Cannabis was one of the first domesticated plants and is the only genus to produce cannabinoids.1,2 Cultivation of hemp historically involved artificial selection for fiber quality. However, contemporary selection is primarily for two cannabinoids: THC and CBD. While ecological roles of cannabinoids are still largely unresolved, it is hypothesized they function as defense compounds. Artificial selection for particular phytochemicals of human interest may differ greatly from the selection pressures of insect herbivores in natural systems. Additionally, phytochemicals are produced from reticulate biosynthetic pathways. Thus, selection for a couple of compounds could have cascading effects on the whole chemical profile significantly altering plant-insect interactions. Feral populations of hemp under natural selection are exposed to abiotic and biotic factors unique to uncultivated sites, and provide an opportunity to compare phytochemical profiles among cultivated and feral varieties and their effects on arthropod communities therefore investigating phytochemically mediated ecological processes by asking: How is phytochemical diversity affected by natural and artificial selection? Does the variation in phytochemical diversity of cannabinoids explain variation in the diversity of associated arthropods?

Agricultural domestication has been one of humanity’s most consequential activities resulting in significant ecological and evolutionary impacts on ecosystem processes and ongoing loss of biodiversity. Artificial selection among plant crops has led to the reduction of genetic diversity by selecting for specific phenotypes. Such genetic erosion has implications for human and natural systems, including threats to food security and ecosystem functioning.1 Phytochemical diversity is a particularly important axis of diversity as it contributes to functional diversity through defenses against herbivores. Functional diversity is an ecologically relevant measure of biodiversity and can provide a mechanistic link between the role of an organism and its impact on its ecosystem,2 and inform management and conservation decisions. While medicinal applications have led to characterizing phytochemical compounds, the field of chemical ecology seeks to understand how diverse mixtures of phytochemicals influence associated herbivores assemblages linking evolution and ecology of plant-insect interactions. This work will contribute to uncovering the role phytochemistry plays in evolutionary and ecological processes, and the maintenance of diversity.

This study was performed in Central Nebraska in September of 2020. Sampling sites included 6 cultivated paired with 6 feral sites. Cultivated sites consisted of hemp fields and feral sites were any patch within one mile of cultivated fields. For each site I sampled three plants. For each plant I estimated plant biomass, surveyed associated arthropods and collected hemp flower. Biomass was estimated using plant size and available leaf area. Arthropod surveys included visual searches followed by sampling by beat sheet. Insects were collected with an aspirator and frozen for later identification. Plant samples used for chemical analyses were taken from a terminal flower in the upper canopy of a plant. Approximately three grams of flower was collected and dried in granular silica in paper bags. Cannabinoids were extracted from biomass by placing the weighed plant material (0.5- 1 gm) into an extraction vial followed by macerating the leaves in 9 mL of methanol followed by hexane. The extract was injected directly onto a gas chromatographic column containing a flame ionization detector. The same filtrate will also be injected onto a reverse phase liquid chromatographic column and the appropriate cannabinoids quantitated using external standards. Phytochemical diversity is defined as the richness, relative abundance and molecular complexity of phytochemicals. It is estimated using NMR spectral data processed using MestReNova software.

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