NCERA 220 Annual Meeting Minutes, 11 March 2014, Des Moines, Iowa

Debbie Finke, Secretary

Attendance:

Matt Grieshop (Michigan State University)
Robert Wright (University of Nebraska)
Jim Nechols (Kansas State University)
Brian McCornack (Kansas State University)
Lee Solter (Illinois Natural History Survey)
Jen White (University of Kentucky)
Ada Szczepaniec (South Dakota State University)
Debbie Finke (University of Missouri)
Ben Puttler (University of Missouri)
John Ruberson (Kansas State University)
Ian Kaplan (Purdue University)
Julie Peterson (University of Nebraska, representing the University of Minnesota)
Camila de Oliveira (student, University of Nebraska)
Matt O'Neal (Iowa State University)

1. Introductions

2. 2013 State reports – State reports were presented as 10 min presentations using powerpoint.

3. Electronic submission of 2012 reports – Reports were submitted electronically for the first time last year. The group agrees that it is an easy and uniform platform for generating the state report. Brian McCornack presented more details on how to use the website. Suggests that biocontrol activities, publications, etc. can be attached to the state reports.

   Brian McCornack proposes that we spend more time at the next meeting discussing how we view the role of the website. Do we want the website to be public? Do we want to use the site for education? How do we see making this website an active part of our teaching/research/extension programs?

   Lee Solter suggests taking down the Midwest Institute site (midwestbiocontrol.org), which is housed at the University of Illinois, since the information is outdated and the site is not maintained.

4. 2015 Symposium Topics? – The next NC branch meeting will be in Manhattan, Kansas. They are encouraging hands-on, interactive events. Topic suggestions include weed biocontrol, biocontrol and climate change, biocontrol and the landscape, conservation biocontrol using prairies, prairies in

agricultural or urban landscapes, grassland associated biological control. Symposium may include field trip to the Konza Prairie.

5. Election of new secretary:

   Brian McCornack nominates self, Matt O'Neal seconds, Brian elected unanimously

6. 2015 Meeting – John Ruberson suggested that state reports should be submitted before the meeting. Members will read state reports beforehand so that the meeting can focused on discussion of linkages among programs and making connections. Jen White suggested that 2 hours is not enough time. Bob Wright suggested meeting on the Saturday before the meeting. Lee Solter commented that other working groups are already meeting that day.

7. Meeting adjourned.

   (State reports follow)

2013 State Reports

Indiana

❖ Indiana 2013: Report #32

Project title:

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

Key personnel:

- Lindsay Kolich
- Cliff Sadof
- Matt Ginzel

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- forests
- ash trees
- emerald ash borer

❖ Indiana 2013: Report #33

Project title:

Effects of thiamethoxam seed treatments on nutritive sources available to Orius insidiosus Say (Hemiptera: Anthocoridae) in Indiana soybean agroecosystems

Key personnel:

- Madeline Spigler
- Christian Krupke

Objective(s) addressed:

Objective 2

Project Description:

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 thiamethxoam 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.

Keywords:
- soybean
- soybean aphids
- neonicotinoids

❖ **Indiana 2013: Report #34**

Project title:

Induced volatiles prime tomato plants for attraction of Cotesia congregata (Hymenoptera: Braconidae)

Key personnel:
- Elizabeth Rowen
- Natalia Dudareva
- Ian Kaplan

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:
- tomato
- plant volatiles

❖ **Indiana 2013: Report #36**

Project title:

Intraguild rodent-beetle interactions impact weed seed predation

Key personnel:
- Carmen Blubaugh
- Kevin Gibson
- Ian Kaplan

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- weed biocontrol

❖ **Indiana 2013: Report #54**

Project title:

Conservation biocontrol and carbon sequestration in agroecosystems: the role of land use and management in maximizing ecosystem services to agriculture

Key personnel:

- Rowe
- Helen; Holland
- Jeffrey D.; Gramig
- B.; Dukes
- J.

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- ecosystem services
- biocontrol
- carbon sequestration
- circuit theory

❖ **Indiana 2013: Report #55**

Project title:

Beetle predators of hardwood borers

Key personnel:

- Holland
- Jeffrey D.; Kissick
- Ashley

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- biocontrol
- hardwood forest
- predators
- Cerambycidae
- Buprestidae

❖ **Indiana 2013: Report #56**

Project title:

Managing spider mite outbreaks in Nursery and landscape tree plantings

Key personnel:

- Sadof
- Cliff; Prado
- Julia; Quesada
- Carlos; Witte
- Adam

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- mites
- ornamental plants

❖ **Indiana 2013: Report #57**

Project title:

Classical biological control of emerald ash borer

Key personnel:

- Cliff Sadof
- Steve Yaninek
- Donnie Peterson

Objective(s) addressed:

Objective 4

Project Description:
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.
Keywords:

- ash trees
- emerald ash borer

Kansas

❖ **Kansas 2013: Report #11**
Project title:
Paternal effects and male seminal depletion in two Coccinella species
Key personnel:

- Geetanjali Mishra Omkar
- Mahadev Bista
- J. P. Michaud

Objective(s) addressed:
Objective 3
Project Description:
Contact key personnel for more information.
Keywords:

- Coccinella septempunctata
- Coccinella transversalis
- fertility
- paternal effects
- sexual activity
- seminal fluid depletion

Kentucky

❖ **Kentucky 2013: Report #13**
Project title:
The endosymbiont Arsenophonus is widespread in soybean aphid, Aphis glycines, but does not provide protection from parasitoids or a fungal pathogen
Key personnel:

- Jason A. Wulff
- Karrie A. Buckman

- Kongming Wu
- George E. Heimpel
- Jennifer A. White

Objective(s) addressed:

Objective 2

Project Description:

Aphids commonly harbor bacterial facultative symbionts that have a variety of effects upon their aphid hosts, including defense against hymenopteran parasitoids and fungal pathogens. The soybean aphid, Aphis glycines Matsumura (Hemiptera: Aphididae), is infected with the symbiont Arsenophonus sp., which has an unknown role in its aphid host. Our research goals were to document the infection frequency and diversity of the symbiont in field-collected soybean aphids, and to determine whether Arsenophonus is defending soybean aphid against natural enemies. We performed diagnostic PCR and sequenced four Arsenophonus genes in soybean aphids from their native and introduced range to estimate infection frequency and genetic diversity, and found that Arsenophonus infection is highly prevalent and genetically uniform. To evaluate the defensive role of Arsenophonus, we cured two aphid genotypes of their natural Arsenophonus infection through ampicillin microinjection, resulting in infected and uninfected isolines within the same genetic background. These isolines were subjected to parasitoid assays using a recently introduced biological control agent, Binodoxys communis [Braconidae], a naturally recruited parasitoid, Aphelinus certus [Aphelinidae], and a commercially available biological control agent, Aphidius colemani [Braconidae]. We also assayed the effect of the common aphid fungal pathogen, Pandora neoaphidis (Remaudiere & Hennebert) Humber (Entomophthorales: Entomophthoraceae), on the same aphid isolines. We did not find differences in successful parasitism for any of the parasitoid species, nor did we find differences in P. neoaphidis infection between our treatments. Our conclusion is that Arsenophonus does not defend its soybean aphid host against these major parasitoid and fungal natural enemies.

Keywords:

- bacterial endosymbionts
- biological control
- defensive symbioses
- invasive species

Michigan

❖ **Michigan 2013: Report #22**

Project title:

Biological Control of Spotted Knapweed in Michigan

Key personnel:

- Doug Landis

Objective(s) addressed:

Objective 2

Objective 3

Project Description:

Spotted knapweed is an invasive weed of growing importance in Michigan. We released three natural enemies: Cyphocleonus achates, Larinus minutus and L. obtusus at 6 MI study sites and

confirmed establishment. Spotted knapweed provides valuable nectar resources for commercial honeybee keepers so we also began native plant species assessment for replacement of knapweed pollinator habitat

Keywords:

- spotted knapweed
- Cypholeonus achates
- Larinus minutus
- Larinus obtusus

❖ **Michigan 2013: Report #23**

Project title:

Evaluating Natrural Biological Control Potential for Brown Marmorated Stink Bug in Michigan and New Jersey

Key personnel:

- Matthew Grieshop
- Anne Nielsen
- Kristin Deroshia
- John Pote

Objective(s) addressed:

Objective 1
Objective 2
Objective 3

Project Description:

We have continued 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. We deployed sentinel eggs in tomatoes and apples and used video surveillance on a subset to capture predation and parasitism events. Overall rates of predation and parasitism were higher in New Jersey compared to Michigan. In Michigan, parasitoids were collected at one of two sites and predation was slightly higher in apples than tomatoes — although overall predation/parasitism rates were under 10% in Michigan. Six species of parasitoids collected and Orthoptera, Neurotptera, Dermaptera, Aranae identified as egg predators. We will continue this study in 2014.

Keywords:

- brown marmorated stink bug
- Conservation Biological Control

❖ **Michigan 2013: Report #24**

Project title:

Classical Biological Control of Emerald Ash Borer in the U.S.

Key personnel:

- Leah Bauer
- Jian Duan
- Kris Abell
- Roy Van Driesche

Objective(s) addressed:

Objective 1
Objective 2
Objective 3
Objective 4

Project Description:

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. planipennisi and an egg parasitoid —O. agrili. In 2013 we continued release and tracking of two parasitoids: (Larval) Tetrastichus planipennisi and (Egg) Oobius agrili. We have confirmed successful establishment in MI, NY and WI and made new releases in Canada in 2013.

Keywords:

- emerald ashborer
- classical biological control
- parasitoids

❖ **Michigan 2013: Report #25**

Project title:

Brown marmorated stink bug parasitoid non-target screening

Key personnel:

- Earnest Delfosse

Objective(s) addressed:

Objective 3
Objective 4

Project Description:

We are continuing to collaborate in a national project funded by USDA APHIS to perform host specificity testing for the exotic egg parasitoid Trissolcus japonicus. In 2013 we began screening

the parasitoid against native/naturalized stink bugs collected in MI. The parasitoid parasitized and completed its development in both the spined soldier bug and brown stink bug. We are continuing trials in 2014.

Keywords:

- brown marmorated stink bug
- classical biocontrol
- quarantine
- host specificity

❖ **Michigan 2013: Report #26**

Project title:

Rotational grazing of hogs for insect, weed, and disease pest management

Key personnel:

- Matthew Grieshop
- Krista Buehrer

Objective(s) addressed:

Objective 1
Objective 2
Objective 3

Project Description:

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. In 2012 and 2013 we evaluated the impact of hogs on non-target insects and annelids. Hogs did not have an impact on the many species evaluated suggesting that they are unlikely to to interfere with ecosystem services.

Keywords:

- livestock apples
- hogs
- augmentative biocontrol
- plum curculio
- codling moth
- apple scab
- weeds

❖ **Michigan 2013: Report #27**

Project title:

Development of black soldier fly as an alternative host for Entomopathogenic nematodes

Key personnel:

- Matthew Grieshop
- Joe Tourtois

Objective(s) addressed:

Objective 1
Objective 3

Project Description:

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. In 2013 we determined that injuring larval flies greatly increased their susceptibility to nematode infection for Steinernematidae but not Heterorhabditidae. Our next step will be to quantify production potential of EPN from black soldier fly larvae and to develop streamlined rearing methods.

Keywords:

- entomopathogenic nematodes
- black soldier fly
- augmentative biological control

❖ **Michigan 2013: Report #28**

Project title:

Development of New Fungal Biocontrol for Fruit Pests

Key personnel:

- Mark Whalon
- Pete Nelson
- Duncan Selby

Objective(s) addressed:

Objective 3

Project Description:

Laboratory experiments were performed to screen 2 strains of Isaria fumosorosea (entomopathogenic fungus) plum curculio, codling moth, and oblique-banded leaf roller. Larvae of all insects were found to be more susceptible than pupae or adults (for plum curculio).

Keywords:

- codling moth
- Oblique banded leafroller
- plum curculio
- entomopathogens

❖ **Michigan 2013: Report #29**

Project title:

Impact of Hightunnels on Biopesticide Infectivity

Key personnel:

- Mark Whalon
- Pete Nelson

Objective(s) addressed:

Objective 3

Project Description:
The impacts of hightunnel fruit production on biopesticides was evaluated under field conditions. Beauveria bassiana was found to be more effective under high tunnels than open crop conditions —this is likely due to UV screening provided by hightunnel plastic. Low soil moisture levels may have limited limiting the success of entomopathogenic nematodes in high tunnels.

Keywords:

- Hightunnel
- Protected Culture
- Beauvaria bassiana
- entomopathogenic nematodes

❖ **Michigan 2013: Report #30**

Project title:

Impacts of insecticide programs on natural biological control in blueberries

Key personnel:

- Rufus Issacs
- Brett Blaauw

Objective(s) addressed:

Objective 1
Objective 3
Objective 4

Project Description:
The impact of commonly used insecticide programs were evaluated in the laboratory and field for their impact on native/naturalized predators, parasitoids and pollinators. Broad spectrum insecticides lowered natural enemy abundance. This is especially important to consider in the face of spotted wing drosophila invasions impact on grower insecticide programs.

Keywords:

- Conservation Biological Control
- Blueberries

❖ **Michigan 2013: Report #31**

Project title:

Improving Open Rearing Systems for Greenhouse and Hightunnel Biological Control

Key personnel:

- Matthew Grieshop
- Joe Tourtois

Objective(s) addressed:

Objective 3
Objective 4

Project Description:
We initiated a study evaluating different open rearing systems for Atheta coriaria —a commonly used soil predator of thirps and fungus gnats. Unprotected open rearing piles produced more beetles than piles contained in perforated plastic containers or in mesh bags. We are repeating

this study and testing the compatibility of common species of entomopathogenic nematodes and A. coriaria in 2014.

Keywords:

- augmentative biological control
- Conservation Biological Control
- Protected Culture
- Atheta coriaria

❖ **Michigan 2013: Report #32**

Project title:

Video identification of soybean aphid predators.

Key personnel:

- Doug Landis
- Megan Woltz

Objective(s) addressed:

Objective 3

Project Description:

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 for a second year in soybean with vacuum samples, direct observations, and video observations. Predatory bugs, carabid beetles, arachnids and lacewings were the most abundant natural enemies. Natural enemy activity was equivalent in day and night but most prey were killed during daytime hours.

Keywords:

- soybean aphid
- predators
- video

❖ **Michigan 2013: Report #33**

Project title:

Impacts of winter cover crops on predator diversity and biological control services in corn biofuel systems

Key personnel:

- Doug Landis
- Ben Werling
- Aaron Fox

Objective(s) addressed:

Objective 3

Project Description:

Predator community surveys were conducted in corn with and without winter cover crops. We did not observe a consistent effect of cover crops and spiders and ants prevalent across treatments. We will repeat the study in 2014.

Keywords:

- Biofuel
- Corn
- Cover Crops
- Conservation Biological Control

❖ **Michigan 2013: Report #34**

Project title:

On Farm Rearing of Entomopathogenic Nematodes

Key personnel:

- Matthew Grieshop
- Joe Tourtois
- John Dindia

Objective(s) addressed:

Objective 4

Project Description:

We developed a handout and YouTube video documenting how to rear entomopathogenic nematodes on wax worms. This material is being shared with farmers so that they can produce their own biological control agents for use against soil pests. The video can be viewed at: http://www.youtube.com/watch?v=kSDQbJRh0Ss

Keywords:

- entomopathogenic nematodes
- augmentative biological control
- Extension
- Outreach

Minnesota

❖ **Minnesota 2013: Report #15**

Project title:

The role of diversified bioenergy cropping systems in enhancing biological control of the soybean aphid

Key personnel:

- Julie A. Peterson
- Milan Plećaš
- James O. Eckberg
- Joe M. Kaser
- Karen E. Blaedow
- Gregg A. Johnson
- George E. Heimpel

Objective(s) addressed:

Objective 2
Objective 3

Project Description:

This study examines the ability of integrated cropping systems (soybean with perennial willow and prairie polyculture) to produce bioenergy and support natural enemies and biological control of the soybean aphid. The abundance of soybean aphids and their natural enemies (e.g., lady beetles, lacewings, minute pirate bugs, hoverflies, parasitoids, etc.) within perennial crops and in adjacent soybean was measured throughout the growing season using a combination of sampling methods. Biological control was quantified using BSI field cages and by monitoring soybean plants with experimentally elevated soybean aphid densities ('flared aphids') at each plot for two weeks. Additionally, bioassays were performed on the gut-contents of field-collected natural enemies to determine the extent of perennial crop-provided resource utilization: polymerase chain reaction (PCR) for alternative prey, anthrone for floral and extra-floral nectar, and acetolysis for pollen.

Keywords:

- Aphis glycines
- Orius insidiosus
- Harmonia axyridis
- Chrysoperla plorabunda
- perennial
- anthrone
- pollen
- PCR

❖ **Minnesota 2013: Report #16**

Project title:

Interactions of a "risky" biological control agent with target and non-target aphids

Key personnel:

- Joe M. Kaser
- George E. Heimpel

Objective(s) addressed:

Objective 3
Objective 4

Project Description:

The parasitoid Aphelinus certus (Hymenoptera: Aphelinidae) was considered for release against the invasive soybean aphid (Hemiptera: Aphididae). Tests revealed broad parasitism by A. certus within Aphididae, therefore release of the parasitoid was considered too great a risk to native aphid species. Unfortunately, A. certus, was inadvertently introduced - first recorded in Pennyslvania in 2005 - and it has since been found through much of the Canadian and US soybean growing region. Interestingly, this accidental introduction presents an opportunity to explore the interaction between risk and efficacy of an introduced biological control agent. We designed a field experiment to explore the direct and indirect effects of A. certus on the target soybean aphid in soybean, and on non-target grain aphids in wheat. Implications for risk-benefit analysis in biological control are discussed.

Keywords:

- Aphelinus certus
- Aphis glycines
- parasitoid

❖ **Minnesota 2013: Report #17**

Project title:

Promoting sustainable biological control of the soybean aphid by examining the effect of biodiversity on releases of the parasitoid wasp Aphelinus glycinis

Key personnel:

- Nick Padowski
- Julie A. Peterson
- George E. Heimpel
- Keith R. Hopper
- Donald L. Wyse
- Carmen Fernholz
- Gregg A. Johnson
- Joe M. Kaser
- James O. Eckberg

Objective(s) addressed:

Objective 1
Objective 2
Objective 3
Objective 4

Project Description:

Our goals are to provide an effective pest control option for organic soybean growers and to reduce insecticide inputs in conventional and reduced input soybean production by releasing a biological control agent of the soybean aphid. This research will identify favorable conditions for release and establishment of the Asian parasitoid wasp Aphelinus glycinis, a biological control agent recently approved for release by the USDA (APHIS-PPQ). These goals will be met by addressing the following objectives: 1) Determine if biodiversity adjacent to soybean fields improves establishment of A. glycinis; 2) Quantify the biological control impact that A. glycinis has on soybean aphid populations; 3) Delineate how diversity-provided resources, such as nectar, are utilized by A. glycinis; 4) Collaborate with organic growers to conduct on-farm and farmer-assisted field releases and evaluations of A. glycinis control of soybean aphid.

Keywords:

- Aphelinus glycinis
- Aphis glycines
- organic
- classical biological control
- parasitoid

❖ **Minnesota 2013: Report #18**

Project title:

Classical biological control of the parasitic fly Philornus downsi attacking Darwin's finch nestlings in the Galapagos Islands

Key personnel:

- Mariana Bulgarella
- George E. Heimpel
- Jonathan Dregni

Objective(s) addressed:

Objective 3
Objective 4

Project Description:

This project will conduct research on the avian parasite Philornis downsi (Diptera: Muscidae) that has invaded the Galapagos Islands where it is attacking Darwin's Finches. This work takes place in the Galapagos as well as mainland Ecuador and Trinidad & Tobago. Efforts are being made to collect parasitoids of the fly in its native range in the Caribbean and mainland Ecuador and assess their suitability for classical biological control.

Keywords:

- Philornis downsi
- Darwin's finch
- parasitoid
- classical biological control

❖ **Minnesota 2013: Report #19**

Project title:

Molecular detection of hitch-hiking parasitoids in migratory aphids from the Midwest Suction Trap Network

Key personnel:

- Anh K. Tran
- Amanda R. Stephens
- Doris M. Lagos
- Julie A. Peterson
- Joe M. Kaser
- George E. Heimpel

Objective(s) addressed:

Objective 2
Objective 3

Project Description:

Long distance dispersal in aphids occurs by the production of winged morphs called alates. Parasitoids are important natural enemies of many aphid pest species, and may be important for effective biological control. Parasitized alate aphids are commonly observed in the field, but it is unclear how this may affect parasitoid dispersal and tracking of aphid hosts. Alate parasitism may be especially important for host-plant alternating aphid species, such as the soybean aphid, Aphis glycines, which migrates between buckthorn and soybean in the spring and fall. Our objective is to determine if parasitized migrating aphids can be detected through molecular analysis.

Keywords:

- Aphis glycines
- Aphelinus certus
- parasitoid
- PCR

❖ **Minnesota 2013: Report #20**

Project title:

Interactions between Harmonia axyridis and Coleomegilla maculata in maize and soybean

Key personnel:

- Kristina Prescott
- David A. Andow

Objective(s) addressed:

Objective 3

Project Description:

Coleomegilla maculata is not common in soybean despite high abundance of soybean aphid. This does not seem to be related to exclusion from intraguild predation by Harmonia axyridis.

Keywords:

- Harmonia axyridis
- Coleomegilla maculata
- intraguild predation

❖ **Minnesota 2013: Report #21**

Project title:

Molecular gut-content analysis using Next Generation DNA sequencing to detect predation

Key personnel:

- D. P. Paula
- A. Vogler
- David A. Andow

Objective(s) addressed:

Objective 2
Objective 3

Project Description:

This project seeks to develop methods for using Next Generation DNA sequencing to analyze the gut-contents of several species of generalist predators.

Keywords:

- PCR
- next generation DNA sequencing
- generalist predators

Missouri

❖ **Missouri 2013: Report #35**

Project title:

Monitoring Soybean Aphid (Aphis glycines)

Key personnel:

- Ben Puttler

Objective(s) addressed:

Objective 2

Project Description:

No overwintering populations of soybean aphids were detected on buckthorn in the spring of 2013.This no doubt contributed to the scarcity and non-existence of aphid populations throughout the state. In central Missouri the aphid was first detected in late August – a month later than in past years. It occurred as single aphids or small colonies on individual plants. This situation existed until the end of September when most of the plants defoliated. In October a few overwintering aphids were found on buckthorn with no eggs detected to date (with W. Bailey, baileyw@missouri.edu).

Keywords:

- soybean aphid

❖ **Missouri 2013: Report #36**

Project title:

Stinkbugs (Pentatomidae) Parasites

Key personnel:

- Ben Puttler
- Wayne Bailey

Objective(s) addressed:

Objective 2

Project Description:

Two species of stinkbug parasites were reared from a small woodland and prairie habitat located on the University of Missouri, Columbia campus. One species was reared in 2010 from an unidentified egg mass collected from a leaf on a buckthorn tree. It was identified as Trissolcus brochymenae (Ashmead). In 2013 an attempt was made to resurrect this species using egg masses obtained from three species of adult stinkbugs (Chinavia hilaris, Euschistus servus, E. variolaris) collected from soybeans. Two sentinel egg masses of each species were attached to foliage of buckthorn and prairie sun flower. After 48 hours they were returned to the lab and held in plastic vials to determine parasitism. Adult parasites emerged from all three species and were subsequently identified as T. euschisti (Ashmead). Adult females emerging from the field parasitized egg masses were exposed to egg masses of the same three species in addition to Podisus maculiventris (obtained from a laboratory colony maintained at the USDA Biological Control Laboratory, Columbia) were accepted for oviposition and successful development (N.F. Johnson, Ohio State University, identified the parasites).

Keywords:

- Stink bug
- Trissolcus brochymenae

- Trissolcus euschisti

❖ **Missouri 2013: Report #37**

Project title:

Biological Control of Spotted Knapweed (Centaurea stoebe)

Key personnel:

- Ben Puttler

Objective(s) addressed:

Objective 2

Project Description:

No extensive surveys were conducted in 2013 to determine the status of the spotted knapweed seed (Larinus minutus) and root (Cyphocleonus achates) weevils at previous release sites except for one. At this established site, both weevils were again readily observed with the seed weevil having dispersed for at least one mile. (Missouri Department of Transportation)

Keywords:

- spotted knapweed
- Centaurea stoebe

❖ **Missouri 2013: Report #38**

Project title:

Monitoring Milky Disease (Paenibacillus lentimorbus)

Key personnel:

- Ben Puttler

Objective(s) addressed:

Objective 2

Project Description:

As in the past two years, climatic conditions in 2013 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.

Keywords:

- milky disease
- Paenibacillus lentimorbus

❖ **Missouri 2013: Report #39**

Project title:

Building parasitoid-host interaction webs

Key personnel:

- Kathryn Ingerslew
- Deborah Finke

Objective(s) addressed:

Objective 2

Project Description:

We are using interaction webs to understand how non-enemy parasitoids can contribute to biological control by inducing changes in herbivore behavior. We have found that parasitoids can reduce the abundance of non-host aphids through behavioral interactions. However, these non-enemy effects may interfere with suppression by biological control agents.

Keywords:

- parasitoids
- behavior
- trait-mediated interactions

❖ **Missouri 2013: Report #40**

Project title:

Pollinator use of ecotype vs. non-ecotype native plants

Key personnel:

- Wayne Bailey

Objective(s) addressed:

Objective 2

Project Description:

Investigating the role of plant ecotype in attracting pollinators in cover crop systems.

Keywords:

- Cover Crops

❖ **Missouri 2013: Report #41**

Project title:

Fungal pathogens of termites

Key personnel:

- Tamra Reall
- Richard Houseman

Objective(s) addressed:

Objective 2

Project Description:

Comparing the relative frequency and virulence of the entomopathogenic fungi (Beauveria and Metarhizium) in forested and developed/urban soils.

Keywords:

- Beauveria
- Metarhizium

Nebraska

❖ **Nebraska 2013: Report #18**

Project title:

Assessing the impact of beneficial arthropods in irrigated sugar beet agroecosystems for sustainable pest- and weed management in western Nebraska

Key personnel:

- Johan Pretorius
- Jeff Bradshaw
- Gary Hein

Objective(s) addressed:

Objective 3

Project Description:

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.

Keywords:

- sugar beets
- carabids
- weed seed predation

❖ **Nebraska 2013: Report #14**

Project title:

Toxicity of thiamethoxam seed treatments on key natural enemies of soybean aphid

Key personnel:

- Carolina Camargo
- Blair Siegfried
- Thomas Hunt

Objective(s) addressed:

Objective 3

Project Description:

Thiamethoxam is a widely used neonicotinoid compound applied as a seed treatment in soybean crops. During the last few years there has been a growing concern about the impact of thiamethoxam on beneficial insects in soybean crops. Negative impacts on beneficial arthropod communities are based on the fact that neonicotinoid residues can be present in soybean vegetative tissue, host insects and flower tissues making them toxic to pollinators and natural enemies. Therefore, the risk characterization of neonicotinoids to natural enemies needs to be developed through the evaluation of multiple routes of exposure to the insecticide. The objective of this study was to evaluate the toxicity of thiamethoxam on key natural enemies of soybean aphid exposed to residues in vegetative tissue and in insect prey. To achieve this objective, the predators Orius insidiosus and Crysoperla rufilabris where exposed to different concentrations of thiamethoxam in soybean leaves and in soybean aphid using different laboratory methodologies. The results show that the concentrations required to kill more than 50% of the evaluated insects were higher than the concentrations that the insects are exposed to in the field. The influence of the laboratory bioassay methodologies in the evaluation of the toxicity of neonicotinoids on natural enemies is also discussed.

Keywords:

- thiamethoxam
- soybeans
- soybean aphid

❖ **Nebraska 2014: Report #7**

Project title:

Suppressing pests and noxious weeds in sugar beets through the conservation of beneficial arthropods

Key personnel:

- Johan Pretorius
- Jeff Bradshaw
- Gary Hein

Objective(s) addressed:

Objective 3

Project Description:

The ability for reduced tillage systems to benefit ecosystem services in cropping systems has been shown in a number of cropping systems common to the central and eastern Great Plains. However, little work has considered the relatively diverse cropping systems of the western Great Plains and the High Plains ecoregion. The study evaluated the functional ecology of the beneficial edaphic arthropods in sugar beets in western Nebraska. We found that our dominant beneficial arthropod group in one sugar beet production system in western Nebraska are the Carabidae. Less dominant groups included: Chilopoda, Staphilinidae, and Araneae. All of the less-dominant groups had significantly-higher numbers in reduced tillage sugar beets (zone tillage) than in a conventional (spring plow) tillage. However, ground beetles numbers were not impacted (n=180 pitfall samples in 2012 and 2013). However, based on seed-feeding exclusion-cage studies, yellow foxtail, barnyardgrass, Kochia, and lambsquarters all had significantly-higher weed-seed consumption in reduced-tillage sugar beets (in 2012 and 2013). This effect was particularly evident for barnyard grass and Kochia were as much as 90% seed-feeding rates were recorded over a 24-hour period in a reduced-tillage system as compared to 20-50% in our conventional system. Studies continue to evaluate effects on predation rates.

Keywords:

- Ground beetles
- biological control
- biocontrol
- crop management

North Dakota

❖ **North Dakota 2013: Report #8**

Project title:

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

Key personnel:

- Ashton Hansen
- Deirdre A. Prischmann-Voldseth

- Amitava Chatterjee
- Greta G. Gramig

Objective(s) addressed:

Objective 3

Project Description:

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.

Keywords:

- weed management
- glyphosate
- soil arthropods
- soybean

❖ **North Dakota 2013: Report #9**

Project title:

Soybean arthropod communities in conventional and organic soybean fields and buckthorn

Key personnel:

- Erin McLean
- Deirdre A. Prischmann-Voldseth
- Jason Harmon

Objective(s) addressed:

Objective 2

Project Description:

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.

Keywords:

- soybean
- buckthorn
- soybean aphids
- natural enemies
- organic systems

❖ **North Dakota 2013: Report #10**

Project title:

Integrated management of Canada thistle

Key personnel:

- Erin Burns

- Greta G. Gramig
- Burns EE
- Deirdre A. Prischmann-Voldseth

Objective(s) addressed:

Objective 3

Project Description:

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.

Keywords:

- Hadroplontus litura
- stem-mining weevil
- Urophora cardui
- gallfly
- thistle

Ohio

❖ Ohio 2013: Report #3

Project title:

Enhancing cold tolerance of the parasitoid Nasonia vitripennis

Key personnel:

- David L. Denlinger and Yuyan Lu

Objective(s) addressed:

Objective 3

Project Description:

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.

Keywords:

- Fly ectoparasitoid
- cold hardiness
- diapause
- Sarcophaga
- Nasonia
- envenomation responses

❖ Ohio 2013: Report #4

Project title:

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

Key personnel:

- Mary Gardiner

Objective(s) addressed:

Objective 3

Project Description:

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.

Keywords:

- vacant land
- urban farm
- brownfield
- biodiversity ecosystem function

South Dakota

❖ **South Dakota 2013: Report #11**

Project title:

Impact of neonicotinoid insecticides applied as seed treatments and foliar sprays on beneficial insects associated with soybean

Key personnel:

- Adrianna Szczepaniec

Objective(s) addressed:

Objective 1
Objective 3

Project Description:

This project addresses the impact of neonicotinoid insecticide treatments with thiamethoxam on beneficial insect communities associated with soybean system. In the first year of the project, we tested if these insecticides affected abundance and diversity of predators in soybean fields. In replicated field experiments at two locations in the eastern South Dakota we demonstrated that predators associated with soybean aphids in particular were more prevalent in untreated plots

than in plots treated with the neonicotinoid insecticides applied as foliar treatments. These predators included Coccinellidae, Anthocorida, and Chrysopidae. Soybean aphid abundance in untreated plots tended to be greater than in treated plots, and differences in predatory insects between treatments were largely explained by aphid numbers. On the other hand, we found that Thripidae and Tetranychidae were more prevalent in plots exposed to foliar treatments of thiamethoxam. Little treatments differences were detected between arthropod abundance in untreated plots and seed-treated plots. These experiments will be repeated this summer. Results of this project were also highlighted during South Dakota State University Volga Field Day. A short outreach article summarizing the results is under preparation and will be posted on iGrow.org, an SDSU Extension website.

Keywords:

- neonicotinoid insecticides
- non-target effects

❖ **South Dakota 2013: Report #12**

Project title:

Classical biological control of invasive weeds

Key personnel:

- Darrell Deneke

Objective(s) addressed:

Objective 3

Project Description:

In a collaborative project with the South Dakota Department of Agriculture and the South Dakota Weed and Pest Board, we are investigating the effectiveness of using the poison hemlock moth against the poison hemlock. This project is in its first year, and activities include identifying rancher/farmer collaborators and tracking the movement of the moths.

In separate projects, we are involved in releases and tracking of the leafy spurge flea beetles for control of the leafy spurge. We have established rancher and land owner collaborators in the state and every year we collect and distribute the flea beetles. This project has been continuing for several years now and has been relatively successful around the state. These activities are highlighted and advertised during field days and described as short blog-like articles on the SDSU Extension website.

Keywords:

- weed biocontrol
- poison hemlock
- purple loosestrife
- spotted knapweed