Native and non-native thistles (*Cirsium* spp.) support many generalists, but fewer specialist bees

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Introduction

- Specialist bees forage on a subset of plant species, usually within a single clade. Their restricted diet increases their vulnerability to anthropogenic disturbances[1]
- Specialist bees may not forage from non-native plants because of innate host preferences
- Two specialist bee species and many generalist species use thistle pollen, *Cirsium* spp., in Ohio
- We investigated the use of native and non-native thistles, genus *Cirsium,* by generalist bees and specialist bees

Questions

1) Does the richness and abundance of bee visitors differ between native and non-native thistles?
2) Do specialist bees visit native thistle species more than non-native species?

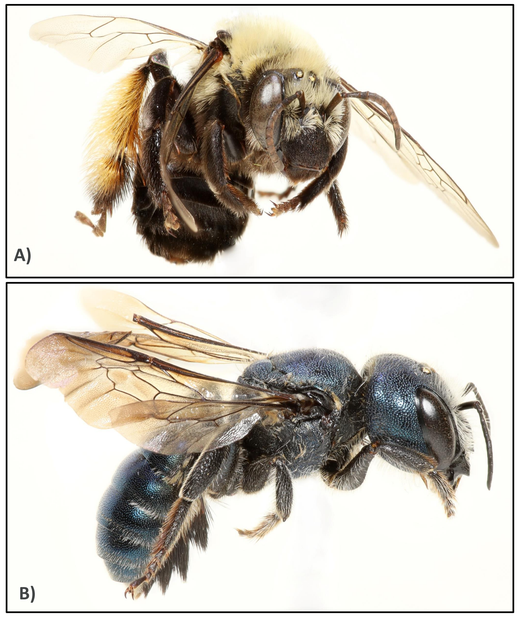

Figure 1: Photos of the specialist bees

Two specialist bees of thistle flowers A) Eastern Thistle Long-horn Bee (*Melissodes desponsus*) and B) Texas Mason Bee (O*smia texana). Images not to scale.*

Photo Credit: MaLisa Spring

Methods

- Sampled one native (*C. discolor*) and two non-native (*C. arvense* and *C. vulgare*) thistles (Fig. 2) June-August 2021-2023 across Ohio
- 15-min netting surveys collecting all bees (counts only of *Bombus* and *Apis*) visiting thistle flowers

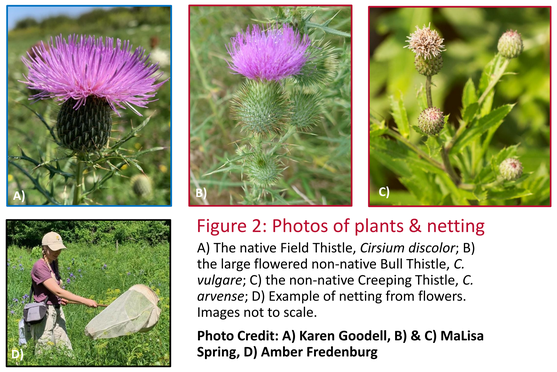

Figure 2: Photos of plants & netting

A) The native Field Thistle, *Cirsium discolor*; B) the large flowered non-native Bull Thistle, *C. vulgare*; C) the non-native Creeping Thistle, *C. arvense*; D) Example of netting from flowers. Images not to scale.

Photo Credit: A) Karen Goodell, B) & C) MaLisa Spring, D) Amber Fredenburg

Results

- We documented 344 bees visiting thistle flowers across 34 timed surveys at 19 sites
- *Cirsium arvense* peak bloom occurred earlier than the native *C. discolor* (Fig. 3)
- Bloom overlapped between non-native *C. vulgare* and the native *C. discolor* (Fig. 3)

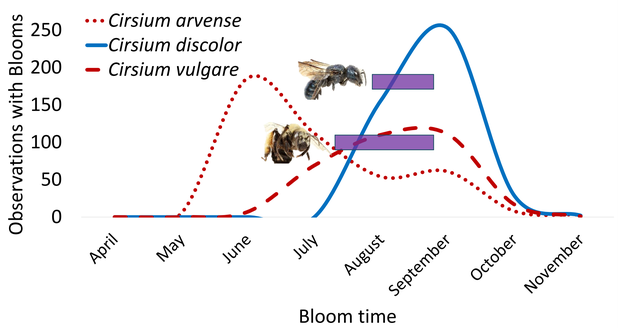

Figure 3: Phenology of *Cirsium* spp. bloom periods

Bloom phenology data from verified records in Ohio on iNaturalist. Red lines are the non-native thistle, the blue line is the native thistle bloom time. Horizontal purple bars represent records of specialist bee observations.

Results (Cont.)

Bee Richness:

- Non-native *Cirsium arvense* had the greatest average bee richness per sampling event (Fig. 4)
- The native *C. discolor* had the second highest richness (Fig. 4)
- Non-native *C. vulgare* had the lowest richness (Fig. 4)

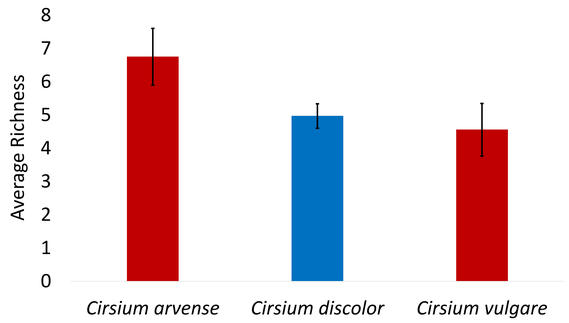

Figure 4: Richness of all bee species on *Cirsium* spp.

Average richness per sampling event of bees observed foraging on the *Cirsium*. Red bars indicate non-native plant species, blue is the native plant species.

Overall Bee Abundance:

- *Cirsium arvense* had the highest abundance of bees per sampling event (Fig. 5), but this was largely from non-native honey bee abundance
- The native field thistle, *C. discolor,* was second highest and the non-native bull thistle, *C. vulgare,* had the lowest abundance of generalists (Fig. 5)

Specialist Bees:

- Most of the specialist bees were *M. desponsus* (141 specimens) with only 2 *O. texana* collected
- Specialist bees disproportionately used the native thistle, with 141 specialist bees collected from *C. discolor,* two from *C. vulgare*, and none from *C. arvense* (Fig. 5)

Results (Cont.)

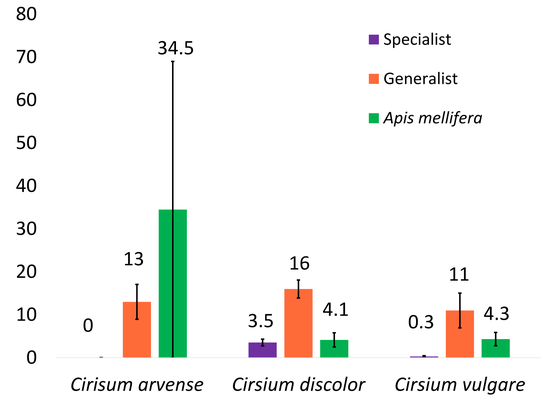

Figure 5: Average Bees on *Cirsium* spp.

The average number of generalist bees, specialist bees and honey bees (*Apis mellifera*) observed per sampling event on each of the three *Cirsium* species during 15-min surveys.

Discussion and Conclusion

- Specialist bee phenology had minimal overlap with *C. arvense* bloom, explaining the lack of specialists visiting this thistle species
- *Melissodes desponsus* was more abundant than *Osmia texana* despite both requiring the same floral resource. Availability of nesting habitat could explain the difference. *Osmia texana* is a cavity nester and *M. desponsus* is a ground nester
- Honey bees (*A. mellifera)* comprise most bee visitors to non-native *C. arvense*, while native generalists comprise the majority of *C. discolor* and *C. vulgare* visitors
- *Cirsium discolor* appears to better support specialist bees. Eradication of *C. arvense* and *C. vulgare* will have a negligible impact on specialist bees and generalist native bees

Acknowledgements

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References

1. Fowler, J. Specialist Bees of the Northeast: Host Plants and Habitat Conservation. Northeastern Naturalist, 23(2):305-320 (2016).
2. Cane, J., & Sipes, S. (2007). Characterizing floral specialization by bees: Analytical methods and a revised lexicon for oligolecty. In *Plant-Pollinator Interactions: From Specialization to Generalization* (pp. 99–122).

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