nutritional content -> stronger development -> greater ecological fitness
- Focal species: *Xylotrechus colonus* (rustic borer)
- Commonly found in eastern United States²
 - Active period: April-October⁵
 - 1-3 years development depending on diet/environment¹
 - Generalist species associated with hardwoods⁴

Question:

Do larger beetles come from preferred host species?

METHODS

1. Infestation of logs and specimen collection

- Collected 10 logs of 10 tree species
 - Tree species: beech, black cherry, black walnut, buckeye, burr oak, hackberry, musclewood, and sugar maple
 - Logs defined as over 63 cm length with diameter at 15 cm on average
- Logs placed at 10 different NICHES land trust properties (Figure 1)
 - Placed in randomly ordered concentric setup, no log/log contact (Figure 2)
 - Ethanol lure changed monthly
- Infestation Period: Early May – Late November 2020
 - Logs collected in cardboard tubes
- Incubation period: 1 year
 - Samples in vials

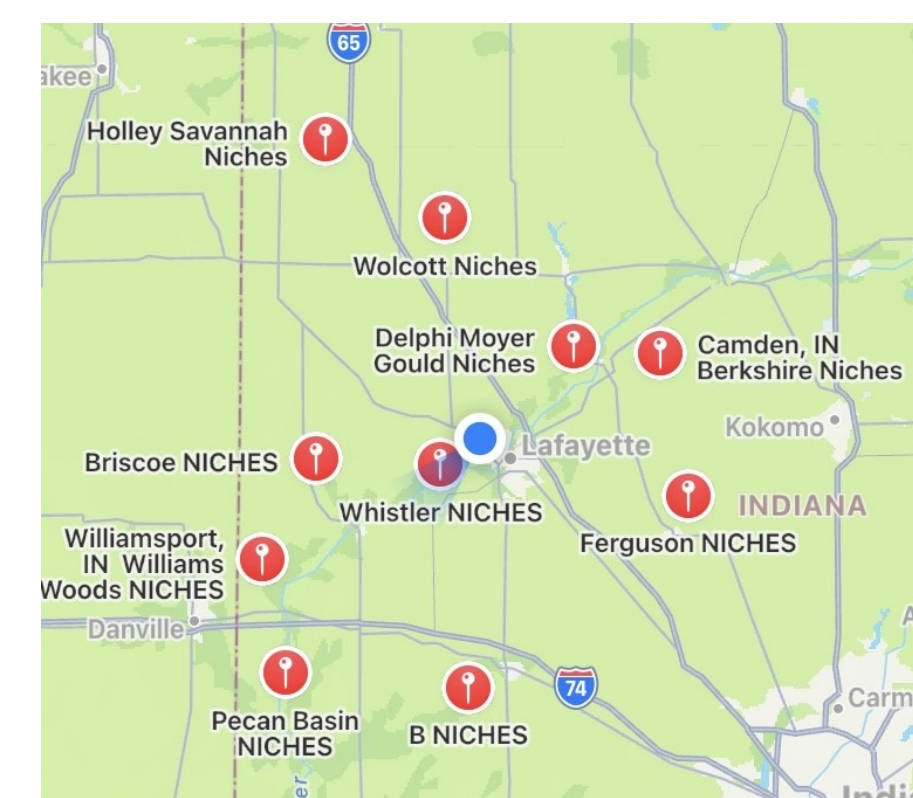


Figure 1



Figure 2

Figure 1 (left): Map of the 10 NICHES properties utilized in the study.

Figure 2 (right): Experimental setup of concentric logs. Ethanol lure placed in middle.

2. Separated/Collected Measurements of each specimen

- Identified focal species (*X. colonus*)
- Sexed with 5 measurements
 - Mass, full body length, head capsule width, elytron length, metathoracic femur length

3. Analyzed data

- Data visualized
 - Correlograms, ANOVA, Tukey-HSD tests
 - To analyze relationships and determine significance

RESULTS

X. colonus counts differ between tree species

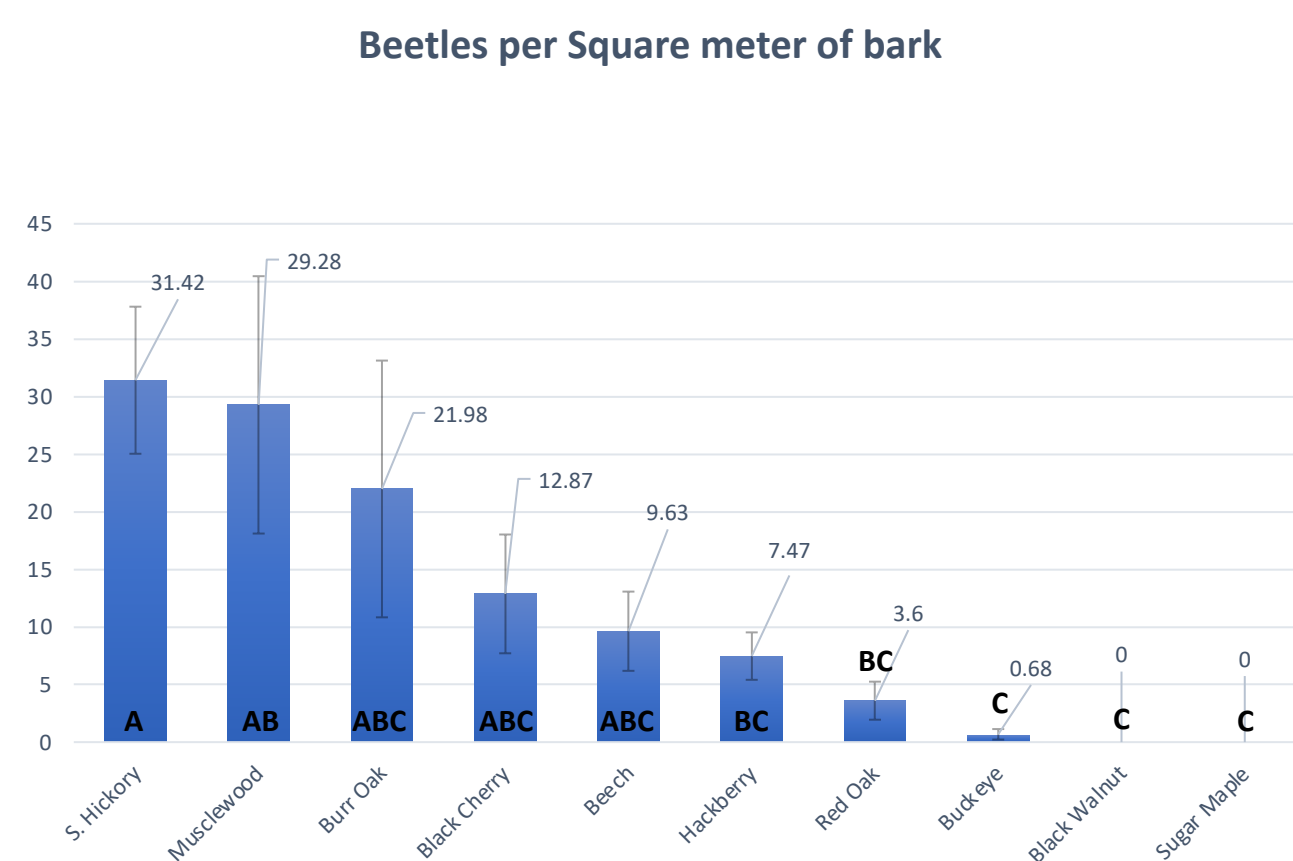


Figure 3

- 356 *X. colonus* emerged from 95 logs
- 172 Males: 184 Females
- Every location and all but two tree species reared *X. colonus*
- Mean corrected counts per log differed between host species

Figure 3 (left): Bar graph of corrected counts of beetles per square meter of bark. Each bar represents the 10 tree species and values are displayed above every bar. Groupings based on Tukey HSD test are displayed in or above the bars. $F_{(DF=94)} = 4.956, P = 2.36e-05$

Size differs between tree species

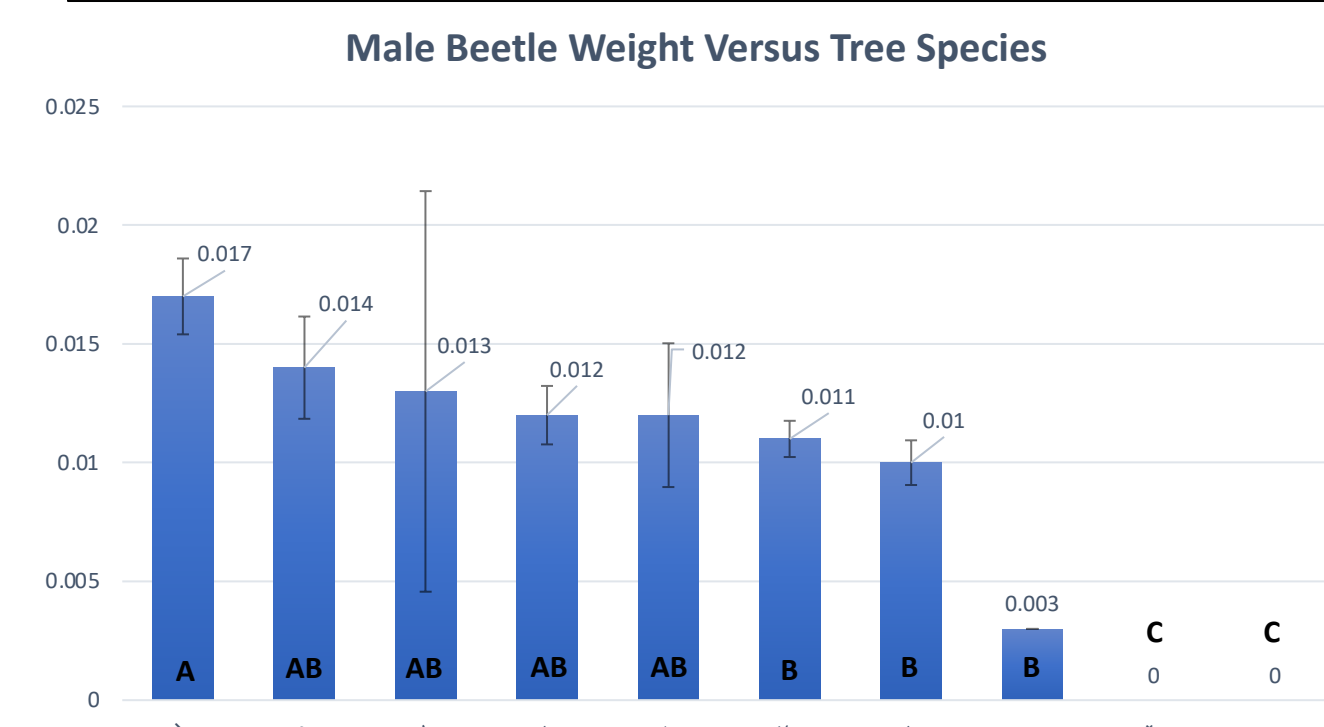


Figure 4

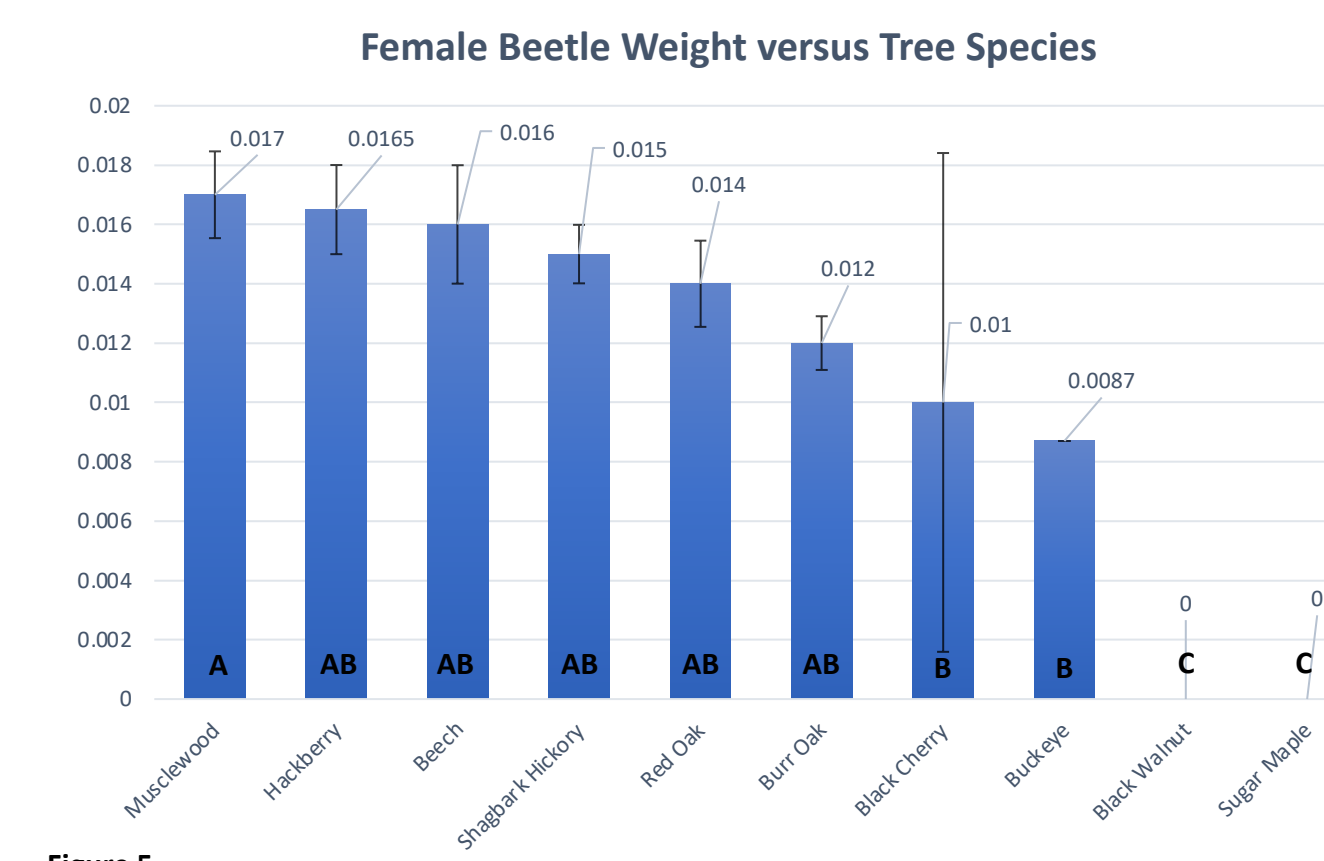


Figure 5

Figure 4 (top left): Bar graph of male beetle weight versus tree species. Each bar represents the 10 tree species and values are displayed above every bar. Groupings based on Tukey HSD test are displayed in or above the bars. $F_{(DF=171)} = 2.72, P = 0.0107$

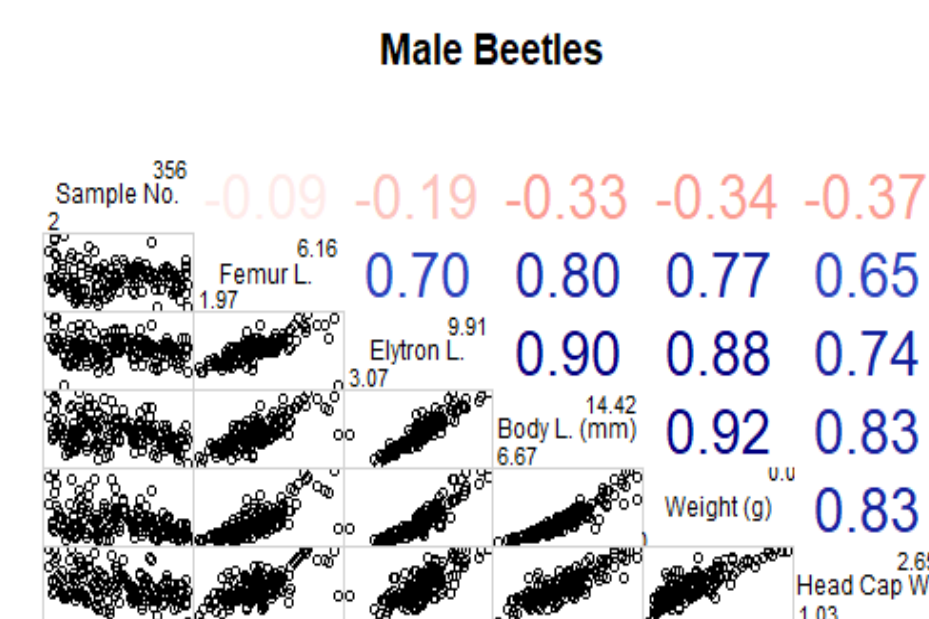


Figure 6



Figure 7

Figure 5 (bottom left): Bar graph of female beetle weight versus tree species. Each bar represents the 10 tree species and values are displayed above every bar. Groupings based on Tukey HSD test are displayed in or above the bars. $F_{(DF=183)} = 3.083, P = 0.00433$

Figure 6+7 (top and bottom right): Correlograms of the 5 measurements separated by sex. All measurements in relation to the others have positive correlation values shown in blue. The largest and smallest values for each measurement are displayed under and above labels.

DISCUSSION

X. colonus exhibits host preference

- Beetles preferred shagbark hickory, musclewood, burr oak, black cherry, beech
- Beetles avoided buckeye, sugar maple, black walnut
- Among most preferred species, large variation occurred

Difference in fitness between host species

- Beetles differed in size by both sex and tree species. Sexes analyzed separately
- The highest preferred species had the largest beetles
- Black cherry greatly preferred host, however beetles were smaller in size
- Larger beetles correlate to greater ecological fitness⁴

A positive correlation exists inside measurements of *Xylotrechus colonus*

- All measurements of beetle size were highly correlated
- Strong positive correlation for all values

Further directions

- Future analyses
 - More cerambycid species/ other families in coleoptera
 - Test potential differences in local environments/communities
 - Explore allometric relationships between beetles and host tree species
 - Investigate the effects of crowding, competition, and parasitism
- Replication of experiment
 - More tree species (conifers)
 - More locations across a larger geographic range
 - Exploring effects of host conditions (longer infestation)

CONCLUSION

- Experiments like this prove useful for conservation efforts
 - Cerambycids play important role in forest ecosystems
- Could provide further direction on costs and benefits of larval development in host

ACKNOWLEDGEMENTS

Thank you to Dr. Ginzel and the entirety of the Ginzel Lab for assisting with the project. Special thanks to Scott Gula, Dr. Matthew Ethington, Kelsey Tobin, Maia Leach, Conner Brescia, and Bryce Chupp. Thank you to NICHES for continued use of their properties for research

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