Pollinator Communities in Annual Pollinator Plantings and Adjacent Dry Bean Crops

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Introduction

Supplemental pollinator plantings are a common practice used to support pollinators by increasing floral resources in agroecosystems (Wratten et al., 2012). These pollinator plantings are often composed of perennial plants. However, since most crops grown globally are annuals, annual pollinator plantings could be more effective in agroecosystems for both the pollinators and producers. One main benefit is the ability to be moved yearly depending on the land allocation or crop rotation (Mallinger et al., 2019). Another advantage of an annual planting is the quick floral expression and, therefore, quick pollinator response (Carreck and Williams, 2002). Additionally, annual plantings can include prevalent annual cover crop species, which can benefit the soil and land productivity while also serving as an extra floral resource for pollinators (Mallinger et al., 2019).

Many crops planted across the United States today directly and indirectly rely on insect pollinators (Klein et al., 2007). However, the leading food crops do not rely on insect pollinators. These include predominant crops such as corn, soybeans, and dry beans. Dry beans, which are self-pollinated, are planted on 1.5 to 2 million acres annually within the United States (UDSA-NASS, 2019), and in 2017 about 705,000 acres were planted in North Dakota alone (USDA-NASS, 2019). Pinto beans are the most abundant dry bean produced in North Dakota, making up about 66% of the total state dry bean production in 2017, accounting for around 468,000 acres (USDA-NASS, 2019). However, there have been little to no studies conducted on the pollinator community within these dry beans, or whether visiting pollinators may have an effect on bean yield.

Figure 1. Pollinator planting at the CREC showing plains coreopsis, buckwheat, and flax.

Objectives:

1. Identify plant-pollinator interactions within annual pollinator plantings.
2. Assess the potential pollinator community and visitation in dry bean crops.

Materials and Methods

An annual seed mix was planted directly adjacent to plots of Palomino pinto beans. Four research plots in each of the last two years were established at the Carrington Research Extension Center (CREC). Similar research was conducted at the Hettinger Research Extension Center (HREC), but this report focuses on CREC results. The seed mix included 17 different annual forbs including cover crops like buckwheat and flax and wildflowers such as phacelia and plains coreopsis. Timed, 15-minute bee surveys in both beans and annual plantings were conducted throughout the growing season to sample the pollinator community. For the 15-minute bee survey, a 20-meter x 2-meter transect collected any

bee visiting a flower. All collected specimens were identified in the lab. These specimens helped determine the network of plant-pollinator interactions within the pollinator planting and determined the insect community that visited the adjacent pinto beans.

Results and Discussion

Pollinator Plantings

A plant-pollinator interaction network (Figure 2) shows the collected species of bees and which plants they were visiting within the pollinator planting. The bars on the left side of the network represent the different plant species the bees visited. The bars on the right side of the network show the different groups of bees (down to the lowest taxonomic level possible). The thicker the bars are, the more observations of that specific group and thicker connecting lines indicate more common interactions.

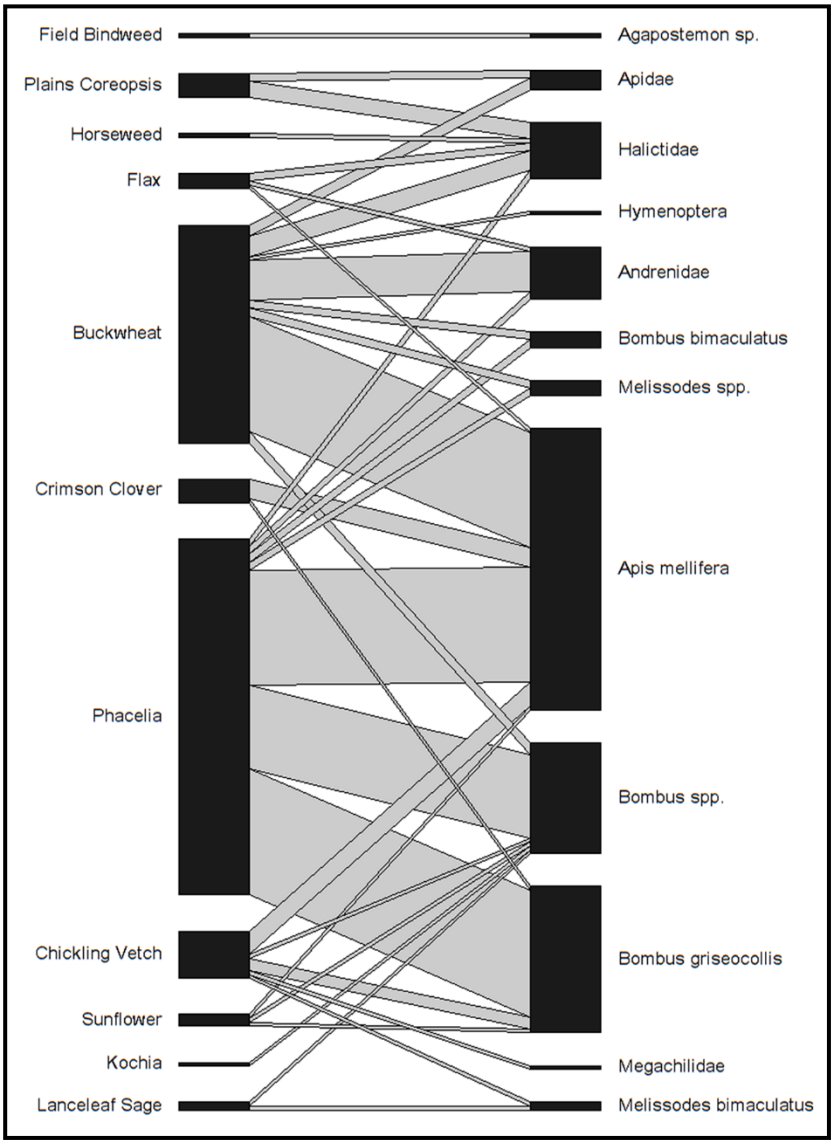

Figure 2. Plant pollinator network from CREC pollinator plantings in 2019 and 2020.

The network shows all observed interactions from 2019 and 2020 in the CREC pollinator plantings. One hundred eighty-one bees were collected on 11 different plants. Phacelia, which is an attractive purple forb, was the most visited flower with 90 out of the 181 interactions. Buckwheat was the next most visited planted forb with 55 out of the 181 interactions. Following these forbs, the most visited planted forbs were chickling vetch, crimson clover, and plains coreopsis. However, breaking down the interactions by year, the buckwheat had more interactions (39 out of 91) in 2020 despite phacelia having higher observed interactions overall. The most frequently observed bee family within the pollinator plantings at CREC was Apidae. The family Apidae is composed of genera such as Apis (honey bees) and Bombus (bumblebees). The most commonly observed bees were honey bees (*Apis mellifera*), brown-belted bumblebees (*Bombus griseocollis*), and other bumblebee species (*Bombus spp.*). Both these genera made up a large proportion of the phacelia interactions and were the only species collected on crimson clover.

Dry Bean Pollinators

For both 2019 and 2020, 49 insect visitors were observed on pinto bean flowers (Figure 3). The most common insect visitor belonged to the order Diptera, which is the order of flies. These flies were 38 out of the 49 total visitations. Following flies, four bees visited bean flowers in 2020. A few other insects such as butterflies, true bugs, and a wasp also visited the pinto bean flowers.

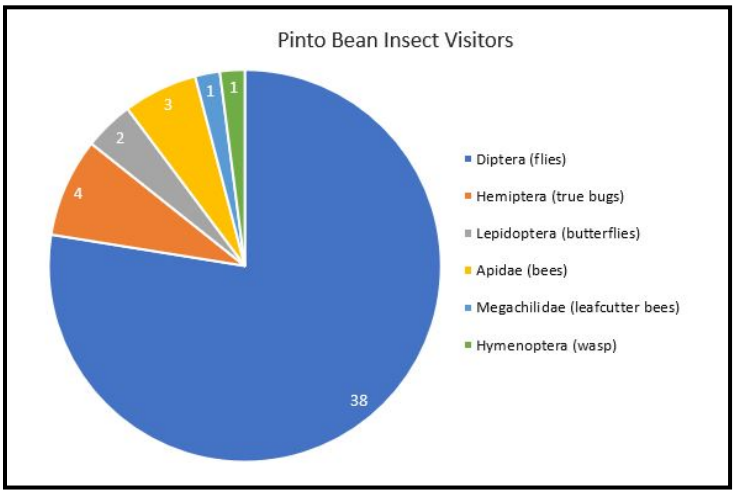

Figure 3. Pie chart of all pinto bean visitors from 2019 and 2020.

Conclusions

Annual pollinator plantings provided extra non-crop floral resources and many insect pollinators utilized and visited the planted forbs. Despite their classification of being self-pollinating, pinto bean flowers do have insect visitors (Figure 3 and Figure 4). Additionally, pinto bean data is being analyzed to see if cross-pollination or insect visitation influence bean yield.

Figure 4. Bumblebee visiting a pinto bean flower.

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