

## NCERA 220 Meeting Minutes

6/7/2013 3:30-6PM

Grand Rapids SD

Author: Matthew Grieshop (NCERA-220 Secretary)

1. Attendance
  1. Steve Yaninek Purdue
  2. Deidre Prischmann-Voldseth North Dakota State
  3. Debbie Finke University of Missouri
  4. Ben Puttler University of Missouri
  5. John Ruberson Kansas State University
  6. Brian McCornack Kansas State University
  7. Julie Peterson University of Minnesota
  8. James Harwood University of Kentucky
  9. Jen White University of Kentucky
  10. George Heimpel University of Minnesota
  11. Matt Grieshop Michigan State University
2. Old Business
  1. Need for survey
    1. One was conceptualized but not carried out?
      1. If we do a survey what should it focus on?
      2. Heimpel: On the ground adoption would be good?
      3. Yanniek: We need to provide a vision for the chairs and federal administrators so they can make strategic plans for hires and programs
        1. How do we get involved in more basic and novel science as biological control continues to transform from a classical focus to new focuses.
        2. White paper on biological control priorities and how they meet new areas of research and grand challenge areas.
      4. Gardiner: A symposium at 2014 ESA might address how biological control fits into grand challenges developed by ESA.
    2. White paper
      1. Heimpel: it would be nice to have biological control represented as a separate white paper.
  2. Online biological control course.
    1. Heimpel: A symposium will be held at the 2014 ESA meeting
      1. Jim Nechols and Parwinder Grewal are leading it
      2. There will be a meeting after the course to discuss the possibility of a biological control course
      3. Ruberson: There has been talk of developing a MOOC (Massive Open Online Course).
  3. Short Course Topics
    1. Jen: Symbionts and basic molecular techniques for identifying them. Had a CAREER grant in review but it was not funded.
      1. Support letters would help for a resubmission
        1. NCERA
        2. Student/young professional committees from ESA
        3. Individual departments
      2. Heimpel: a molecular tools course that encompasses symbionts might be more widely appropriate

1. Or a course on symbionts and their role in biological control
  3. Yanniek: Do the sections in ESA support these training courses? They may have resources to share.
  2. Gardiner: there are short courses offered by other groups that can be used for leverage
    1. Matt O'Neal did this with a the Leopold Institute on a conservation BC topic
  3. Gardiner and Yanniek: Entomopathogen short course —a regular topic that is useful to the group.
  4. Heimpel: There have also been courses on foreign exploration
  5. Gardiner: We could also use the website to post information on other short courses that relate to biological control
    1. Send them to Gardener or McCornack
    2. Peterson: Could we pursue IOBC for funding for some of these ideas?
    3. Heimpel: If money is the big issue we should consider what we need to charge.
      1. Gardener: What are people willing to pay?
      2. Yanniek: Ask your chairs!
      3. Peterson: ESA student and young professional committee may also provide funding for this
3. State Reports
1. Mary Gardiner Ohio State
  2. Deborah Finke: Missouri State
    1. Ben Putler: Soybean Aphids
      1. No soybean aphids detected in MO last year
      2. We did have cotton mellon aphids
        1. Had high populations
        2. Harmonia and syrphid flies responded
        3. Populatiions collapsed after a thunderstorm
      3. New population temporal patterns?
    2. Ben ## Spotted Knapweed
      1. We've been releasing and tracking the flower and seed weevil since 2009
      2. We've recovered it in sufficient numbers to consider it established
  3. Matt Grieshop: Michigan State
  4. Jen White: University of Kentucky
    1. James Harwood: Spider dietary range and selection
  5. George Heimpel: University of Minnesota
    1. Julie Peterson: Biofuels crops and biological control
  6. Deirdre Prischmann-Voldseth: North Dakota State
  7. Brian McCornack: Kansas State University
    1. Sink source dynamics of canola
    2. Fate of aphids depending on plant architecture and species.
4. Website Update
1. New website provides a simpler means for collecting reporting information
  2. Users limited to state representatives (for now)
  3. Reports will now be entered through the site
5. Steve Yanniek: Organizational Report
1. We are up for a mid term review
    1. Run by experiment station director
    2. Minutes need to be submitted August 2013

3. Impact statement made by December 2013
2. FY 2014 budget should be stable
  1. Pest management programs are being integrated into a new category:  
Integrated Crop Protection
    1. Cut about 4% beyond pre-existing cuts (ca. \$34 Million reductions)
    3. Refer to Steve's notes for additional information
    4. Funding: SCRI and OREI are on track for 2014 but at a substantial reduction.
6. President and Secretary elections:
  1. President: Matt Grieshop
  2. Secretary: Deborah Finke
7. Announcements
  1. Biological control position announced at UGA Tifton!
  2. Mary Gardiner is seeking a technician (M.S. Level)
  3. Matt Grieshop is seeking a post doc
8. To do's
  1. Check in with IOBC on course funding opportunities

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## State Report List

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- #: 57

State: [Indiana](#)

Project title: Classical biological control of emerald ash borer

[view report](#)

Keywords: [ash trees; emerald ash borer](#)

Key personnel: [Sadof, Cliff; Yaninek, Steve; Peterson, Donnie](#)

Objective(s) addressed: Objective 4

Abstract: We (Sadof Lab) have continued to work with Jon Lelito in the Brighton, MI, USDA APHIS lab to release 3 parasitoids at selected sites infested with EAB. To date we have released over 20,000 parasitoids. Details of ongoing releases have been posted on <http://www.mapbiocontrol.org/> database. In the past year, we (Sadof, Yaninek and Peterson) initiated a project to test the capacity of blue ash (*Fraxinus quadrangulata*) to serve as a host of the larval EAB parasitoids. We have been working with Jian Duan (USDA ARS Delaware, Leah Bauer (USDA USFS, MI), and David Jennings (University of Maryland) to design and deploy relevant experiments. Initial EAB infestations were made on green and blue ash trees in the summer of 2013. Parasitoid releases are planned for the fall of 2013 and spring of 2014.
- #: 56

State: [Indiana](#)

Project title: Managing spider mite outbreaks in Nursery and landscape tree plantings

[view report](#)

Keywords: [mites, ornamental plants](#)

Key personnel: [Sadof, Cliff; Prado, Julia; Quesada, Carlos; Witte, Adam](#)

Objective(s) addressed: Objective 2

Abstract: In 2007 we (Prado and Sadof) initiated a project in Indiana nurseries to determine causes of spider mite outbreaks on nursery grown maple trees. Prado will be completing her Dissertation in the fall of 2013 that describes how insecticide use, intraguild predation and leaf domatia work to promote outbreaks in nursery conditions. A second project (Sadof, Witte, Quesada), initiated in 2011 on honeylocust (*Gleditzia triacanthos*), investigated the how early season applications of systemic and foliar insecticides against calico scale contribute to spider mite outbreaks later in the season. The role of domatia and intraguild predation are being explored as explanatory variables. Both students working on this project are expected to complete the MS degrees in December 2013.
- #: 55

State:

[Indiana](#)

Project title:

Beetle predators of hardwood borers

[view report](#)

Keywords:

[biocontrol](#), [hardwood forest](#), [predators](#), [Cerambycidae](#), [Buprestidae](#)

Key personnel:

[Holland, Jeffrey D.](#); [Kissick, Ashley](#)

Objective(s) addressed:

Objective 2

Abstract:

We are using sampling data from several different projects across Indiana to examine how the functional diversity of predatory beetles is sustained, and what this means for control of boring beetles in hardwood forests.

- #: 54  
State: [Indiana](#)  
Project title: Conservation biocontrol and carbon sequestration in agroecosystems: the role of land use and management in maximizing ecosystem services to agriculture  
[view report](#)  
Keywords: [ecosystem services](#), [biocontrol](#), [carbon sequestration](#), [circuit theory](#)  
Key personnel: [Rowe, Helen](#); [Holland, Jeffrey D.](#); [Gramig, B.](#); [Dukes, J.](#)  
Objective(s) addressed: Objective 2  
Abstract: Aphids and their predators were sampled in tallgrass prairie, prairie restorations, and soybean fields and adjacent conservation plantings throughout Newton County, IN. We used circuit theory and graph theory approaches to model the flow of aphid predator insects in 5 families to determine how they move through complex networks of habitats.
- #: 53  
State: [Michigan](#)  
Project title: A Web-Enabled Geospatial Framework for the Monitoring, Management and Evaluation of Emerald Ash Borer Biological Control Agents  
[view report](#)  
Keywords: [spatial ecology](#), [Outreach](#), [Extension](#), [invasive](#)  
Key personnel: [Ziegler, Amos](#), [Landis, Doug](#), [Joy](#)  
Objective(s) addressed: Objective 2, Objective 4  
Abstract: This continuing project is developing a geo-database developed for monitoring the establishment of emerald ash borer biological control agents. We have established a database with 1000's of entries and are exploring the possibility of expanding the project to additional invasive species biocontrol efforts.
- #: 52  
State: [Michigan](#)  
Project title: Identification of native natural enemies of brown marmorated stink bug  
[view report](#)  
Keywords: [brown marmorated stink bug](#), [conservation biocontrol](#), [video](#)

Key personnel:

[Grieshop, Matthew, Nielsen, Anne, Deroshia, Kristin](#)

Objective(s) addressed:

Objective 1, Objective 2, Objective 3, Objective 4

Abstract:

We have initiated a study using video surveillance of sentinel egg masses to determine the initial incidence of brown marmorated stink bug egg parasitism and predation in organic apples and vegetable crops. Activities in 2012 largely consisted of establishing a laboratory colony of BMSB for the provision of eggs as well as the development of a video surveillance system. Research is beginning in the summer of 2013 in Michigan and New Jersey.

- #: 51  
State: [Michigan](#)  
Project title: Identification of native natural enemies of brown marmorated stink bug  
[view report](#)  
Keywords: [brown marmorated stink bug](#), [conservation biocontrol](#), [video](#)  
Key personnel: [Grieshop, Matthew, Nielsen, Anne, Deroshia, Kristin](#)  
Objective(s) addressed: Objective 1, Objective 2, Objective 3, Objective 4  
Abstract: We have initiated a study using video surveillance of sentinel egg masses to determine the initial incidence of brown marmorated stink bug egg parasitism and predation in organic apples and vegetable crops. Activities in 2012 largely consisted of establishing a laboratory colony of BMSB for the provision of eggs as well as the development of a video surveillance system. Research is beginning in the summer of 2013 in Michigan and New Jersey.
- #: 50  
State: [Michigan](#)  
Project title: Improving Open Rearing Systems for Greenhouse Biological Control  
[view report](#)  
Keywords: [thrips](#), [conservation biocontrol](#), [augmentative biocontrol](#), [Amblyseius cucumeris](#), [Atheta coriaria](#), [greenhouse](#)  
Key personnel: [Grieshop, Matthew, Riddle, Joe](#)  
Objective(s) addressed: Objective 1, Objective 3  
Abstract: We are conducting research assessing factors that may limit the success of biological control of thrips in greenhouses with the goal of improving open rearing approaches for natural enemies. In 2012 we began assessing the impact of irrigation on *Amblyseius cucumeris* residence on bedding plants and determined that plant macro leaf complexity may help retain natural enemies more readily than micro leaf complexity. We have also begun exploring the development of open rearing systems for *Atheta coriaria*.
- #: 49  
State: [Michigan](#)  
Project title: Conservation biological control in cabbage through cover crop management  
[view report](#)  
Keywords: [conservation biocontrol](#), [cabbage](#), [parasitoids](#), [predators](#), [aphids](#), [diamondback moth](#), [cabbage worms](#)  
Key personnel: [Szendrei, Zsafia, Bryant, Alexandria](#)  
Objective(s) addressed: Objective 3

Abstract:

We have been evaluating the use of rye and vetch cover crops as a means of promoting general biological control of cabbage pests. We have found that later cover crop kill dates lead to increased N.E. abundance and biological control services. However later cover crop kill dates also reduced cabbage yields due to plant competition.

- #: 48  
State: [Michigan](#)  
Project title: Survey/Manipulation of asparagus leaf miner parasitoids  
[view report](#)  
Keywords: [asparagus](#), [augmentative biological control](#), [asparagus leaf miner](#), [parasitoids](#)  
Key personnel: [Szendrea, Zsofia](#), [Morrison, Rob](#)  
Objective(s) addressed: Objective 3  
Abstract: The asparagus leaf miner is an important pest of asparagus in Michigan and is currently largely unmanaged. The purpose of our project was to identify parasitoids of this pest as well as cultural practices that might enhance biological control. We found three families of parasitoids in 2011 and 2012: Braconidae, Pteromalidae and Eulophidae. Present work is evaluating whether floral strips bordering asparagus fields can enhance parasitoid activity.
- #: 47  
State: [Michigan](#)  
Project title: Development of black soldier fly as an alternative host for Entomopathogenic nematodes  
[view report](#)  
Keywords: [entomopathogenic nematodes](#), [black soldier fly](#), [augmentative biological control](#)  
Key personnel: [Grieshop, Matthew](#), [Riddle, Joe](#)  
Objective(s) addressed: Objective 1, Objective 3  
Abstract: Entomopathogenic nematodes can be a useful augmentative biocontrol agent for a variety of soil dwelling insect pests. A major limiting factor to their use in organic systems is the lack of OMRI approved sources of nematodes. Nematodes can be easily reared on wax worms but this requires a supply of worms. We are exploring black soldier fly as an alternative rearing host for EPN. Black soldier fly are used as a composting agent and can also be fed to small livestock.
- #: 46  
State: [Michigan](#)  
Project title: Rotational grazing of hogs for insect, weed, and disease pest management  
[view report](#)  
Keywords: [livestock](#), [apples](#), [hogs](#), [augmentative biocontrol](#), [plum curculio](#), [codling moth](#), [apple scab](#), [weeds](#)  
Key personnel: [Grieshop, Matthew](#), [Buehrer, Krista](#)  
Objective(s) addressed: Objective 1, Objective 2, Objective 3  
Abstract: We have been exploring the use of flash grazed hogs to provide biological control of key insect, weed and disease pests of apples in organic orchards. Hogs are grazed during the "June Drop" period of apple development and again post harvest. We found that hogs can provide biological control of direct insect pests, weeds, and apple scab inoculum without affecting earthworms or native beneficials. Post harvest grazing of hogs completely eliminated left over fruit on the orchard floor and reduced damage from plum curculio and fruit moths in following years.

- #: 45  
State: Michigan  
Project title: Brown marmorated stink bug parasitoid non-target screening  
[view report](#)  
Keywords: brown marmorated stink bug, classical biocontrol, quarantine, host specificity  
Key personnel: DelFosse, Earnest  
Objective(s) addressed: Objective 3, Objective 4  
Abstract: We are collaborating in a national project funded by USDA APHIS to perform host specificity testing for the exotic egg parasitoid *Trissolcus japonicus*. In 2012 we completed the construction and permitting of a quarantine facility and began colonies of both brown marmorated stink bug and native/naturalized stink bugs.

- #: 44  
State: Michigan  
Project title: Classical Biological Control of Emerald Ash Borer in the U.S.  
[view report](#)  
Keywords: emerald ash borer, classical biocontrol, parasitoids  
Key personnel: Bauer, Leah, Duan, Jian, Abell, Kris, Van Driesche, Roy  
Objective(s) addressed: Objective 1, Objective 2, Objective 3, Objective 4  
Abstract: In June 2002, *Agrilus planipennis* (Coleoptera: Buprestidae) native to northeast Asia, was identified as the cause of ash (*Fraxinus* spp.) tree mortality in southeast Michigan & nearby Ontario. In Asia, little was known about *A. planipennis* biology except as a periodic pest of ash. Common name of emerald ash borer (EAB) was given. North American ash spp. are more susceptible to EAB than are Asian ash spp. We have begun a 12 step program to provide classical biocontrol of this important pest.

1. Study biology of EAB (FS & MSU)
2. Survey for native natural enemies (FS, APHIS, MSU)
3. Foreign exploration for natural enemies (FS, APHIS, ARS)
4. Select potential biocontrol agents
5. Import & study biocontrol agents in quarantine
6. Host range studies and Biological Assessment for FWS
7. Request APHIS permit for environmental release
8. Prepare petition for release of each species to North American Plant Protection Organization (NAPPO)
9. APHIS compiled the Environmental Assessment (EA)
10. EA was posted on Federal Register for public comment
11. Select field sites, rear and release parasitoids
12. Determine establishment, efficacy, impact

We are presently working through steps 11 and 12 for a larval parasitoid –*T. planipennis* and an egg parasitoid –*O. agrili* .

- #: 43  
State: Michigan  
Project title: Using native plants for enhanced biocontrol in fruit systems  
[view report](#)  
Keywords: Native plants, conservation biocontrol



Key personnel:

[Isaacs, Rufus, Blaauw, Brett](#)

Objective(s) addressed:

Objective 1, Objective 3, Objective 4

Abstract:

The impact of floral diversity strips on natural biological control was tested using small diversity strips of varying sizes (1 – 100 m<sup>2</sup>) planted with 12 Michigan wildflower species. Wildflower plantings were established adjacent to five commercial blueberry fields at farms in west Michigan as well as adjacent to five apple and five cherry orchards. 2009-2012 activity was funded by USDA-SARE and Project GREEN. Beat, visual observation, and vacuum sampling revealed that once floral strips were established both the abundance of natural enemies as well as their impact on sentinel prey increased within crop rows adjacent to floral strips relative to control plots lacking floral strips. Wild pollinator activity was also positively impacted by floral diversity strips.

• #:

42

State:

[Michigan](#)

Project title:

Biological Control in Bioenergy and Food Crops

[view report](#)

Keywords:

[bioenergy](#), [predators](#), [parasitoids](#), [landscape](#), [conservation biocontrol](#)

Key personnel:

[Landis, Doug, Werling, Ben](#)

Objective(s) addressed:

Objective 1, Objective 2, Objective 3

Abstract:

The main goal of our research is to understand how landscape structure affects biocontrol services.

The 2012 GLBRC study was focused on examining the effect of potential biofuel landscapes on biological control in food crops using closed, sham, and open plots within soybean crops to test natural enemy effects on pests and compare crop yields between different plot treatments. Data are forthcoming.

• #:

41

State:

[Michigan](#)

Project title:

Biological Control of Cereal Aphids

[view report](#)

Keywords:

[Cereal aphids](#), [predators](#), [parasitoids](#), [sentinel prey](#)

Key personnel:

[Landis, Doug, Safarzoda, Shalo](#)

Objective(s) addressed:

Objective 1, Objective 3

Abstract:

We used the bird cherry oat aphid (*Rhopalosiphum padi*), and naturally occurring greenbug aphids to explore the role of natural enemies in impacting population growth in wheat under field and laboratory conditions. The initial studies are focused on refining a study system that is amenable to addressing these questions.

What natural enemies may be important in consuming the bird cherry oat aphid under Michigan conditions? We were collecting potential natural enemies from local fields, providing them with favorable conditions in the lab, and observing the rate at which they consume bird cherry oat aphids.

Are natural enemy communities effective in suppressing aphid populations in the field? Using a combination of fully caged, open, and sham caged plants we observed the influence of natural enemies on aphid population growth in the field.

How do coccinellids impact cereal aphid populations?

In order to answer these questions we performed the following research:

Adult carabid and coccinellid beetles were collected from wheat fields on the campus of Michigan State University, East Lansing, MI during May 2012 and tested as potential natural enemies of wheat aphids. We used dry (without any killing solution) 11 cm diameter pitfall traps to collect carabid beetles, and swept vegetation to collect coccinellids. In 100mm x 15mm Petri dishes, we placed wheat leaves infested with aphids and later were presented the natural enemies to them. The results showed that both coccinellids and carabid beetles can be natural enemies of cereal aphids.

To understand how the natural enemies impacted aphid densities in 2012, experiments were conducted in two winter wheat fields on the Michigan State University General Farm, East Lansing, MI. In the plots, we used tomato cages covered with mesh and sham cages with 4 cm holes. Open plots were used as controls within the fields. In plots where naturally enemies were excluded using mesh, aphid populations were much higher than in the sham and control plots.

To study the impact of coccinellids beetles we implemented a field study where we used 1x1 m cages covered with mesh on 2 and 5 sides. We attempted to determine the role of coccinellids in aphids population growth, but unfortunately due to later season and hot temperature, we did not get the expected result. However, we observed both coccinellid adults and larvae in all plots.

- #: 40  
State: [Michigan](#)  
Project title: Biological Control Extension/Outreach  
[view report](#)  
Keywords: [Outreach, Extension](#)  
Key personnel: [Landis, Doug](#)  
Objective(s) addressed: Objective 1  
Abstract:  
We have produced a variety of educational materials for stakeholder groups and the general public. These include: Biodiversity Services and Bioenergy Landscapes bulletin E-3164. We have also provided materials on how growing bioenergy crops will transform agricultural landscapes and affect the ecosystem services they deliver, including natural pest control services by predatory arthropods
- #: 39  
State: [Michigan](#)  
Project title: Spotted Knapweed Biological Control  
[view report](#)  
Keywords: [Centaurea maculata, invasive plants, weed biocontrol, spotted knapweed](#)  
Key personnel: [Landis, Doug, Carson, Brendan](#)  
Objective(s) addressed: Objective 3  
Abstract:  
In the Landis lab at Michigan State University, we have been focusing on three main aspects of spotted knapweed biocontrol. We have been investigating the establishment and dispersal of the seedhead weevils *Larinus minutus* and *L. obtusus*, and the root-boring weevil *Cyphocleonus achates*. All of these weevils have recently been introduced to Michigan to help reduce populations of spotted knapweed, and have undergone rigorous host-specificity testing. We have been collecting detailed plant community data that will allow us to determine what impact knapweed biocontrol has had on knapweed demography and the surrounding plant community.  
Because we recognize that knapweed flowers are utilized by honey bees and many other pollinators, we are also investigating methods for establishing native nectar-producing plants at biocontrol release sites. While we believe that knapweed will continue to be a significant part of the floral landscape for the foreseeable future, we want to ensure that there are enough nectar resources available if knapweed populations do decrease.  
Finally, we are researching the use of spotted knapweed by pollinators to determine how important of a nectar source the plant is at different times of the year.
- #: 38  
State: [Michigan](#)  
Project title: Study of native and exotic coccinellid biocontrol agents  
[view report](#)  
Keywords:

Coccinellidae, aphid, native, exotic

Key personnel:

[Landis, Doug, Bahlai, Christie](#)

Objective(s) addressed:

Objective 1, Objective 2, Objective 3

Abstract:

Aphidophagous ladybeetles (Coleoptera: Coccinellidae) are important providers of herbivore suppression ecosystem services. In the last 30 years, the invasion of exotic coccinellid species coupled with observed declines in native species has led to renewed interest in the community dynamics and ecosystem function of this guild. Several hypotheses have been proposed to describe the mechanism of invasion coupled with native species declines (i.e. vacant niche exploitation, competitive displacement and habitat compression, intraguild predation), and the relationship of this decline to biodiversity and herbivore suppression. We use a 24 year dataset of a coccinellid community in nine habitats in southwestern Michigan to test for evidence supporting or refuting these hypotheses, and for changes in community function.

Abundance of coccinellids varied widely between years and became increasingly exotic-dominated. More than 71% of 57,813 adult coccinellids captured over the 24 year study were exotic species. Population dynamics of individual species were variable, although certain species (*Coccinella septempunctata*, *Coleomegilla maculata*, and *Hippodamia parenthesis*) exhibited regular boom-bust cycles over the duration of the study. Correlation analyses indicated interactions between exotic and native species were not generalizable: the magnitude and sign of the correlation was interaction specific, suggesting that impact of exotic species on native coccinellids varies with their degree of interaction. Habitat use patterns by some native species (*Adalia bipunctata* and *Coccinella trifasciata*) changed during years when the exotic *Harmonia axyridis* reached high numbers, lending support to the habitat compression hypothesis, where native species retreat to ancestral habitats when invaders dominate cultivated habitats.

Shannon diversity increased slightly over time, but herbivore suppression potential of the community remained roughly constant over the course of the study. The relationship between Shannon diversity and herbivore suppression potential varied with habitat type: a positive relationship in forest and perennial habitats, but uncorrelated in annual habitats. An analysis of potential herbivore suppression indicated that although the composition of the coccinellid community has changed dramatically in the past 30 years in southwestern Michigan, its function appears to be relatively unchanged in both agricultural and natural habitats. However, coccinellid communities dominated by exotics may be less robust to changing land-use patterns.

• #:

37

State:

[Michigan](#)

Project title:

Biocontrol of Soybean Aphid

[view report](#)

Keywords:

[soybean aphid](#), [predators](#), [video](#)

Key personnel:

[Landis, Doug, Woltz, Megan](#)

Objective(s) addressed:

Objective 3

Abstract:

Nocturnally-active predators can make important contributions to insect pest suppression in agroecosystems. In particular, nocturnal predators have been shown to be responsible for significant predation of herbivores within soybean fields. In spite of this fact, much of the existing research on *A. glycines* natural enemies has focused on members of the diurnal predator community. We assessed diel variation of the predator community and *A. glycines* predation events in soybean with vacuum samples, direct observations, and video observations. The majority of predation events observed (21/22) occurred during daylight hours and were primarily by anthocorids (17/21), followed by chrysopid larvae (2/21), and one each by a coccinellid, and a predatory mite. The sole nocturnal predation event observed was by a spider. We found that anthocorids and nabids were most active in the afternoons and formicids and carabids were more active at night. Spiders and anthocorids were the most abundant predatory arthropods captured in vacuum samples. In contrast, on video samples, lacewing larvae were most active during the day and lacewing larvae, spiders, opiliones and carabids were similarly active at night. The differences between the two sample methods suggests that vacuum samples may represent predator abundance more accurately, while video data can be used to better assess relative time spent foraging.

• #:

36

State:

[Indiana](#)

Project title:

Intraguild rodent-beetle interactions impact weed seed predation

[view report](#)

Keywords:

[weed biocontrol](#)

Key personnel:

[Carmen Blubaugh](#), [Kevin Gibson](#), [Ian Kaplan](#)

Objective(s) addressed:

Objective 2

Abstract:

Weed seed removal by invertebrates (e.g., carabid beetles) and vertebrates (rodents) is well-documented, but interactive effects of the two groups on weed biocontrol are virtually unstudied. In two separate ongoing experiments, we are quantifying predator-prey interactions between vertebrate and invertebrate granivores and determining how these interactions ultimately carry over to the weed community. To do so, we compare weed emergence rates and total weed biomass in undisturbed plots with different cover types (e.g., clover) and varying access to seed predators over two growing seasons.

- #: 35  
State: [Indiana](#)  
Project title: Tri-trophic effects of host-plant chemistry on hornworm-parasitoid interactions  
[view report](#)  
Keywords: [tri-trophic interactions](#)  
Key personnel: [Michael Garvey](#), [Curtis Creighton](#), [Ian Kaplan](#)  
Objective(s) addressed: Objective 2  
Abstract: Plant defensive chemistry may impact the ability of parasitic wasps to develop inside of herbivorous hosts. We are using the system consisting of hornworms, *Manduca sexta*, and their endoparasitoid, *Cotesia congregata*, to test for host-plant mediated effects on wasp development across a range of agricultural species (e.g., tomato, potato, pepper) and wild solanaceous weeds (e.g., *Solanum carolinense*, *S. dulcamara*). Further, the immune response of caterpillars to wasps are being evaluated across host-plants to link crop defenses with pest immune function and thus vulnerability to biocontrol agents.
- #: 34  
State: [Indiana](#)  
Project title: Induced volatiles prime tomato plants for attraction of *Cotesia congregata* (Hymenoptera: Braconidae)  
[view report](#)  
Keywords: [tomato](#), [plant volatiles](#)  
Key personnel: [Elizabeth Rowen](#), [Natalia Dudareva](#), [Ian Kaplan](#)  
Objective(s) addressed: Objective 2  
Abstract: Recent efforts in biological control have explored the possibility of using the attractive qualities of herbivore-induced plant volatiles (hereafter HIPVs) to recruit natural enemies to protect crops. We are testing the role of synthetic HIPVs, focusing on the compound methyl salicylate, as lures in altering tomato defense signaling, which subsequently impacts the attraction of predators and parasitoids to caterpillar-infested plants. Preliminary evidence suggests that volatiles prime crops to emit more rapid and stronger HIPV responses when pre-exposed.
- #: 33  
State: [Indiana](#)  
Project title: Effects of thiamethoxam seed treatments on nutritive sources available to *Orius insidiosus* Say (Hemiptera: Anthracoridae) in Indiana soybean agroecosystems  
[view report](#)  
Keywords: [soybean](#), [soybean aphids](#), [neonicotinoids](#)

Key personnel:

[Madeline Spigler](#), [Christian Krupke](#)

Objective(s) addressed:

Objective 2

Abstract:

Neonicotinoids are known to have severe toxic effects on pollinating insects, however the extent of damage caused to populations of other beneficial insects, such as omnivores in the field, is largely unknown. These experiments aimed to categorize the effects of thiamethoxam seed treatments on a resident omnivore, *Orius insidiosus* in terms of possible prey reduction as well as exposure via phytophagy and pollenivory. This was accomplished via field experiments, feeding assays, and quantitative methodologies to determine levels of thiamethoxam in plant tissue and pollen. Results revealed consistent differences in *O. insidiosus* populations occurring later in the season, which are expected to be large independent from thrips populations. Further analyses revealed that high levels of thiamethoxam is found in treated plant tissue early in the season, however it dissipates quickly, in line with literature values. No detectable levels of any neonicotinoid (or metabolite) was found in any pollen samples.

• #:

32

State:

[Indiana](#)

Project title:

Towards developing ash varieties resistant to emerald ash borer and increasing the efficacy of its biological control agents

[view report](#)

Keywords:

[forests](#), [ash trees](#), [emerald ash borer](#)

Key personnel:

[Lindsay Kolich](#), [Cliff Sadof](#), [Matt Ginzel](#)

Objective(s) addressed:

Objective 2

Abstract:

In this project we use reciprocal grafts of five ash species (i.e., green, white, black, Manchurian and Chinese) to determine whether resistance to emerald ash borer (EAB) can be conferred to a scion when grafted onto resistant rootstock. We also explore whether herbivory by adult female beetles induces a change in the volatiles released by these reciprocal grafts. This work may pave the way toward developing systems for propagating *Fraxinus* scions that are resistant to EAB and exploit potential phytochemical connectivity between roots and shoots. We also determine whether two common EAB parasitoids are preferentially attracted to volatiles of these reciprocal grafts and the volatiles of blue ash. This work will inform deployment strategies for the biological control of EAB. Blue ash is a native species that appears to have more resistance to EAB than other North American ash. Blue ash may provide a sustained reservoir of EAB hosts on which parasitoid populations could grow and become better established as more susceptible species of ash die during the initial wave of EAB infestation.

• #:

31

State:

[North Dakota](#)

Project title:

Integrated management of Canada thistle

[view report](#)

Keywords:

[Hadroplontus litura](#), [stem-mining weevil](#), [Urophora cardui](#), [gallfly](#), [thistle](#)

Key personnel:

[Greta Gramig](#), [Erin Burns](#), [Deirdre Prischmann-Voldseth](#)

Objective(s) addressed:

Objective 3

Abstract:

Canada thistle is a noxious weed that impacts rangeland, cropland, and urban landscapes. Biological control is one potential management option; however, the literature indicates that using an IPM approach may be most successful. This project explores the effects of multiple control tactics and/or biocontrol agents on weed performance within an environmental context.

• #:

30

State:

[North Dakota](#)

Project title:

Effects of weed management on soil arthropods within a soybean cropping system

[view report](#)

Keywords:

[weed management](#), [glyphosate](#), [soil arthropods](#), [soybean](#)

Key personnel:

[Ashton Hansen](#), [Deirdre Prischmann-Voldseth](#), [Amitava Chatterjee](#)

Objective(s) addressed:

Objective 3

Abstract:

Soil arthropods are important components of terrestrial ecosystems that are essential to nutrient cycling, soil health, and crop production. Weed management has been shown to affect soil arthropods in agricultural systems and also alter the above-ground arthropod fauna. The goal of this project is to determine how the presence of weeds and a commonly used herbicide impacts soil arthropods and explore subsequent effects on soil properties, soybean plants, and foliar pests.

- #: 29  
State: [North Dakota](#)  
Project title: Soybean aphid IPM: combining host plant resistance and biological control  
[view report](#)  
Keywords: [soybean](#), [Rag1](#), [soybean aphid](#), [parasitoid](#), [Binodoxys communis](#)  
Key personnel: [Kiran Ghising](#), [Elissa Ballman](#), [Deirdre Prischmann-Voldseth](#), [Janet Knodel](#), [Pat Beauzay](#), [Ted Helms](#), [Paul Ode](#), [Jason Harmon](#)  
Objective(s) addressed: Objective 2  
Abstract: Multiple pest control tactics are used in integrated pest management programs, but it is important to determine if the methods used are complementary and result in enhanced pest suppression. The goal of this project was to determine how and why soybean aphid control by a hymenopteran parasitoid was impacted when the insects were on a resistant host plant.
- #: 28  
State: [North Dakota](#)  
Project title: Impact of nitrogen source on soybean aphids and parasitization by *Lysiphlebus testaceipes*  
[view report](#)  
Keywords: [soybean](#), [soybean aphid](#), [nitrogen](#), [soil rhizobia](#), [parasitoid](#)  
Key personnel: [Deirdre Prischmann-Voldseth](#), [Samantha Brunner](#), [Stephanie Swenson](#), [RJ Goos](#)  
Objective(s) addressed: Objective 3  
Abstract: Soybean plants can obtain nitrogen from fertilizer or from nitrogen fixation. The source of the nitrogen can impact the identity and amount of nitrogenous compounds within the plant's foliar tissue, which may have an impact on herbivorous arthropods and higher trophic levels. The goal of this project is to determine how varying nitrogen availability and the source of nitrogen affects pest soybean aphids and a native parasitoid.
- #: 27  
State: [North Dakota](#)  
Project title: Soybean arthropod communities in conventional and organic soybean fields and buckthorn  
[view report](#)  
Keywords: [soybean](#), [buckthorn](#), [soybean aphids](#), [natural enemies](#), [organic systems](#)  
Key personnel: [Erin McLean](#), [Deirdre Prischmann-Voldseth](#)  
Objective(s) addressed:

## Objective 2

### Abstract:

Natural enemies are important components of IPM programs, but the identity of key natural enemies and their impact of target pests within larger food webs can vary geographically. The goal of this project is to identify and quantify densities of pest soybean aphids, their natural enemies, and potential alternative prey in three environments in the Red River Valley: 1) conventionally managed soybean, 2) organically managed soybean, and 3) buckthorn.

- #: 26  
State: [North Dakota](#)  
Project title: Biological control of corn rootworm larvae by predatory mites  
[view report](#)  
Keywords: [Diabrotica](#), [corn rootworm](#), [Hypoaspis](#), [Gaeolaelaps](#), [predatory mite](#)  
Key personnel: [Deirdre Prischmann-Voldseth](#), [K Dashiell](#)  
Objective(s) addressed: Objective 3  
Abstract: Corn rootworms have been a major pest of maize in the Midwest, but because the most damaging pest life stages are subterranean, there are significant gaps in knowledge about the identity and efficacy of key biocontrol agents. The goal of this project is to elucidate the potential role of soil-dwelling mites as corn rootworm biocontrol agents using lab based feeding trials and field experiments.
- #: 25  
State: [Missouri](#)  
Project title: Impact of introduced exotic lady beetles on native lady beetle community  
[view report](#)  
Keywords: [lady beetle](#), [exotic species](#), [native species](#), [prairie](#), [grassland](#), [introduced](#)  
Key personnel: [Lauren Diepenbrock](#), [Deborah Finke](#), [Kelly Tindall](#), [Kent Fothergill](#)  
Objective(s) addressed: Objective 3  
Abstract: The diversity and abundance of native lady beetle (Coccinellidae) species in the US is declining. This decline has been attributed to the intentional and unintentional introduction of exotic lady beetles, including *Coccinella septempunctata* and *Harmonia axyridis*. However, most of the studies documenting negative effects of exotic species on the community of native lady beetles have been done in agricultural systems, whereas grasslands are suggested as potential refuge habitats for native species from the pressures of exotics. Our objectives are 1) to document the impact of the introduction of exotic species on the community of native lady beetle species occurring in Missouri using a historical dataset (1893-present), and 2) to determine whether different grassland habitats provide similar refuges for native species by comparing the community of native and exotic lady beetle species in remnant native tallgrass prairies, restored native tallgrass prairies, and non-native tall fescue fields.
- #: 24  
State: [Missouri](#)  
Project title: Effects of predator diversity on the prevalence of aphid-borne yellow dwarf virus in wheat  
[view report](#)  
Keywords: [predator diversity](#), [barley yellow dwarf](#), [wheat](#), [aphid](#), [vector](#), [pathogen](#)  
Key personnel: [Elizabeth Long](#), [Deborah Finke](#)  
Objective(s) addressed: Objective 3  
Abstract:

Predators may indirectly influence the occurrence of disease by directly altering the abundance and/or behavior of vectors that are responsible for pathogen transmission. We are evaluating the impact of altered predator diversity on the bird cherry-oat aphid (*Rhopalosiphum padi*), a vector of barley yellow dwarf virus in cereal grains, to ultimately determine if predator diversity effects on aphid abundance, distribution, or feeding behavior cascade down to influence the prevalence of this pathogen in wheat. Overall, we find that predators have strong negative impacts on vector abundance and pathogen prevalence. When we focus on the effect of predator diversity, we find that a diverse group of predators reduces vector abundance to a greater extent than single-species assemblages, however diverse treatments do not differ from single-species treatments in the spatial occurrence of vectors across the habitat, or in the proportion of wheat plants that are infected. However, predators stimulate vector movement similarly across diversity treatments, resulting in more frequent interruptions to vector feeding sessions when predators are present. Therefore, it appears that predators may indirectly influence pathogen prevalence in a host population by directly impacting vectors, and a key mechanism by which this influence may be exerted is via impacts to vector feeding behavior, which can further alter the efficiency of pathogen transmission from host to host.

- #: 23  
State: [Missouri](#)  
Project title: Monitoring Milky Disease (*Paenibacillus lentimorbus*)  
[view report](#)  
Keywords: [milky disease](#), [Paenibacillus lentimorbus](#)  
Key personnel: [Ben Puttler](#)  
Objective(s) addressed: Objective 2  
Abstract: As in 2011, climatic conditions in 2012 during September – November (cooler and drier than normal with no thunderstorms) may have again contributed to the absence of grub species (mostly masked chafers) from the turf grass surface of the golf course monitored 11th fairway. Consequently, no evidence of the milky disease could be detected.
- #: 22  
State: [Missouri](#)  
Project title: Monitoring Spotted Knapweed (*Centaurea stoebe*)  
[view report](#)  
Keywords: [spotted knapweed](#), [Centaurea stoebe](#)  
Key personnel: [Ben Puttler](#)  
Objective(s) addressed: Objective 2  
Abstract: In recent years, spotted knapweed has become a widespread, invasive weed throughout Missouri. An attempt at reducing populations of the weed biologically utilizing a seed weevil (*Larinus minutus*) and root weevil (*Cyphocleonus achates*) was initiated in 2008 with the release of the root weevil and subsequently in 2009-2012 of both weevils. Most of the released weevils were from established populations collected in Montana. A few were from Colorado.  
  
Results to-date are encouraging since both weevils have been recovered this year (2012) at selected release sites from the 2008-2009 releases. Establishment is claimed since the recoveries meet the three-year/three-generation criteria used to determine establishment of a released biotic organism.  
  
Division of Plant Sciences, Missouri Extension, and the Missouri Departments of Transportation and Conservation are participants in this program.

- #: 21  
State: [Missouri](#)  
Project title:



## Monitoring Soybean Aphid (*Aphis glycines*)

[view report](#)

Keywords:

[soybean aphid](#), [Aphis glycines](#)

Key personnel:

[Ben Puttler](#), [Wayne Bailey](#)

Objective(s) addressed:

Objective 2

Abstract:

Soybean aphid populations during 2012 were apparently non-existent in soybean field per our observations in central Missouri, nor were any brought to our attention throughout the state. Consequently, no fall migrant back to overwintering buckthorn was detected. Present were small colonies of the cotton/melon aphid (*Aphis gossypii*). Populations of this aphid on the buckthorn were extremely high in early spring (2013). A combination of factors contributed to decimating the aphid population. These were the parasitoid *Lysiphlebus testaceipes* and the predators *Harmonia axyridis* and syrphid larvae and climatic conditions; rain, thunderstorms.

- #: 20  
State: [Missouri](#)  
Project title: An integrative approach of Bt crop and biological control of *Diabrotica virgifera virgifera*, a major maize pest  
[view report](#)  
Keywords: [Diabrotica virgifera virgifera](#), [western corn rootworm](#), [WCR](#), [entomopathogenic nematode](#), [rhizosphere](#), [chemical ecology](#), [Bt maize](#), [insect pest control](#)  
Key personnel: [Ivan Hiltbold](#)  
Objective(s) addressed: Objective 3  
Abstract: Entomopathogenic nematodes, when used along with the right maize varieties, have been shown to be attracted towards WCR-damaged maize roots. Indeed, WCR feeding induces indirect root defenses and subsequently the emission of volatile signals recruiting the insect-killing nematodes. The aims of the present project are to evaluate the compatibility of Bt maize and entomopathogenic nematodes in an integrated approach. In the lab as well as in the field, nematodes are attracted toward certain Bt maize lines and therefore reducing the insect pest population around these root systems.
- #: 19  
State: [Missouri](#)  
Project title: Development of high quality, cost-effective, mass-reared biocontrol agents for small and urban farms, organic farms and greenhouses  
[view report](#)  
Keywords: [spined soldier bug](#), [Podisus maculiventris](#), [Predatory insects](#), [Stink bug](#), [breeding](#), [molecular genetics](#), [performance](#), [cost-effective](#)  
Key personnel: [Tom Coudron](#)  
Objective(s) addressed: Objective 3  
Abstract: OVERALL OBJECTIVE:  
To develop improved strains of beneficial insects through traditional breeding techniques.  
  
Objective 1.  
Select and develop beneficial lines of a predator, the spined soldier bug, *Podisus maculiventris*, for improved bionomic traits such as increased female fecundity, sex ratio, development time, and shelf life.  
  
Sub-objective 1A. Determine genetic variability of a domesticated predator in laboratory-maintained populations and field populations from around the U.S. and in commercial insectaries.  
  
Sub-objective 1B. Identify and develop predator breeds with the most useful bionomic traits with minimal physiological tradeoffs, such as

reduced immune capacity, and identify genes associated with the traits.

#### Objective 2.

In partnership with small and urban vegetable growers, develop novel beneficial insect delivery systems for application, using such strategies as chemical attractants, artificial diets, and release mechanisms.

Collaborators: John Foster (UNL) and Jaime Piñero (Lincoln University)

Two recent representative publications:

Kneeland, K., Coudron, T. A., Lindroth, E., Stanley, D., and Foster, J. E. Genetic variation in field and laboratory populations of the spined soldier bug, *Podisus maculiventris*. *Entomol. Exp. Appl.* 143: 120-126. 2012.

Zou, D. Y., Coudron, T. A., Liu, C., Zhang, L., Wang, M., and Chen, H. Nutrigenomics in *Arma chinensis*: transcriptome analysis of *Arma chinensis* fed on artificial diet and Chinese oak silk moth *Antheraea pernyi* pupae. *PloS One* 8 (4) e60881([www.plosone.org](http://www.plosone.org)).

- #: 18  
State: [Nebraska](#)  
Project title: Assessing the impact of beneficial arthropods in irrigated sugar beet agroecosystems for sustainable pest- and weed management in western Nebraska  
[view report](#)  
Keywords: [sugar beets](#), [carabids](#), [weed seed predation](#)  
Key personnel: [Johan Pretorius](#), [Jeff Bradshaw](#), [Gary Hein](#)  
Objective(s) addressed: Objective 3  
Abstract: Sugar beets in western Nebraska are grown under irrigation and often in rotation with corn. Sugar beets are often planted into a seed bed that experiences either a spring plow tillage or various other intensities of tillage. Our project is to first conduct a survey of common beneficial arthropods in these systems and then measure the impact of tillage on weed seed removal and predation using published procedures. An emphasis in this study is placed on the relatively new introduction of glyphosate-tolerant sugar beets and the simultaneous development of resistant weed species that are unintentionally selected.
- #: 17  
State: [Kansas](#)  
Project title: Using Mobile Technologies to Forecast and Track Natural Enemy Effectiveness on Cereal Aphids in Changing Landscapes  
[view report](#)  
Keywords: [landscape ecology](#), [wheat](#), [greenbug](#), [Lysiphlebus testaceipes](#), [sticky cards](#), [sweep nets](#), [iWheat.org](#)  
Key personnel: [Wendy Johnson](#), [Brian P. McCornack](#)  
Objective(s) addressed: Objective 3  
Abstract: The goal of this project is to develop an online module within an existing web-based support system ([www.iwheat.org](http://www.iwheat.org)), which will calculate the effectiveness of natural enemies for aphids in winter wheat at the field-level. Our specific objectives are to: 1) determine if predicting level of biocontrol effectiveness is feasible in Kansas wheat, and 2) update existing sampling recommendations to include prioritizing at-risk fields in an accessible web module for wheat stakeholders. This benefits producers by streamlining management decisions and reducing unwarranted insecticide use. The advantage of iWheat is the real-time dissemination of sampling recommendations to wheat stakeholders using mobile technologies (e.g. data phones). Caged studies are used to determine level of biocontrol effectiveness. This study includes 1) large mesh cages to exclude only predators on plants having greenbug infestation, 2) small mesh cages to exclude both predators and parasitoids, and 3) open plants exposed to both predators and parasitoids.
- #: 16  
State:

Kansas

Project title:

Influence of plant architecture on trophic interactions involving winter canola, aphids and Hippodamia convergence

[view report](#)

Keywords:

Hippodamia convergens, convergent lady beetle, aphids, Lipaphis erysimi, turnip aphid, Myzus persicae, green peach aphid, Brevicoryne brassicae, cabbage aphid, brassicae, canola, glucosinolates

Key personnel:

Ximena Cibils-Stewart, Brian P. McCornack

Objective(s) addressed:

Objective 3

Abstract:

This research focuses on understanding the canola system itself, more specifically, the plant-level interactions that are influencing predator-prey dynamics. Canola belongs to the Brassicae family of plants. All Brassica plants express characteristic secondary compounds called glucosinolates (derived from amino acids) that serve as defense mechanisms against herbivores and provide the brassica with their characteristic smell and chemical profile. We are interested in determining how different canola plant structures express these compounds and their influence on tritrophic relationships between a predator, the convergent lady beetle (Hippodamia convergens), and two prey species, a generalist (green peach aphid, Myzus persicae) and a specialist (Brevicoryne brassicae). Understanding aphid population dynamics, assessing if aphid quality (sequestration/excretion of glucosinolates by aphids) is influenced by plant location, and its impact on the existing predator communities (impact on development and reproductive output for adults and immature stages) are among the questions we want to answer.

• #:

15

State:

Kansas

Project title:

Seasonal occurrence and diversity of natural enemies in winter canola

[view report](#)

Keywords:

lady beetles, Coccinellidae, aphids, Lipaphis erysimi, turnip aphid, Myzus persicae, green peach aphid, Brevicoryne brassicae, cabbage aphid, brassicae, canola

Key personnel:

Ximena Cibils-Stewart, Brian P. McCornack

Objective(s) addressed:

Objective 3

Abstract:

This research, which is part of a collaboration between University of Arkansas, Oklahoma State University and the USDA ARS in Arizona focuses on understanding the dynamics of aphid pests and beneficial insects in canola. Canola production has had a 10 fold increase in the past decade in Kansas. Widespread planting of canola was followed by rapid infestations of aphids. Aphids infest canola across all plant developmental stages and might cause as much as 75% in yield loss. Crop producers therefore were forced to evaluate effectiveness of immediate pest suppression tactics (insecticides), while temporarily ignoring the dynamics and roles of beneficial insects in the system. Currently, use of broad-spectrum insecticides is common during spring flowering when high densities of aphids, natural enemies, and pollinators utilize canola. Beneficial insects (natural enemies and pollinators) are at great risk in canola systems and current pest management approaches are not sustainable (>90% of foliar applications are with synthetic pyrethroids; Franke et al. 2009). Therefore, the objective of this project is to understand population dynamics of both beneficial and pest insects to generate better management programs that mitigate pests and conserve natural enemies (predators, parasitoids, and pollinators). For this, the population dynamics of aphids and beneficial insects (i.e., green lacewings, lady beetles, and syrphid flies) was compared between fields with the following two management treatments: (1) Insecticidal seed treatment +late-spring insecticide application during flowering, and (2) Insecticidal seed treatment. Seasonal occurrence and diversity of pests and natural enemies was documented weekly by individual plant observations across the above mentioned treatments. The standard variable life table method (Gilbert et al. 1976, Southwood and Henderson 2000) will be used to model population dynamics of late-season aphids. Based on row width and plant density per row, insect intensity data will be transformed to density.

• #:

14

State:

Kansas

Project title:

Beneficial insect movement between canola and already established landscapes

[view report](#)

Keywords:

lady beetles, Coccinellidae, aphids, predators, lacewings, protein marking, wheat, canola, pasture, sticky cards

Key personnel:

[Ximena Cibils-Stewart, Brian P. McCornack](#)

Objective(s) addressed:

Objective 3

Abstract:

This research, which is part of a collaboration between University of Arkansas, Oklahoma State University and the USDA ARS in Arizona, focuses on understanding the potential landscape-level impact of adding winter canola to an existing agricultural system, and its influence on the associated arthropods (pests and beneficial) and the ecosystem services they provide. Winter canola is a first generation biofuel crop that can be used in rotation with winter wheat for improved weed and disease management. Winter wheat and winter canola are both attacked by unique aphid complexes that are crop specific. But the aphid species found colonizing canola might serve as suitable prey for the natural enemies present in these new wheat-canola landscapes. Therefore, the goal of our research is to determine whether canola is acting as a source or as a sink (ecological trap) to beneficial insects and pollinators that were once only using a predominately pasture-wheat landscape. Insects of interest are passively collected using yellow sticky traps; while movement within crops is determined using protein-marking analyzed using ELISA (enzyme-linked immunosorbent assay). The methodology for this project has the potential to be applied to other newly introduced crops across different environments to provide a better understanding of the potential effects of adding a new crop into existing cropping system. In addition, this work can apply to already extant crop systems to understand movement of insect pests or natural enemies between crops.

• #:

13

State:

[Kansas](#)

Project title:

Life table studies for natural enemies in winter canola

[view report](#)

Keywords:

[lady beetles](#), [Coccinellidae](#), [aphids](#), [Lipaphis erysimi](#), [turnip aphid](#), [Myzus persicae](#), [green peach aphid](#), [Brevicoryne brassicae](#), [cabbage aphid](#), [brassicae](#), [canola](#)

Key personnel:

[Ximena Cibils-Stewart, Brian P. McCornack](#)

Objective(s) addressed:

Objective 3

Abstract:

This experiment utilizes a typical mesh-cage exclusion approach (Kring et al. 1985, Lee et al. 2005) to experimentally evaluate the impact of aphid NEs on late-season infestations in canola. Cages used to monitor the effects of natural enemies consisted of either, no mesh (open), large mesh (to enable parasitoid free movement), and fine mesh (to enable no natural enemy movement). The effect of each natural enemy guild (parasitoid and predator) will be accounted for in the design. The experiment will enable us to determine which natural enemy guild is more important in mitigating aphid populations in canola. Mixed model ANOVA will be used to analyze resulting data to test effects of exclusion treatment on response variables over time, such as aphid and NE density. We will also utilize covariate analysis methods to include predator abundance and/or parasitism levels as variables explaining aphid intensities among exclusion treatments. This research, which is part of a collaboration between University of Arkansas, Oklahoma State University and the USDA ARS in Arizona.

• #:

12

State:

[Kansas](#)

Project title:

Effect of canopy height and prey location on lady beetle (Coleoptera: Coccinellidae) captures in soybean

[view report](#)

Keywords:

[lady beetles](#), [Coccinellidae](#), [aphids](#), [soybean](#), [soybean aphid](#), [Aphis glycines](#)

Key personnel:

[Ximena Cibils-Stewart, Brian P. McCornack](#)

Objective(s) addressed:

Objective 3

Abstract:

For soybean aphid, within-plant distributions change throughout the season but the reasons for these shifts are unclear. The goal of this research was to evaluate how coccinellid communities respond to differing aphid populations within a changing soybean canopy. In a early-planted and double-cropped soybean field, 40 randomly selected plants were enclosed using a 1-2 m tall wire cylinder covered with mesh and coated in tangle foot (sticky cylinders). This cylinder design allowed us to passively record height and direction for all lady beetle captures in response to four aphid treatments. These included two controls (a plant with no aphids and a cylinder with no plant) and plants with aphids restricted to upper or lower canopy using leaf exclusion cages. Although aphid location within the canopy varied, aphid density was kept

consistent between treatments. Changes in coccinellid communities were calculated using the Shannon-Weaver index and rank-proportion between fields and treatments.

- #: 11  
State: [Kansas](#)  
Project title: Paternal effects and male seminal depletion in two *Coccinella* species  
[view report](#)  
Keywords: [Coccinella septempunctata](#), [Coccinella transversalis](#), [fertility](#), [paternal effects](#), [sexual activity](#), [seminal fluid depletion](#)  
Key personnel: [Geetanjali Mishra Omkar](#), [Mahadev Bista](#), [J. P. Michaud](#)  
Objective(s) addressed: Objective 3  
Abstract:  
Contact key personnel for more information.
- #: 10  
State: [Kansas](#)  
Project title: Pleiotropic effects of melanism on the reproductive behavior of *Harmonia axyridis* in China  
[view report](#)  
Keywords: [paternal effects](#), [fecundity](#), [fertility](#), [mate choice](#), [male investment](#), [mate guarding](#)  
Key personnel: [Wang Su](#), [J. P. Michaud](#)  
Objective(s) addressed: Objective 3  
Abstract:  
Contact key personnel for more information.
- #: 9  
State: [Kansas](#)  
Project title: Maternal effects in Coccinellidae  
[view report](#)  
Keywords: [egg size](#), [developmental time](#), [fecundity](#), [fertility](#), [reproductive effort](#), [reproductive schedules](#)  
Key personnel: [German Vargas](#), [J. P. Michaud](#)  
Objective(s) addressed: Objective 3  
Abstract:  
This project examined the nature of age-specific maternal effects on reproductive parameters of *Coleomegilla maculata* and *Hippodamia convergens* and the constraints imposed by female body size.
- #: 8  
State: [Kansas](#)  
Project title: Non-target effects of sunflower seed treatments on beneficial insects  
[view report](#)  
Keywords: [cloranthraniliprole](#), [thiamethoxam](#), [Hippodamia convergens](#), [Chrysoperla carnea](#), [Orius insidiosus](#), [Lysiphlebus testaceipes](#), [extrafloral nectar](#)

Key personnel:

[Valeria Moscardini](#), [Pablo Gontijo](#), [J. P. Michaud](#)

Objective(s) addressed:

Objective 3

Abstract:

The project is evaluating the potential effects of neonicotinoids and rynodine receptor modulators on beneficial insects when applied as seed treatments to sunflower. The extrafloral nectaries of sunflower provide a unique avenue of potential consumption of systemic insecticides as they are an important summer resource utilized by many beneficial insects. Natural enemies from four different insect orders (Coleoptera, Hemiptera, Hymenoptera and Neuroptera) will be tested.

• #:

7

State:

[Kansas](#)

Project title:

Natural Enemy Foraging in Spatially-Fragmented Landscapes: Improving Biological Control in Protected Environments

[view report](#)

Keywords:

[augmentative biological control](#), [landscape ecology](#), [foraging traits](#), [genetic selection](#), [twospotted spider mite](#), [Tetranychus urticae](#), [predatory mite](#), [Phytoseiulus persimilis](#), [predator-prey interaction](#), [greenhouse crops](#)

Key personnel:

[James Nechols](#), [David Margolies](#)

Objective(s) addressed:

Objective 3

Abstract:

Research continues to understand the relationship between prey (twospotted spider mite, *Tetranychus urticae*) and plant distribution pattern and foraging efficiency of the predator mite, *Phytoseiulus persimilis*. We are particularly interested in whether selecting for increases in predator foraging traits (e.g., higher prey consumption rate, tendency for early dispersal) improves biological control success and, if so, on which landscapes. Preliminary studies on ~ 1-m<sup>2</sup> landscapes with a continuous coverage of lima bean seedlings suggest that predators released from a single prey patch that have been selected for early dispersal provide better pest suppression and less plant damage throughout the landscape than those selected for high consumption. This finding was observed both when prey were distributed in a single large clump (patch) and in a more dispersed, fragmented pattern. Recent studies suggest that discontinuity of plant distribution (gaps vs. a continuous canopy) strongly impedes predator dispersal, and thus the ability to control pest spider mites throughout the cropscape.

• #:

4

State:

[Ohio](#)

Project title:

Incorporating spatial heterogeneity to study predator biodiversity-ecosystem function relationships within the urban landscape of Cleveland, OH.

[view report](#)

Keywords:

[vacant land](#), [urban farm](#), [brownfield](#), [biodiversity ecosystem function](#)

Key personnel:

[Mary Gardiner](#)

Objective(s) addressed:

Objective 3

Abstract:

Global species decline has fueled rapid growth in biodiversity-ecosystem function research. On average, a positive association among species richness and productivity has emerged. However, studies examining predators indicate larger variation in richness-resource capture relationships. Cleveland, OH will serve as a model system to test relationships between predator richness, abundance, and function. Cleveland contains over 20,000 vacant city lots. Decisions regarding vacant land management will shape the ecological and social quality of inner-city neighborhoods for decades to come. Therefore, understanding how the composition of these habitats and their landscape context influence biodiversity-ecosystem function relationships is a critical task. Objective 1 will document how patch and landscape heterogeneity affect the dietary niche overlap of generalist arthropod predators, as a measure of resource partitioning. Objective 2 will test whether changes in heterogeneity affect resource capture via random gain or loss in richness, non-random gain or loss of highly effective predatory species, and/or altering the per-capita contributions of species. To inform conservation and management, Objective 3 will track the dispersal of predators among patches within a landscape to determine if heterogeneity affects the ability of a patch to serve as a source of biocontrol services.

• #:

3

State:

[Ohio](#)

Project title:

Enhancing cold tolerance of the parasitoid *Nasonia vitripennis*

[view report](#)

Keywords:

[Fly ectoparasitoid](#), [cold hardiness](#), [diapause](#), [Sarcophaga](#), [Nasonia](#), [envenomation responses](#)

Key personnel:

[David L. Denlinger and Yuyan Lu](#)

Objective(s) addressed:

Objective 3

Abstract:

One of the urgent needs of the biological control industry is the ability to store and transport parasitoids while assuring clients that they will be healthy and ready to perform upon demand. Our goal is to enhance the ability to store parasitoids, such as *Nasonia vitripennis*, for long periods without sacrificing quality of the parasitoid. We are thus examining ways to increase cold tolerance of the parasitoids by manipulating diets, hosts and other environmental parameters.