**Understanding complex arthropod food webs in changing agroecosystems**

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With a growing global demand for food and fuel, we have seen increases in agricultural acreage and intensification of farming practices. Yet, there is a need for enhanced sustainability in addition to higher yields. In the drive to achieve these goals, agroecosystems are undergoing rapid changes, including increased acreage of bioenergy crops, the adoption of genetically modified crops, and the presence of evolving and emerging pests. Arthropods are a highly diverse and abundant group that play numerous roles in agroecosystems; natural enemies that can help control pest populations are of particular importance and are key in biological control. I will present two research narratives that explore how changes in agricultural systems can affect complex arthropod food webs, and subsequently, biological control of plant pests:

1. Disentangling the spider’s web: seasonal patterns in a generalist predator’s diet and the effect of crop pollen consumption on development and fecundity

Many generalist predators supplement their diets by consuming non-prey resources. Sheet-web spiders (Araneae: Linyphiidae) intercept high amounts of corn pollen during anthesis and readily consume this high-protein food resource. Consumption of corn pollen enhances growth and survival of linyphiid spiders. To delineate trophic interactions, six PCR primer pairs were designed to amplify target DNA from a primary pest (Western corn rootworm), two secondary pests (corn flea beetle and aphids), a detritivore (springtails), a predator (long-legged flies) and a non-prey food (corn). Results indicated four distinct patterns of resource utilization: 1) spiders consumed springtails throughout the season; 2) corn consumption spiked during anthesis; 3) aphid predation peaked early in the season; and 4) predation was very low on the remaining prey. This research has revealed the strength of trophic connections between web-based spiders and their prey in an agroecosystem across the growing season. The early-season predation observed on aphids, particularly colonizing alates, has significance for biological control.

1. A perennial solution to an invasive problem: integrating bioenergy crops to enhance biocontrol

The soybean aphid, *Aphis glycines*, is a serious invasive pest that has caused a 130-fold increase in insecticide use on US soybean acreage. The efficiency of integrated cropping systems (soybean with short-rotation willow and prairie polyculture) to produce bioenergy and support natural enemies and biological control of the soybean aphid is examined. Soybean fields immediately adjacent to perennial biofuel plots showed an increased abundance of several natural enemy groups, including lady beetles, minute pirate bugs, lacewings and their eggs, damsel bugs, and parasitoid wasps. Flared aphid populations were significantly reduced on soybean plants adjacent to perennial crops after being exposed to natural enemies in the field for two weeks compared to plants adjacent to all-soybean control plots. Additionally, PCR, anthrone and acetolysis bioassays revealed levels of trophic connectivity between natural enemies and alternative prey, nectar, and pollen resources provided by bioenergy crops, potentially providing mechanisms for the observed increases in abundance and biological control. These data support the proposal that diversified, perennial bioenergy crops can promote populations of beneficial arthropods and enhance ecosystem services when integrated within monoculture crops. This system has the added potential to decrease insecticide usage by providing biological control of an invasive agricultural pest.