Can You Bee-lieve it? The Intertegular Span of Bees

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Abstract: Bees are an important part of our ecosystem. They pollinate 4 out of 10 bites of food that we consume. While we use honeybees to pollinate some crops, native bees provide adequate pollination for many crops and native plant species. Native bees include ground dwelling bees as well as twig nesting and cavity nesting bees. Rising concerns over the declining bee populations have scientists looking for the reasons behind the decline. While solid answers have not yet been found, several possible explanations are being researched. Habitat loss along with the increase in pesticide usage and the increasing number of parasites and harmful pathogens are three of many factors related to bee declines that scientists are looking into. This study focuses on the effects of invasive plant cover on native bees. We evaluated if the intertegular spans of 1) the overall bee communities and 2) the individual bee species varied with invasive plant cover. By studying the affect invasive plant species, specifically Kochia scoparia and Salsola tragus, have on native bees, we will add to the current research behind why the bees are disappearing. While the data collection is still in progress, differences between large-bodied bee species and small-bodied bee species have been observed. This data suggests that the level of invasive plant cover affects larger-bodied bee species less than smaller-bodied bee species.

Keywords: Intertegular Span, Invasive Plant Cover, Native Bees, Pan Traps

Introduction

High rates of honeybee colony loss, sometimes called colony collapse disorder, have been reported worldwide. While exact data is difficult to gather for non-managed colonies, the estimates for decreases in domesticated bee colonies in central Europe between 1985 and 2005 were 25% and even greater losses of 59% between 1947 and 2005 in North America (Goulson 2015). Where wild bees are concerned, the available data are limited. Most of what is available is on bumblebees. In both Europe and North America, there have been several bumblebee species that have gone extinct and several other species that now occupy small areas of their large former ranges (Goulson 2015). There are many factors that could cause colony loss, and while one factor by itself may not be lethal, the combination of multiple factors is. Wild and captive bees are being chronically exposed to a wide range of agrochemicals. While these agrochemicals are being tested for the potential of harming bees, the long-term effects the chemicals have on the bees are difficult to monitor. Habitat loss and the limitation of food sources are also factors leading to declines in populations. The decline of flower varieties and abundance as well as the over exposure to a single crop at a time that captive bee colonies are subject to are factors that are being looked into. However, it is currently unclear as to how the lack of nutrition diversity is affecting fitness (Goulson 2015).

Intertegular span, the distance between where the wings attach on the body, has been used as an estimate of bee body size and expected flight abilities (Cane 1987). Intertegular span has typically been used to compare across bee species. However, intertegular span may vary within species, and may vary with environmental

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conditions. For example, the structure of the bee community may differ among sites with different levels of invasive plant cover that modify flight distances between available nest sites and floral resources. The goal of our study was to evaluate if invasive plant cover influences the intertegular span of the overall bee community or individual bee species.

Methods

Intertegular span data were collected from bees gathered by Kaitlin O'Brien for her master's thesis research focusing on the effects of invasive plants on native bee communities in the Southern Plains Network of the National Park Service. She collected the bees from the Sand Creek Massacre National Historic Site near Eads, Colorado. Within the site, several plots of 0.3 hectares were chosen with different levels of invasive species plant cover. Each plot had three groups of three pan traps within it. The pan traps, 12-oz disposable bowls filled with soapy water, were used to collect the bees. The pans were set up five meters apart in a triangle. Fluorescent yellow, fluorescent blue, and white pan traps were used to represent different flower colors because those colors have been identified for collecting a diverse bee community (Vrdoljak and Samways 2011). Kaitlin collected and placed the specimens in individual vials (one pan trap per vial) with 70% ethanol. She then transported the specimens to Oklahoma State University for processing.

Once the processing was complete and the bees were made available for use in this study, two hundred and four bees were observed under a microscope and the intertegular span was measured using an ocular micrometer (Figure 1). The

Figure 1 - Intertegular span was measured under the microscope as the distance between the tegula as shown by the orange arrow.

intertegular span (averaged for each species) of the bee communities collected in each treatment (low 0-3%, medium 8-15%, or high >30% levels of invasive plant cover) were then compared using an Analysis of Variance. When sample sizes were adequate, we used a t-test to compare intertegular distances between individual species collected from plots with varying levels of invasive plant cover.

Progress to Date

We found no difference in the intertegular span of bee communities collected in areas with different levels of invasive plant cover ($F=0.99$, $df=2$, $P=0.398$; Figures 2, 4). Although this suggests bee body size and flight distances did not differ with invasive plant cover, the composition of the bee community did differ

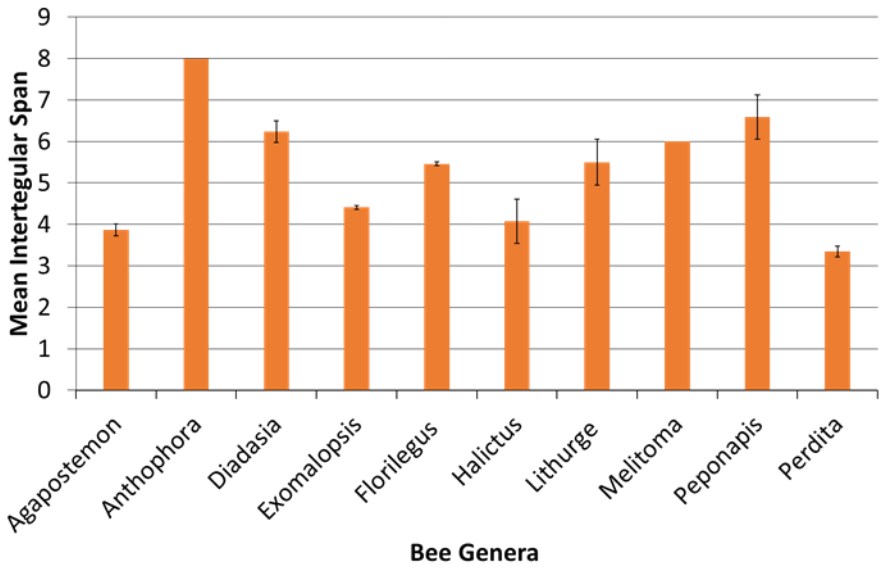

Figure 2 - Mean (±SE) intertegular span of the 10 bee genera measured.

among sites. No individuals were collected from plots with high invasive plant cover.

The intertegular distances are larger for Exomalopsis collected from plots with medium invasive plant cover levels compared to plots with low invasive plant cover (t=-1.95, df=27, P=0.062; Figures 2, 3). This suggests that larger individuals with greater flight abilities may be able to use areas with more invasive cover, at least up to a certain point, compared to smaller individuals.

We found no difference in intertegular span for Florilegus in plots with medium invasive plant cover levels compared to plots with low invasive plant cover (t=-0.6, df=26, P=0.554; Figures 2, 3). This species is larger than Exomalopsis, and suggests that invasive plant cover has less of an effect on larger-bodied bee species.

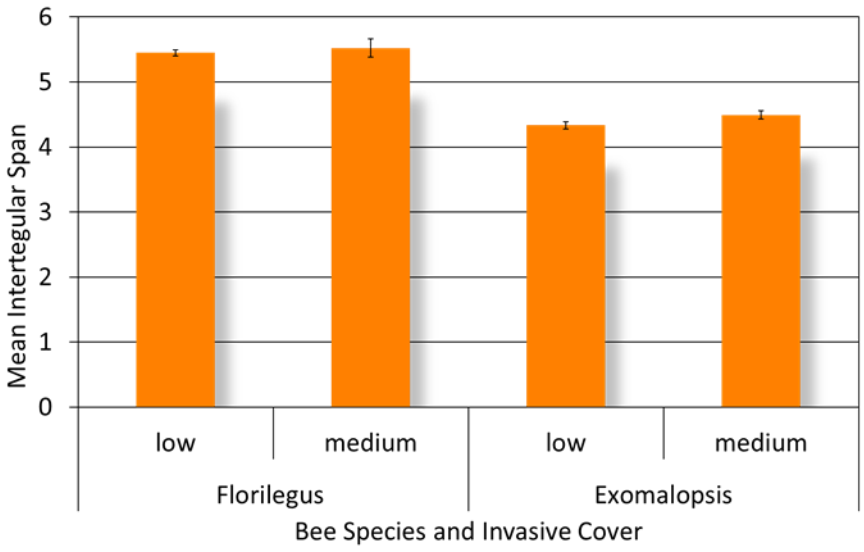

Figure 3 - Mean (±SE) intertegular span for selected bee species based on invasive plant cover levels.

Conclusion

Currently, all the data has not been collected. We plan to increase our sample sizes for individual species and include specimens from more sites and more sampling periods (i.e., bees collected at different times throughout the growing season) to gain a better understanding of how invasive plant cover influences bee populations and communities.

The data gathered to date suggests that the level of invasive plant cover has less of an effect on larger-bodied bee species than it does on

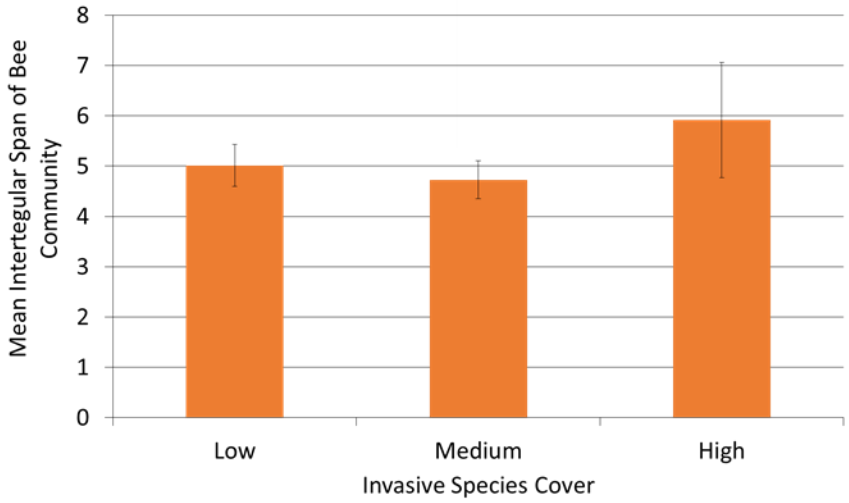

Figure 4 - Mean (±SE) intertegular span of the overall bee community based on invasive plant cover levels

smaller-bodied bee species. The lack of bees collected from plots with high levels of invasive plant cover suggests that bees may be unable to use those areas.

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