What you eat matters: Host-derived bottom-up effects on larval development and adult reproductive traits of *Neoclytus acuminatus acuminatus* (Coleoptera:Cerambycidae)

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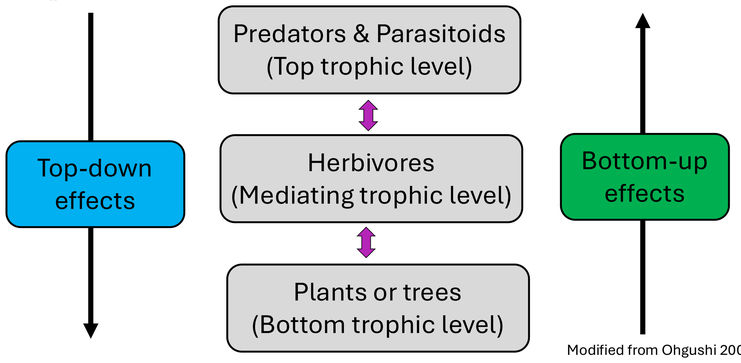
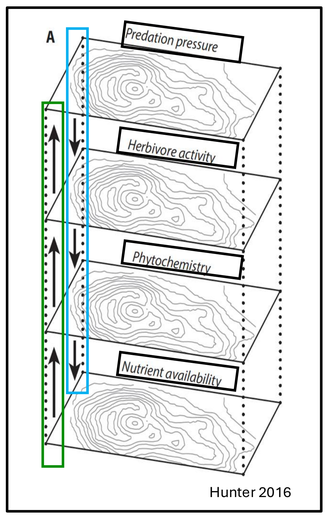
Bottom-up effects shape the life cycle, survival, and reproductive success of herbivorous insects

- Bottom-up effects are the predominant drivers of community structure, functions, and population dynamics in many ecosystems, including managed and unmanaged forests[1].
- The flow of nutrients is altered by the bottom-up effects from plants and can influence larval survival, development, longevity & reproductive success of herbivorous insects[2].



Modified from Ohgushi 2006

Phytochemical landscape hypothesis predicts that chemical variation influences biotic interactions across all trophic levels[3]



Hunter 2016

Differences in herbivore abundance and diversity impacts the abundance and diversity of natural enemies

Difference in plant suitability and attractiveness impacts the abundance and diversity of herbivores

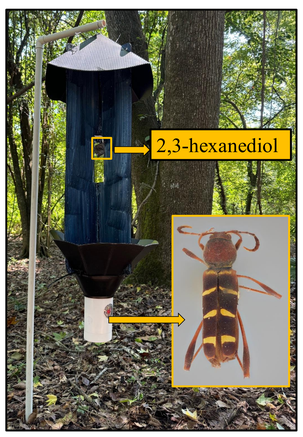
Differences in soil chemistry impacts where plants grow and the availability of nutrients to plants, leading to differences in growth and defense

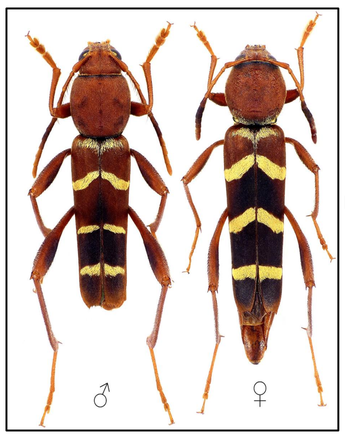
We hypothesized that host plants will impact larval development and adult reproductive traits of beetles

We tested our hypothesis using the red-headed ash borer (*Neoclytus acuminatus acuminatus* Fabricius) among there different hosts: muscle wood, black cherry, and green ash

- Ecologically and economically important group of woodboring insects[4,5]
- Play vital role in hastening the decomposition process and nutrient recycling by feeding on coarse woody debris[6,7]
- Highly diverse and globally distributed[5]
- It is not well-known how feeding in different hosts impacts the population dynamics and success of these beetles in their native or introduced range

Materials and Methods



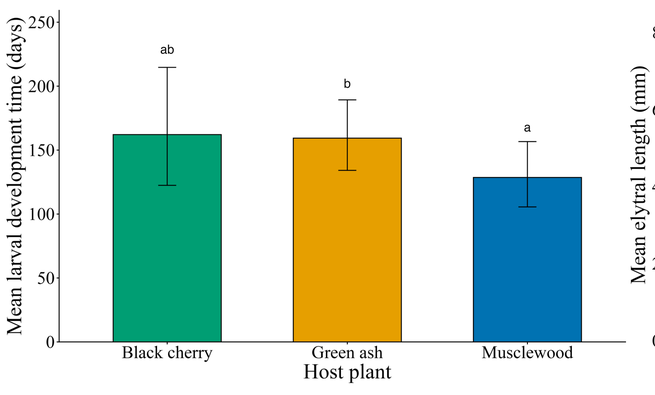


Statistical Analysis

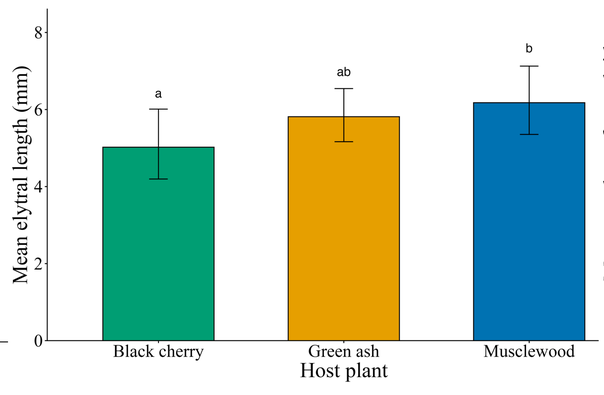
- Functional traits were analyzed using generalized linear mixed models (GLMM) in R
- Host plant was treated as fixed effect while replication/bolts/cage were treated as random effects
- Pheromone quantification was done using external standard calibration curve having regression equation: y = 618950.08x - 350148.17; $R^2 = 0.98$

Results

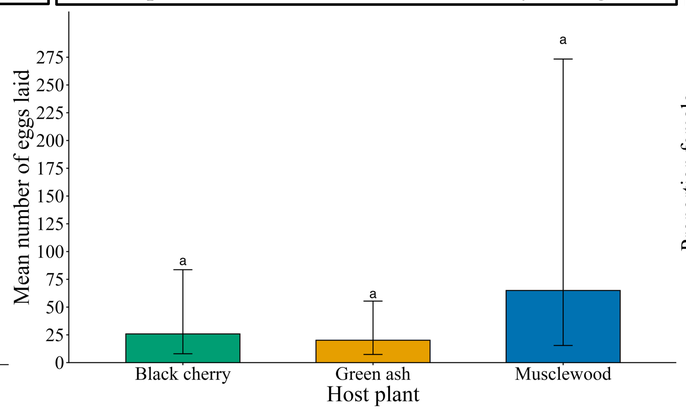
Larval development was significantly faster on musclewood than green ash and black cherry



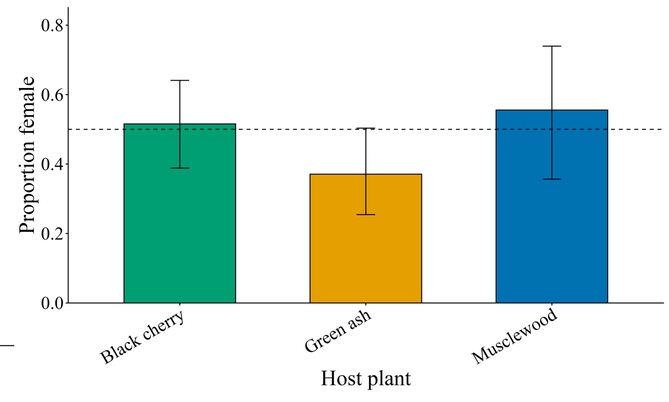
Beetle emerged from muscleweed were significantly larger than those from black cherry & green ash



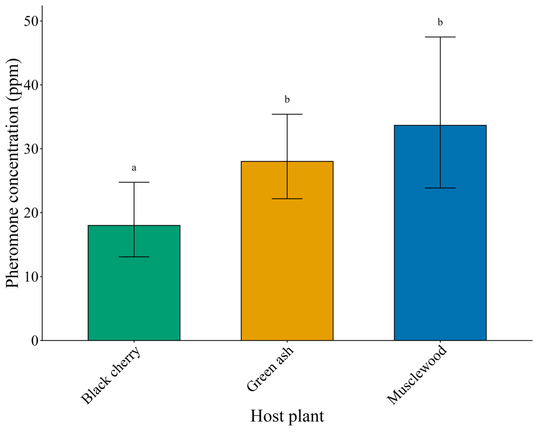
Fecundity of beetles did not differ significantly irrespective of the host from which they emerged



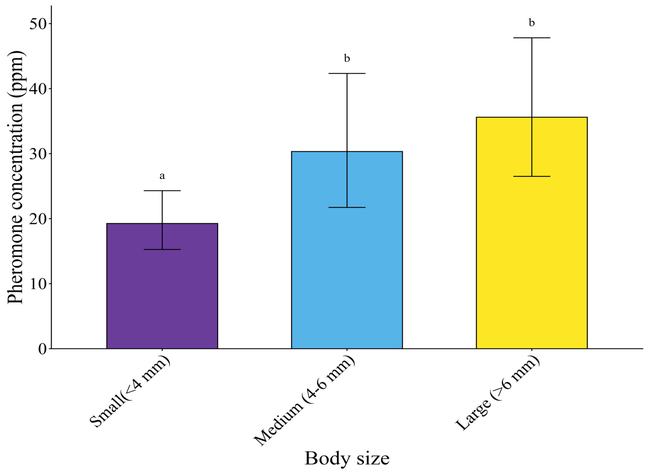
Host plants shaped the sex of emerging beetles, favoring females on musclewood and black cherry



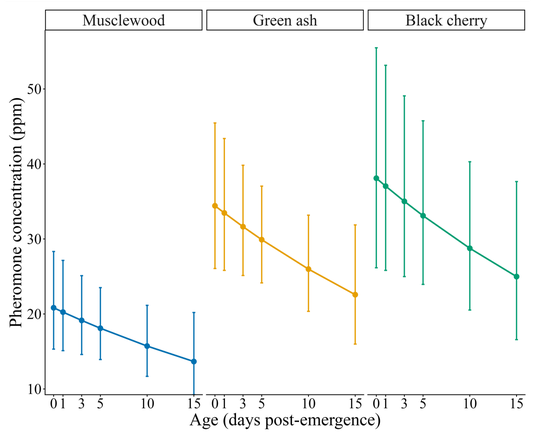
Pheromone production was significantly higher on beetles emerged from green ash and musclewood than black cherry



Pheromone production showed a positive correlation with body size



Pheromone production decreased *with adult age across all host plants*



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Committee members

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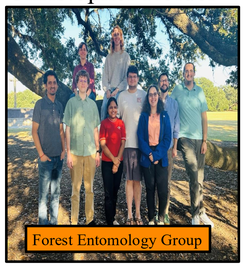

References

1. Mitchell et al. 2010. Plant Soil.
2. Scherber et al. 2014. Oecologia.
3. Hunter 2016. The Phytochemical landscape.
4. Haack 2017. Cerambycidae of the world.
5. Ross and Goczal 2021. Zool J.
6. Buse et al. 2008. Cons Biol.
7. Hogstad & Stenberg 1997. J Ornithol.