Insects & Biochar: What's Making the Impact?

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Background

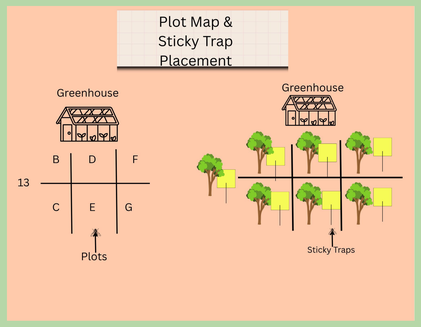
- Biodiversity refers to the variety of life in a given area. This provides essential resources, regulates climate, and supports the livelihood of all living things.[1]
- We Have a Problem: With the rapid rise of atmospheric CO2 and other greenhouse gases, our planet's biodiversity is at risk due to the alteration of habitats and the disruption of ecosystems.[2]
- Soil invertebrates are especially at risk as the use of chemical pesticides, and fertilizers alters the habitats of these organisms. However invertebrates are still poorly acknowledged as mediators of soil function and the delivery of ecosystem services.[3]
- A Possible Solution: Biochar is a soil amendment generated by the pyrolysis of organic matter in high temperature, anoxic environments, proposed as a means to remove atmospheric co2 [4]
- **Our Research: How are insect populations affected by the use of biochar and the planting of an orchard?**

Methods

June-July 2024
Native understories were planted, sticky traps were placed on empty plots to collect initial insect data

May 2025
Apple trees were planted and biochar was added along the topsoil

June-July 2025
Sticky traps were placed 2-3 ft in between trees on each plot biweekly to collect insects for 5 days



Here is a plot map showing how the plots were arranged at the greenhouse orchard. As well as where the trees were planted and where the sticky traps were placed to collect insect data.

Figure 1: Plot map (Hannah Bell)

Results

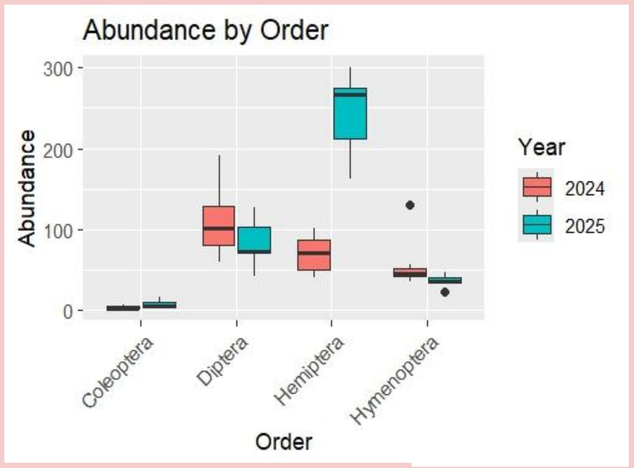


Figure 2: This graph shows the abundance of each major order and the differences betweenthe populations in 2024 and 2025 (Manuela Mejia)

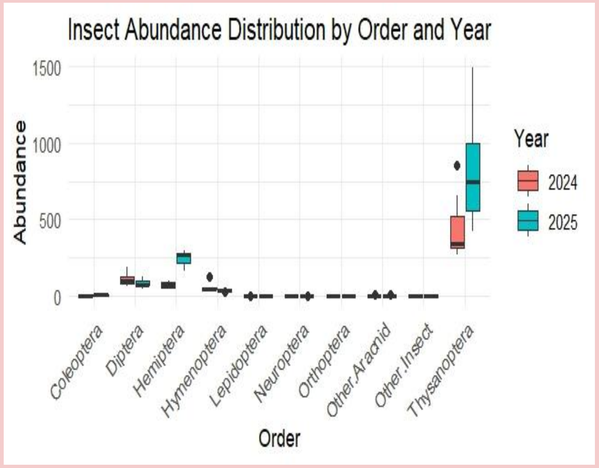


Figure 3: This graph shows the abundance of insect populations in all orders observed between 2024 and 2025 (Manuela Mejia)

- Diptera (Flies): A decrease in population was noted in 2025 compared to that of 2024.
- (p=0.151) **Not statistically significant**
- Hemiptera (Cicadas): **An increase** in the presence of Hemipterans in 2025 compared to 2024
- (p = <2e-16) **Statistically significant**
- Hymenoptera (Bees, Ants, Wasps): **A decrease** in 2025 population compared to 2024
- (p=0.0164) **Statistically significant**
- Coleoptera (Beetles): **An increase** in 2025
- (p=0.0416) **Statistically Significant**
- Thysanoptera (Thrips): **An increase** in 2025 population compared to 2024
- (p=0.00543) **Statistically significant**

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 4) DIptera: (*Diptera – Page 2 – Lyman Entomological Museum*, 2016)

Fig 5.) Hemiptera: (WANG et al., 2024)

Fig. 6) Hymenoptera: (Khanna, 2019)

Fig 7) Coleoptera:(Ll et al., 2022))

Discussion/Conclusion

- The research suggests that **biochar in itself cannot be proven to have positive or negative impacts on insect populations on its own.** Rather that insects are highly sensitive organisms who may be impacted by the changing of many different variables
- Based on previous research and literature it is likely that **multiple variables involved in the planting of the orchard** can be observed as contributors to the changes in insect population as they are known to be **highly sensitive to their environments.**
- The research can assist in efforts to increase the presence of certain insect groups like pollinators, or predatory herbivorous insects that will **ultimately encourage diversity** in plant, animal, and invertebrate communities.
- The analysis highlights **distinct changes in population across the insect orders.**
- Data collection is still ongoing, so **more evidence as to which variable is most impactful may arise**

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