Survey of arthropods associated with *Juglans nigra* (black walnut) in the Chicago Botanic Garden

Kate LaPlante[1] and J.F. Steffen[2]
[1] University of Maine at Machias
kate.laplante@maine.edu
[2] Chicago Botanic Garden

Introduction

In the past, several native tree species have been devastated due to introduced insects and pathogens. The American chestnut and elm are two prime examples of this loss. More recently, the introduced emerald ash borer has caused a rapid loss of millions of ash trees of several species in the Midwest. It is suggested that at least 44 species of invertebrates are threatened by the loss of those ash trees (Gandhi and Herms 2010). At the Chicago Botanic Garden, essentially the entire ash population, well over a thousand trees, died within a three-year period. With these trees being decimated so quickly, there was little time available to examine any arthropod populations associated with those trees.

A new threat, *Geosmithia morbida* (thousand canker disease), is a fungus thought to be native to the Western U.S. that has recently been detected in the east with the closest occurrence to Illinois being in Indiana (IDNR Report). This fungal pathogen is lethal to *Juglans nigra* (black walnut) and is dispersed by *Pityophthorus juglandis*, the walnut twig beetle. The Botanic Garden contains a healthy population of walnut that is likely to experience a decline similar to that of the ash trees.

The goal of this study was to take advantage of the lead-time in the spread of this disease by conducting a comprehensive sampling of arthropods associated with a number of mature walnut trees within the natural areas of the Chicago Botanic Garden. These collections provide further understanding of what arthropod species may be threatened by the loss of the walnut population.

Materials and Methods

- Mature walnut trees were selected for sampling based on location and structural characteristics.
- A total of 5 trapping methods were used over the course of 4 weeks:

  Window traps in canopy (10)
  Bee bowls in canopy (7)
  Funnel traps in canopy and at base (10)
  Bubble wrap at base (7)
  Beating canopy (3)

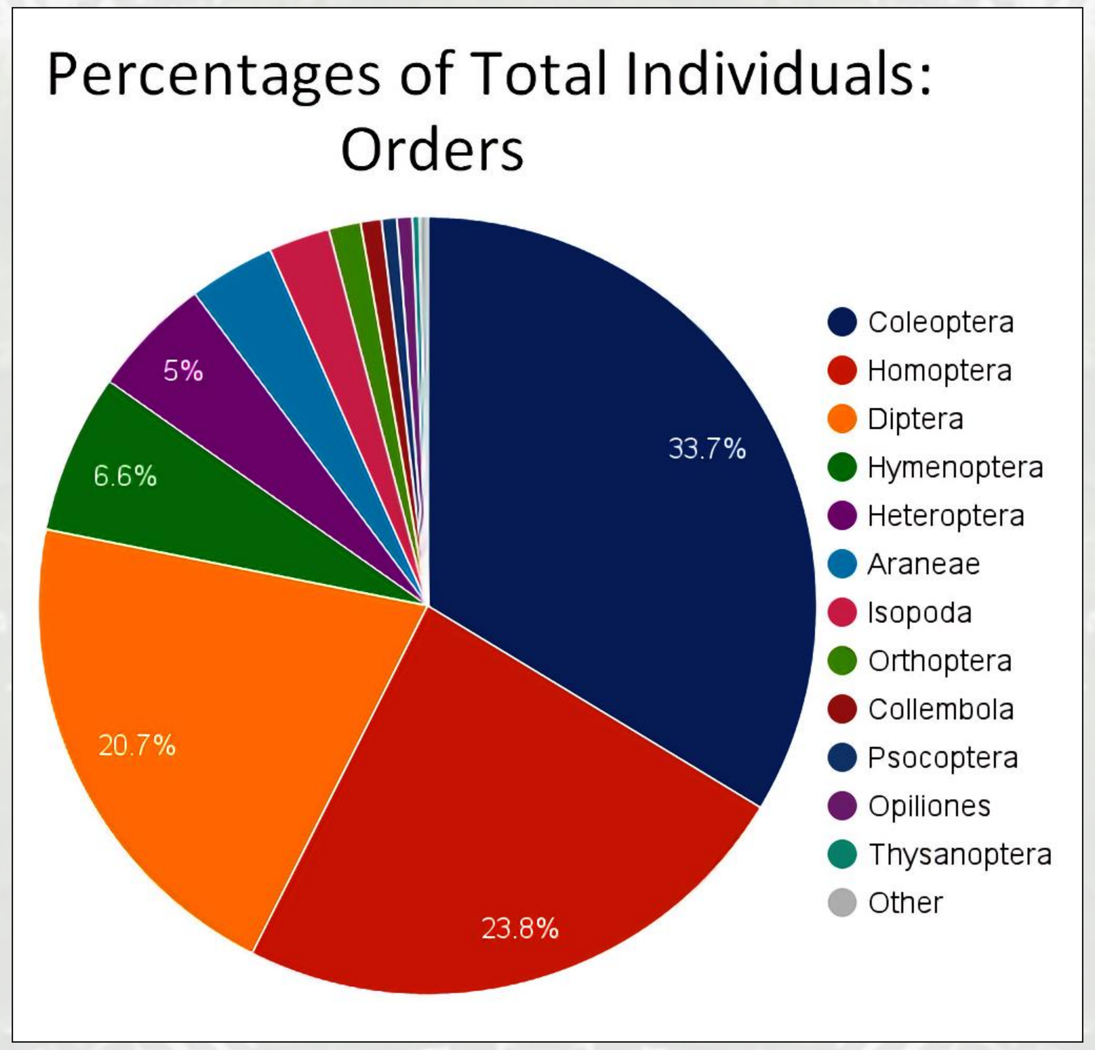
- Samples were taken periodically throughout the 4 week period.
- For each sampling collection, specimens were immediately put into 70% ethanol for preservation.
- Once collected, specimens were identified and pinned in the Abbot Ecology Laboratory.

A. Funnel trap filled with propylene glycol stapled to the trunk of a sample tree.
B. Window trap with 70% ethanol.

Results

- 1734 total individuals were collected and identified to at least to the level of family
- 102 total families from 16 orders
- Over 1/3 of everything caught belonged to Coleoptera (the beetles)
- Number of samples collected from each trap type:

  Window traps: 8
  Bee bowls: 1
  Funnel traps in canopy: 4
  Funnel traps at base: 5
  Bubble wrap: 3
  Beating canopy: 2



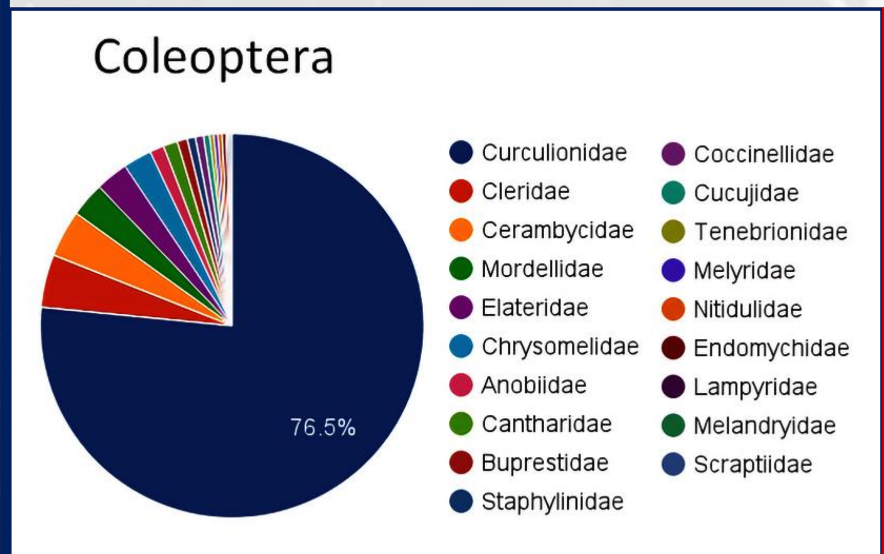
Edge-Effect

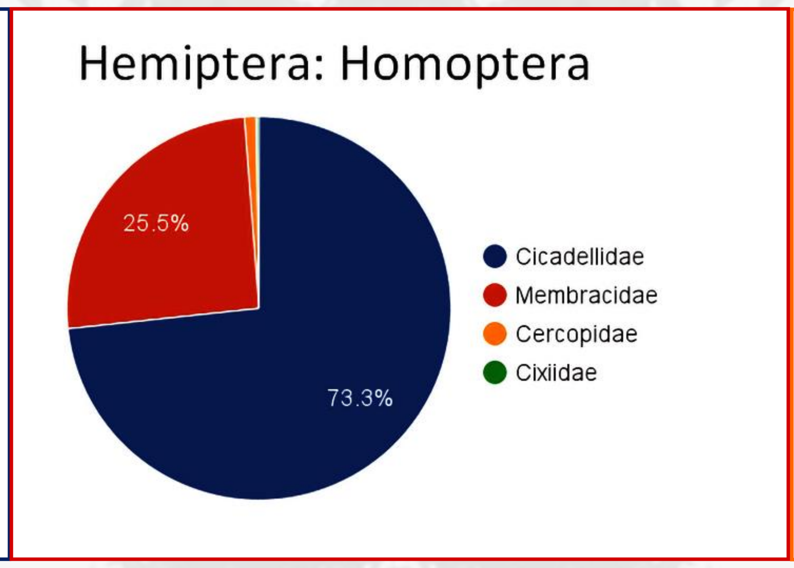
- 215 (53.6%) individuals were collected from interior window traps
- 186 (46.4%) from edge window traps

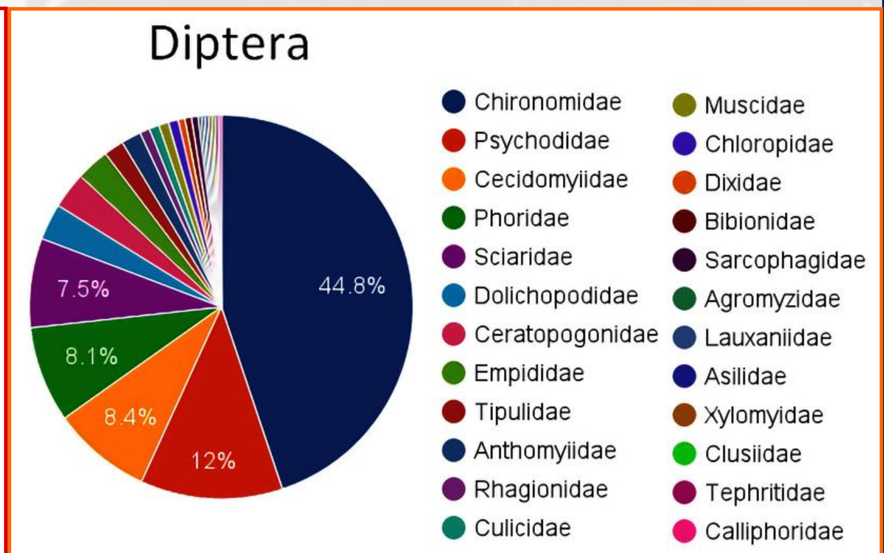
- 42 families were found from interior window traps
- 39 families were found from edge window traps

Base Vs. Canopy

- 475 (39%) individuals were collected from base funnel traps
- 793 (61%) from canopy funnel traps







- The most commonly collected Coleoptera family was Curculionidae (true weevils). Of these, 93% were the species *Polydrusus sericeus*.

Curculionidae: *Polydrusus sericeus*

- The most commonly collected Homoptera family was Cicadellidae (leaf hoppers).

Cicadellidae: *Pediopsoides distinctus*

- The most commonly collected Diptera family was Chironomidae (midges).

Chironomidae

Conclusions

The large range of families found in the sample data would suggest that the methods of collection adequately sampled the arthropod populations. These methods allowed for individuals to be trapped on the trunk both at the base and in the canopy, as well as from the air amid the dense foliage in the canopy. Thus, this collection represents a variety of arboreal niches.

There was both a greater number and greater diversity of individuals collected from window traps placed further into the interior of the woodland areas sampled compared to those placed at the edge of these areas. This result suggests that there are more arthropods and in greater diversity within arboreal ecosystems towards the center of the woodland. This result was unanticipated, as the edge of woodlands represents an ecotone and would be expected to have higher diversity than the interior.

When funnel traps attached to the base of sample trees were compared to those attached to the limbs in the canopy, there was a greater number of individuals caught in canopy traps. This result might suggest that more arthropods access the canopy of walnuts from the air than the base.

Abundant rainfall limited collecting methods available during the trapping period of this study. Bee bowl traps were only used once, and their open structure prohibited use in rainfall. Additionally, funnel traps were intended to be directed both upward and downward. The traps designed to collect arthropods moving down the trunk were not used, as they would collect rainfall.

The brevity of the trapping period limited the individuals available to those present and active between mid June and mid July. Additionally, this shortened time frame limited the extent to which the specimens could be identified, resulting in many only being identified to family. In order to thoroughly survey the arthropod communities dependent on a species of tree, future iterations of this study would need to be extended to a larger time frame as well as more individuals trees from a broader range.

References

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Acknowledgments

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