Grant Agreement Number: 06-033W

Adam M. Wallner
Natural Resources Building
607 E. Peabody Dr.
Champaign, IL 61820
(217) 384-0433
Time Frame: 07/05 – 09/05 & 07/06 – 09/06
wallner@uiuc.edu

Project Objectives

1) Generate a faunal inventory of auchenorrhynchous Homoptera from wet, mesic, sand, dolomite and loess hill prairies throughout the state of Illinois
2) Construct a database of all species encountered at each site and make it available to the scientific and public communities
3) Produce species distribution maps of auchenorrhynchous Homoptera using GIS
4) Identify conservation priority areas
5) Publish manuscripts and give oral presentations

Introduction

Auchenorrhynchous Homoptera (i.e., leafhoppers, treehoppers, spittle bugs, cicadas, and planthoppers) or AH represent some of the most speciose and abundant groups of organisms on the Illinois prairie (DeLong 1948, Harper *et al*. 2000, and Hamilton 2005). Many of these species are endemic to particular prairie ecotypes (Hamilton and Whitcomb 1993); are sensitive to environmental perturbations, such as fire (Panzer *et al*. 1995, Harper *et al*. 2000); and are readily identifiable and easily sampled (DeLong 1948, Nickel 2003). Despite these advantages, studies using AH to identify conservation priority areas in Illinois are lacking. Thus, the focus of this project was to 1) generate a faunal inventory of AH from wet, mesic, sand, dolomite, and loess hill prairies throughout the Illinois landscape; 2) construct a database of all species encountered at each site and make it available to the scientific and public communities; 3) produce species distribution maps of AH encountered using GIS software; and 4) use these data to identify conservation priority areas.

Materials and Methods

Approximately 31 prairies were collected in Illinois in the summer of 2005 and 2006. Sites were selected based on the advice of botanists from the Illinois Department of Natural Resources, The Nature Conservancy, and volunteer agencies. All major prairie ecotypes (i.e., wet, mesic, sand, dolomite, and loess) were sampled to accurately represent the entire tallgrass prairie biome within Illinois. In 2006 I focused my collecting efforts on hill prairies because they were under sampled in 2005, they represent some of the most endangered prairies in Illinois (Robertson *et al*. 1997), and harbor some of the most endemic and diverse AH fauna of any type of prairie community in Illinois (Bouchard *et al*. 2001, Hamilton 1995).

My sampling scheme consisted of randomly placing three 40-meter linear transects when vegetation was homogeneous. However, when vegetation was heterogeneous at a site I implemented stratified-random sampling. Strata were delineated by vegetation and three-random transects were placed within each stratum. All transects were parallel to one another and perpendicular to a 50-meter baseline (see Figure 1). The baseline was placed in the middle or near the edge of each site. I used a random numbers table for the placement of each transect along the baseline.

Along each of these transects I collected AH with a modified leafblower vacuum for approximately five minutes (see Figure 2). Sampling of AH was conducted in mid-July through mid-September, between 11:00 – 16:00 am for 3 to 4 hours, when annual richness/abundance occurs. GPS was used to accurately identify the location of sample points. All insects were stored in ethanol. Adult AH were identified to species, individuals were tallied, and specimens were deposited at the Illinois Natural History Survey Insect Collection. Soil moisture was not measured because of time constraints.

Results and Discussion

Of the 31 sites visited in 2005 and 2006, only 10 sites from 2005 have been processed. Based on these samples, AH species richness is greatest at Cox Creek Hill Prairie, followed by Fult's Hill Prairie, Revis Hill Prairie, Goose Lake Prairie, Sand Prairie-Scrub Oak Nature Preserve, Lost Mound Army Depot, Matanzas Prairie, Long Branch Nature Preserve, Ayers Sand Prairie, and then Grant Creek Prairie (see Table 1 for complete list of species at each of these sites).

A total of 48 AH species were recorded in the hill prairie opening at Cox Creek, including a number of rare species. *Bruchomorpha dorsata* (Figure 3), *B. jocosa* (Figure 4), *B. tristis*, *Delphacodes andromeda*, *D. caerulata* (new state record), *D. megadonte* (new state record), *D. rotundata*, *Fitchiella robertsonii*, *Flexamia pectinata*, *F. reflexa*, *F .sandersi Laevicephalus unicoloratus*, *L. minimus*, *Pendarus punctiscriptus* (new state record), *Phylloscelis pallescens*, *P. atra*, *Polyamia compacta*, *P. dilata*, *Rhyncomitra microrhina*, *Scolops angustatus*, and *S. pungens* all of which specialize on native perennial grasses and forbs, and are known only from a few localities in Illinois. A new planthopper genus (unknown to science) was also collected from this site.

The AH fauna of Fult's Hill Prairie, comprised 40 species, all of which were denizens in the unburned parts of the preserve. Two sites were extensively sampled. On the south part of the preserve yielded a large population of *Fitchiella robertsonii*, and *Bruchomorpha dorsata*, *B. pallidipes*, which are known to specialize on native prairies grasses and both, are known to occur in relatively undisturbed xeric prairies. Other notable finds include *Cicadetta calliope*, a cicada that occupies ecotonal habitats, *Delphacodes rotundata D. megadonte* (new county record), *Flexamia clayi*, *F. pectinata*, *F. reflexa*, *F. prairiana*, *Laevicephalus unicoloratus*, *Oliarus ecologus*, *Phylloscelis pallescens*, *Polyamia dilata*, and *P. compacta*, known only from a few localities in Illinois. On the large northern opening of the hill prairie, the most notable finds were *Cuerna alpina* (new state record) (Figure 5), *C. costalis*, and *Scaphytopius varius* (new county record), all known from only a few localities in Illinois.

A total of 38 AH species were recorded on the hill prairie openings at Revis Hill Prairie including a number of rare and prairie indicator species, such as *Acinopterus acuminatus*, *Athysanella incongrua* (Figure 6), *Bruchomorpha dorsata*, *B. jocosa*, *B. pallidipes*, *Chlorotettix spatulatus*, *Delphacodes rotundata*, *Flexamia albida* (Figure 7), *F. pectinata*, *F. reflexa*, *F. sandersi*, *Laevicephalus minimus*, *L. unicoloratus*, *Memnonia flavida*, *Paraphlepsius lobatus*, *P. umbellatus* (new county record), *Phylloscelis pallescens*, *P. atra*, *Polyamia compacta*, *P. dilata*, *Scaphytopius cinereus*, *Scolops angustatus*, *S. perdix*, and *Xerophloea major*, all of which specialize on native perennial grasses and forbs, and are known only from a few localities in Illinois.

Intensive sampling at Goose Lake Prairie yielded 37 AH species. The most notable finds were *Amplicephalus osborni*, *Bakerella cinerea*, *B. muscotana*, *Caenodelphax nigrapennata*, *Delphacodes sagae* (new county record), *Deltocephalus gnarus*, *Destria fumida*, *Dorydiella kansana*, *Flexamia inflata*, *Graminella aureovittata*, *Hecalus major*, *Laccocera vittipennis* (new county record), and *Neohecalus magnificus*, all specialize on native grasses and sedges. In addition, I recorded a population of *Opsius stractogalus*, an introduced ornamental tamarix-feeding leafhopper (see DeLong 1948). All species recorded occupied a large 300 acre remnant prairie, just southeast of the railroad tracks.

A total of 27 AH species were collected at Lost Mound Army Depot. A large population of *Philaenarcys killa*, *Polyamia rossi*, and *Rosenus cruciatus* (a specialist on *Koeleria macrantha*) were recorded, which are known to specialize on native prairie grasses, and are only known to occur in relatively undisturbed sand prairies (Hamilton 1995, 2005). Other notable finds include *Flexamia aerolata*, *F. reflexa*, *Laevicephalus unicoloratus*, *Polyamia herbida*, *Prairiana kansana*, *Rossmoneura tecta*, and

Scaphytopius cinereus, all of which specialize on native prairie grasses and forbs, and are known only from a few localities in Illinois.

The AH fauna at Sand Prairie-Scrub Oak Nature preserved, harbored 26 species. The most notable finds were *Bruchomorpha dorsata*, *Delphacodes mcateei*, which is a specialist on little bluestem and other native grasses, *Flexamia areolata*, *F. prairiana*, *F. reflexa*, and *F. sandersi*, *Graminella mohri*, *Laevicephalus unicoloratus*, *Polyamia rossi*, and *Xerophloea major*, all of which are prairie grass-specialists and prairie indicator species.

The AH fauna at Matanzas Prairie, harbored 26 species. The most notable finds were *Amplicephalus osborni*, a sedge specialist, *Kelisia veniculata* (new state record), *Megamelus distinctus*, and *Paraphlepsius lobatus*, a native grass-specialist. Nevertheless, many AH species typical of wet or wet-mesic prairie remained absent and the numerically dominant AH were widespread, generalist typhlocybine species, such as *Dikranuera angustata*, *Empoasca* spp., and *Forcipata loca*.

The AH fauna of Long Branch Nature Preserve, harbored 24 species. Rare prairie grass-specialist species found here include *Delphacodes rotundata*, *Flexamia areolata*, *F. grammica* (a specialist on *Calamovilfa longifolia*), *F. reflexa*, *F. sandersi*, *Laevicephalus unicoloratus*, *Polyamia rossi*, and *Xerophloea major*. However, many AH species typical of sand prairie remained absent and the numerically dominant leafhoppers were widespread, generalist deltocephaline species, such as *Endria inimica*, *Exitianus exitiosus*, and *Macrosteles quadrilineatus*, which maybe attributed to frequent burning.

Ayers Sand Prairie only harbored 9 species, which is the result of processing one sample. However, many rare prairie grass-specialist species were recorded, which include *Laevicephalus unicoloratus*, *Polyamia rossi*, *Prairiana kansana*, *Rosenus cruciatus*, and *Scolops angustatus*. All species recorded were restricted to unburned parts of the native prairie.

Grant Creek Prairie Nature Preserve harbored only 5 AH species. Nevertheless, most of these species recorded are rare and prairie indicators, which include *Aflexia rubranura* (see Figure 8), a specialist on *Sporobolus heterolepis*, *Aphelonema simplex*, a specialist on *Spartina pectinata*, *Flexamia inflata*, and *Neohecalus magnificus*, a specialist on *Spartina pectinata*. Low diversity may be attributed to the excessively hot and humid summer of 2005, which may dramatically affect AH development. Additional factors may include absence of host plants, and intensive burn management.

Summary

Preliminary data suggests that hill prairies harbored the highest number of AH species (126 spp.), followed by sand prairies (86 spp.), and then wet prairies (68 spp.). Moreover, of all the prairie ecotypes processed, hill prairies seemed to have retained most of their endemic AH fauna compared to the other prairie ecotypes sampled. Infrequent natural (e.g., wind) and anthropogenic (e.g., fire, grazing, development, etc.) disturbances may partially explain these results (see Robertson *et al*. 1997), but additional samples are needed to determine the validity of this trend.

References

DeLong, D.M. 1948. The leafhoppers, or Cicadellidae, of Illinois (Eurymelinae - Balcluthinae). State of Illinois Natural History Survey Bulletin 24(2): 97 - 376.

Hamilton, K.G.A. 1995. Evaluation of leafhoppers and their relatives (Insecta: Homoptera: Auchenorrhyncha) as indicators of prairie preserve quality. Pp. 211-2226 *in* D.C. Hartnett, ed., Proceedings of the Fourteenth North American Prairie Conference: Prairie Biodiversity. Kansas Sate University, Manhattan.

Hamilton, K.G.A. 2005. Bugs reveal an extensive, long-lost northern tallgrass prairie. Bioscience 55(1): 49 - 59.

Hamilton, K.G.A., and R.F. Whitcomb. 1993. Leafhoppers (Insecta: Homoptera: Cicadellidae) evidence of Pleistocene prairie persistence. Abstract from the 4th joint meeting of the Botanical Society of America and the Canadian Botanical Association, Ames, IA. American Journal of Botany 195: 67.

Harper, M.G., C.H. Dietrich, R.L, Larimore, and P.A. Tessene. 2000. Effects of prescribed fire on arthropods: an enclosure study. Natural Areas Journal 20: 325 - 335.

Nickel, H. 2003. The leafhoppers and planthoppers of Germany, (Homoptera: Auchenorrhyncha): Patterns and strategies in a highly diverse group of phytophagous insects. *In* H. Nickel, ed. Pensoft Publishers, Sofia-Moscow, 460 pp.

Panzer, R., D. Stillwaugh, R. Gnaedinger, and G. Derkovitz. 1995. Prevalence of remnant dependence among the prairie and savanna-inhabiting insects of the Chicago region. Natural Areas Journal 15: 101 - 116.

Robertson, K.R., R.C. Anderson, and M.W. Schwartz. 1997. The tallgrass prairie mosaic. Pp. 55 - 87 *in* M. Scwartz, ed., Conservation in Chronically Fragmented Landscapes. Chapman Hall, New York.

Tables and Figures

Table 1: List of AH species collected. LMAD is Lost Mound Army Depot., and SPSO is Sand Prairie-Scrub Oak Savanna

Genus	Species	Cox Creek	Fult's	Revis	Goose Lake	LMAD	SPSO	Matanzas	Longbranch	Ayers	Grant Creek
Acanalonia	*bivittata*	X	X								
Acinopterus	*acuminatus*			X							
Aflexia	*rubranura*										X
Agalliopsis	*novella*		X								
Agalliota	*constricta*	X			X						
Amphigonalia	*gothica*	X									
Amplicephalus	*osborni*				X			X			
Aphelonema	*simplex*				X						X
Aphrophora	*quadrinotata*	X									
Athysanella	*incongrua*			X							
Athysanus	*argentarius*				X						X
Bakerella	*cinerea*				X						
Bakerella	*muscotana*				X						
Balclutha	*impicta*				X						
Balclutha	*abdominalis*	X	X								
Balclutha	*neglecta*	X					X				
Bruchomorpha	*jocosa*	X		X							
Bruchomorpha	*dorsata*	X	X	X			X				
Bruchomorpha	*oculata*			X				X			
Bruchomorpha	*pallidipes*		X	X							
Bruchomorpha	*tristis*	X									
Campylenchia	*latipes*		X								
Ceratagallia	*uhleri*			X							
Ceratagallia	*agricola*	X	X	X		X	X	X	X		
Chlorotettix	*spatulatus*	X	X	X							
Chlorottetix	*galbanatus*	X									
Cicadetta	*calliope*		X								
Cicadula	*melanogaster*							X		X	
Cuerna	*alpina*		X								
Cuerna	*costalis*		X								
Delphacodes	*nigripennata*				X						
Delphacodes	*puella*						X	X	X		
Delphacodes	*sagae*				X						
Delphacodes	*andromeda*	X									
Delphacodes	*caerulata*	X									
Delphacodes	*campestris*					X					
Delphacodes	*megadonte*	X	X								
Delphacodes	*rotundata*	X	X	X					X		
Deltocephalus	*gnarus*				X						
Destria	*fumida*				X						
Dikraneura	*angustata*				X			X			
Dikraneura	*mali*		X		X	X					
Dorydiella	*kansana*				X						
Draeculacephala	*mollipes*				X	X					
Draeculacephala	*antica*	X									
Draeculacephala	*constricta*	X	X								
Empoasca	*bifurcata*							X			
Empoasca	*recurvata*				X						
Empoasca	*fabae*	X	X			X			X		
Endria	*inimica*			X		X	X	X	X		
Erasmoneura	*nigra*					X					
Erasmoneura	*vulnerata*			X							
Erythridula	*obliqua*							X			
Erythroneura	*comes*			X	X						
Exitianus	*exitiosus*							X	X		
Fitchiella	*robertsonii*	X	X								
Flexamia	*albida*			X							
Flexamia	*areolata*					X	X		X		
Flexamia	*grammica*								X		
Flexamia	*inflata*				X						X
Flexamia	*reflexa*	X	X	X		X	X		X		
Flexamia	*sandersi*	X		X			X		X		
Flexamia	*clayi*		X								
Flexamia	*pectinata*	X		X							
Flexamia	*prairiana*	X	X	X		X	X				
Forcipata	*loca*	X			X	X	X	X	X		
Graminella	*aureovittata*				X						
Graminella	*fitchii*								X		
Graminella	*mohri*						X				

Graminella	*nigrifrons*		X	X		X	X	X	X		
Gyponana	*aculeata*	X						X			
Hecalus	*major*				X						
Isodelphax	*basivitta*						X				
Kansendria	*kansana*	X					X				
Kelisia	*vesiculata*							X			
Laccocera	*vittipennis*				X						
Laevicephalus	*minimus*	X		X							
Laevicephalus	*unicoloratus*	X	X	X		X	X		X	X	
Latalus	*personatus*				X	X		X			
Latalus	*sayi*							X			
Lepyronia	*quadrangularis*			X							
Liburniella	*ornata*	X	X	X	X		X	X	X		
Macrosteles	*quadrilineatus*	X			X	X	X	X	X		
Macrosteles	*variata*										
Megamelus	*distinctus*							X			
Memnonia	*flavida*			X							
Micrutalis	*calva*				X						
Neocoelidia	*tumidifrons*	X		X	X			X			
Neohecalus	*magnificus*				X						X
Oliarus	*ecologus*		X								
Oncometopia	*orbona*	X					X				
Opsius	*stactogalus*				X						
Paraphlepsius	*irroratus*	X		X			X		X		
Paraphlepsius	*lobatus*			X							
Paraphlepsius	*umbellatus*			X							
Paraulazices	*irrorata*		X	X							
Pendarus	*punctiscriptus*	X									
Penthimia	*americana*		X								
Philaenarcys	*bilineata*					X				X	
Philaenarcys	*killa*					X					
Phylloscelis	*atra*			X							
Phylloscelis	*pallescens*	X	X								
Pissonotus	*piceus*						X	X			
Planicephalus	*flavicostus*		X	X					X		
Polyamia	*apicata*				X						
Polyamia	*caperata*	X	X	X	X	X	X		X	X	
Polyamia	*herbida*					X					
Polyamia	*rossi*						X		X	X	
Polyamia	*weedi*		X				X		X		
Polyamia	*compacta*	X	X	X							
Polyamia	*dilata*	X	X	X							
Prairiana	*kansana*					X				X	
Prosapia	*bicincta*	X	X								
Psammotettix	*lividellus*				X						
Rhynchomitra	*microrhina*	X									
Rosenus	*cruciatus*					X				X	
Rossmoneura	*tecta*					X					
Scaphytopius	*cinereus*		X	X		X					
Scaphytopius	*frontalis*	X			X						
Scaphytopius	*acutus*							X			
Scaphytopius	*varius*		X								
Scolops	*angustatus*	X		X						X	
Scolops	*perdix*			X							
Scolops	*pungens*	X									
Scolops	*sulcipes*	X	X								
Stenocranus	*delicatus*							X	X	X	
Stirellus	*bicolor*	X	X	X	X	X	X				
Texananus	*majestus*		X								
Vanduzea	*triguttata*			X							
Xerophloea	*major*		X	X			X		X		
Xerophloea	*peltata*				X						
Xestocephalus	*pulicarius*	X	X	X	X	X	X	X	X		

Figure 1. 40m transect at Longbranch Prairie Mason Co., IL

Figure 2. Vacuum sampling using a modified leafblower at Longbranch Prairie

Figure 3. *Bruchomorpha dorsata*

Figure 4. *Bruchomorpha jocosa*

Figure 5. *Cuerna alpine*

Figure 6. *Athysanella incongrua*

Figure 7. *Flexamia albida*

Figure 8. *Aflexia rubranura*