

A Survey of the Formicidae (Insecta) of Wilderness State Park

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Biology of Insects EEB 442
18 Aug 2015
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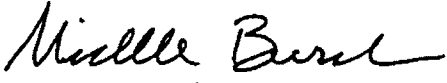
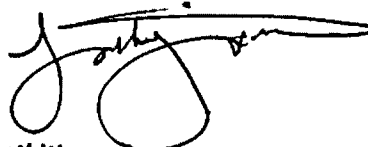

Abstract

We surveyed Wilderness State Park over the course of the 2015 summer session, making 4 trips to the park. Formicidae (ants) were surveyed using pit traps, bait traps, leaf litter sampling, and individual collecting. Using a combination of records from this survey and historical records we recorded 40 species of Formicidae. Ant species showed distinct (and previously documented) habitat specializations, with groups of species almost completely confined to either open or wooded habitats. Our sampling demonstrated that multiple collecting techniques are necessary for a complete survey of ant species, but that pit traps provide the bulk of the records in our area. We recorded several county records. Adding these results to those from the previous 4 summers, the Biology of Insect classes have now recorded 305 species in 28 families from Wilderness State Park.

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CALVIN JONES

Initial Survey of Formicidae (Hymenoptera) in Wilderness State Park

Report to Wilderness State Park and Michigan DNR

by

Brian Scholtens and the 2015 UMBS summer Biology of Insects class

This report continues work completed during the summers of 2011-2014 by the Biology of Insects class. During the summer of 2015 the class studied the large and ecologically important family Formicidae (ants) in the Hymenoptera, of Wilderness State Park. As social insects, the ants are perhaps the most important family of insects worldwide. They interact with many parts of an ecosystem, including acting as pollinators, seed dispersers, predators, herbivores, parasites and mutualists (Hölldobler & Wilson 1990). They are also common pests of human habitations (Klotz et al. 2008), and the stings of some species can cause severe allergic reactions (Taber 2000). These human effects are much less prevalent in northern Michigan, but ants are still certainly a key part of most terrestrial ecosystems. Because most species nest in or near the ground, species are often specialized on particular habitat or soil types (Folgarait 1998). The diverse array of habitats in Wilderness State Park supports a wide range of ant species.

We had an initial potential list of species based on the published Michigan list of Wheeler et al. (1994) and specimens at UMBS and the University of Michigan Museum of Zoology (UMMZ), but we expected to add significantly to this list.

Materials and Methods

The summer 2015 Biology of Insects class from the University of Michigan Biological Station continued the effort started in 2011 of surveying insect groups in Wilderness State Park.

Over the course of the summer, the class sampled an array of habitats in Wilderness State Park, focusing primarily on 1) dunes, 2) mixed deciduous/conifer forest, 3) Great Lakes marsh, 4) inland marsh, and 5) dry oak forest. The class formed 3 working groups, each group focusing on a different ant sampling technique (Agosti et al. 2000). Group one sampled using test tubes as pit traps, group two sampled by baiting test tubes with fresh tuna pieces, and group three sampled by sifting and sorting leaf litter samples from each habitat.

In each habitat, each group sampled a series of transects (typically 3-5) using their chosen technique. For bait traps, ants were allowed to accumulate over the period of approximately 2-3 hours we were at a site and then baited vials were capped and brought to the lab. Ants were then transferred to alcohol, sorted to species and placed in vials. For litter sampling, at each sampling location a 1m² area of litter was sifted and collected into a bag using a kitty litter box with a sifting insert. All debris and organisms that fell through the sifter were collected, returned to the lab and placed in a Berlese funnel to extract ants into alcohol. Ants were then

removed from the alcohol, sorted to species and placed in vials. For pit trap samples, large diameter test tubes with a 50/50 mix of water and propylene glycol were placed in the ground with the lip flush to the soil. These remained in place for 2 days, after which they were retrieved and capped. They were then returned to the lab and the ants were transferred to alcohol, sorted to species and placed in vials. In addition to these sampling techniques, the class also hand collected ants at each of these sites and others that we visited over the course of the summer.

The major sampling locations were the marsh and dunes on Waugoshance Pt., a beaver marsh inland from the Waugoshance cabin, the Nebo Trail, and Sturgeon Bay including both dune areas (north and south regions) and nearby wooded areas. We also examined and included historical records from the collections at UMBS and UMMZ and from the Scholtens collection.

Ants were identified using primarily Fisher & Cover (2007) and Ellison et al. (2012), but older works were also consulted (e.g. Wheeler 1910). Collections will be stored at the University of Michigan Biological Station. All groups were either pinned using standard techniques or stored in alcohol in small vials with polyseal caps (Triplehorn & Johnson 2005).

Results

Over the course of the summer, the three working groups accumulated 362 collection events, resulting in 950 individual ant specimens. These were identified as 41 different species in three subfamilies of ants (Formicinae – 20 spp.; Dolichoerinae – 4 spp.; Myrmecinae – 17 spp.) (Table 1).

The most productive collecting locations were Waugoshance Pt. dunes (18 spp.), Nebo Trail and associated open field (16 spp.), oak woods near Bliss Beach (14 spp.) and the dunes and flats at Bliss Beach (11 spp.)

Of the 41 species identified from Wilderness State Park, three have been recorded only in historical collections, *Camponotus herculeanus*, *Formica glacialis*, and *Lasius nearcticus*. All these species likely still exist in the park, but we didn't encounter them in our sampling because of either specialized habitat requirements or rarity.

Based on the previous reports of Wheeler et al. (1994) our sampling efforts resulted in 20 county records for Emmet County.

Discussion

As in previous years of this survey, our work consists of initial samples in a long term effort to document diversity in Wilderness State Park. It is very common for these initial surveys to document new records or significant range extensions (Scholtens & Wagner 2007), and often undescribed species are found. All these things are true for our work this past summer. In addition, these surveys have greatly improved our understanding of the distribution, abundance and phenology of the insects species in Wilderness State Park, and therefore in the surrounding area.

Based on the survey work of Wheeler et al. (1994), 58 species were previously recorded from the two county region of Emmet and Chebygan Counties, with 28 species known from Emmet County where Wilderness State Park is located. Our work filled in many of the known gaps in species distributions for common species, but also added some significant records for the two county region. A few were records at the northern edge of the range of a species, and may represent recent range extensions. These include *Temnothorax texanus* and *Monomorium minimum*, both found on the sand flats at the Bliss Beach dunes. This habitat is perhaps the most similar to more southern areas, with a very warm microclimate suitable for southern range extensions. Another more southern species we recorded was *Crematogaster lineolata* at the field off of Nebo Trail. This is a common species to the south and has been recorded in the area previously, but could be monitored to see if it is becoming more common compared to its much more abundant congener, *C. cerasi*.

Other species for which we only encountered a few specimens are those that occur in small colonies, and often in secretive habitats. For example, the genera *Temnothorax* and *Leptothorax* largely form colonies in small containers such as hollow acorns. They have relatively limited foraging ranges and so are not so easily encountered. Nonetheless, we did see 5 species in these two genera, and with the abundance of oaks in the park, we expect that they are fairly common.

Several species we recorded are commonly recognized, and even covered in recent identification manuals (e.g. Ellison et al. 2012), but still not described. These include those indicated in Table 1 as *Lasius cf. niger*, *Leptothorax* AF-can, *Leptothorax* AF-erg, and *Myrmica* AF-scu. All of these have been known for several years under other species names, but recently have been separated from their parent species and not yet described.

Each major habitat type in the park tends to have species that specialize on that soil type. E.g. *Myrmica brevispinosa* is only found on dune habitats, *Dolichoderus mariae* is found mainly in the high marsh habitats, and the *Camponotus* species are found mostly in forested habitats. This habitat specialization emphasizes the importance of maintaining the entire range of habitat types in Wilderness State Park.

Our survey was certainly not complete, and we would expect to find other species included in the Wheeler et al. (1994) list with additional sampling effort. We also encountered some significant identification challenges. Several species in the genera *Formica* and *Myrmica* and very difficult to tell apart, and some of our identifications may need to be modified as experts are consulted (see species indicated by ? in Table 1). Unlike 2014, we don't think that weather had any significant impact on our sampling. Because ants form perennial colonies, adults are active and available for sampling at any point during the summer, rather than seasonally. This effectively negated any effect of weather. In addition, we did not experience extreme temperatures or drought that could potentially affect ant activity.

Acknowledgements

The Biology of Insects class gratefully acknowledges the Michigan DNR and Wilderness State Park for permits to sample in the Park. We are especially grateful to the staff of Wilderness State Park. They have been extremely helpful throughout our sampling effort. The University of Michigan Biological Station provided support for travel and supplies.

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Table 1. Species of Formicidae documented from Wilderness State Park from mid-May through August 2015 (and historical records). County records indicated by asterisks.

Hymenoptera

Formicidae

Formicinae

Camponotus herculeanus (only historical)

*Camponotus nearcticus**

Camponotus novaeboracensis

*Camponotus pennsylvanicus**

Formica argentea

Formica aserva

Formica difficilis?

Formica glacialis (only historical)

Formica impexa?

*Formica incerta**

Formica lasioides

*Formica neogagates**

*Formica pallidefulva**

*Formica pergandei**

*Formica rubicunda**

*Formica subaenescens**

Formica subsericea

Lasius alienus

Lasius cf. niger

Lasius nearcticus (only historical)

Dolichoderinae

*Dolichoderus mariae**

*Dolichoderus plagiatus**

Dolichoderus pustulatus

Tapinoma sessile

Myrmicinae

Aphaenogaster rudis

Crematogaster cerasi

*Crematogaster lineolata**

Leptothorax AF-can

*Leptothorax AF-erg**

*Monomorium minimum**

Myrmica AF-scu

Myrmica americana

Myrmica brevispinosa

Myrmica detritinodis

Myrmica fracticornis

Myrmica incompleta

*Myrmica punctiventris**

*Stenamma diecki**

*Temnothorax ambiguus**

*Temnothorax curvispinosus**

*Temnothorax texanus**

Formicidae	Formica subsericea	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSScholtens		UMBS	
Formicidae	Formica subsericea	Emmet	WSP, Waugoshance Pt., dunes 45.757N 84.972W	11-14 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	8
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius alienus	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius cf. niger	Emmet	WSP, Bliss beach, 45.684N 84.972W	1-Aug-15	Gallagher, O'Neil, McClear	litter in alcohol vial	UMBS	1
Formicidae	Lasius cf. niger	Emmet	WSP, Bliss beach, 45.684N 84.972W	23-Jul-13	BGSScholtens		BGS	
Formicidae	Lasius cf. niger	Emmet	WSP, boat launch, 45.747N 84.9087W	20-Jul-12	BGSScholtens		BGS	
Formicidae	Lasius cf. niger	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	
Formicidae	Lasius cf. niger	Emmet	WSP, end of Gill Rd., dunes, 45.705N 84.952W	23-May-15	BGSScholtens		UMBS	

Formicidae	Myrmica brevispinosa	Emmet	WSP, picnic area dunes, 45.750N 84.891W	28-May-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, picnic area dunes, 45.750N 84.891W	28-May-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, picnic area dunes, 45.750N 84.891W	28-May-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, picnic area dunes, 45.750N 84.891W	28-May-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, picnic area dunes, 45.750N 84.891W	28-May-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, southmost picnic area, 45.679N 84.981W	16-Jul-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, southmost picnic area, 45.679N 84.981W	16-Jul-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, Sturgeon Bay dunes, 45.713N 84.943W	24-Jul-14	BGSchoitens		BGS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, Sturgeon Bay dunes, 45.713N 84.943W	24-Jul-14	BGSchoitens		BGS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSchoitens		UMBS	
Formicidae	Myrmica brevispinosa	Emmet	WSP, Waugoshance Pt., dunes 45.757N 84.972W	11-14 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	72
Formicidae	Myrmica detritinodis	Emmet	WSP, Nebo trail field, 45.751N 84.880W	18-21 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	2
Formicidae	Myrmica detritinodis	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-4 Aug 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	1
Formicidae	Myrmica detritinodis	Emmet	WSP, Waugoshance cabin marsh, 45.7430N 84.9574W	25-28 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMMZ	7
Formicidae	Myrmica detritinodis (=emeryana)	Emmet	WSP, Waugoshance Pt.	29-Jul-52	P. B. Kammowski		UMMZ	
Formicidae	Myrmica detritinodis (=emeryana)	Emmet	WSP, Waugoshance Pt.	29-Jul-52	P. B. Kammowski		UMMZ	
Formicidae	Myrmica fracticornis	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-4 Aug 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	1
Formicidae	Myrmica fracticornis	Emmet	WSP, Waugoshance cabin marsh, 45.7430N 84.9574W	25-28 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	2
Formicidae	Myrmica fracticornis	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Myrmica fracticornis	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Myrmica fracticornis	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Myrmica fracticornis	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Myrmica incompleta	Emmet	WSP, Waugoshance cabin marsh, 45.7430N 84.9574W	25-Jul-15	BGSchoitens		UMBS	
Formicidae	Myrmica punctiventris	Emmet	WSP, Waugoshance cabin marsh, 45.7430N 84.9574W	25-Jul-15	BGSchoitens		UMBS	
Formicidae	Myrmica punctiventris	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-Aug-15	Gallagher, O'Neil, McClear	leaf litter in alcohol vial	UMBS	10
Formicidae	Myrmica punctiventris	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-Aug-15	Gallagher, O'Neil, McClear	leaf litter in alcohol vial	UMBS	2
Formicidae	Myrmica punctiventris	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-Aug-15	Younan & Jones	tuna bait in alcohol vial	UMBS	6
Formicidae	Myrmica punctiventris	Emmet	WSP, southmost picnic area, 45.679N 84.981W	16-Jul-15	BGSchoitens		UMBS	
Formicidae	Stenamma diecki	Emmet	WSP, Nebo trail field, 45.751N 84.880W	18-Jul-15	Gallagher, O'Neil, McClear	leaf litter in alcohol vial	UMBS	3
Formicidae	Tapinoma sessile	Emmet	WSP, Nebo trail field, 45.751N 84.880W	18-21 Jul 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	4
Formicidae	Tapinoma sessile	Emmet	WSP, Nebo trail field, 45.753N 84.878W	14-Jul-11	BGSchoitens		BGS	
Formicidae	Tapinoma sessile	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-4 Aug 2015	Landgraf & Regan	pit trap in alcohol vial	UMBS	3
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt.	29-Jul-52	P. B. Kammowski		UMMZ	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt.	29-Jul-52	P. B. Kammowski		UMMZ	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt. marsh, 45.757N 84.972W	6-Jun-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt., 45.758N 84.970W	11-Jul-15	BGSchoitens		UMBS	
Formicidae	Tapinoma sessile	Emmet	WSP, Waugoshance Pt., dunes 45.757N 84.972W	11-Jul-15	Gallagher, O'Neil, McClear	leaf litter in alcohol vial	UMBS	4
Formicidae	Tennothorax curvispinosus	Emmet	WSP, Waugoshance Pt., dunes 45.757N 84.972W	1-Aug-15	Gallagher, O'Neil, McClear	leaf litter in alcohol vial	UMBS	2
Formicidae	Tennothorax curvispinosus	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-Aug-15	TRegan	in acorn, in alcohol vial	UMBS	19
Formicidae	Tennothorax curvispinosus	Emmet	WSP, oaks at Bliss beach, 45.682N 84.973W	1-Aug-15	TRegan	in acorn, in alcohol vial	UMBS	19
Formicidae	Tennothorax texanus	Emmet	WSP, Bliss beach, 45.684N 84.972W	2-Jun-15	BGSchoitens		UMBS	

Appendix 2: Summary of all species identified during 5 years of insect surveys at Wilderness State Park, 2011-2015. County records are indicated by asterisks.

Odonata

Aeshnidae

Aeshna canadensis
Aeshna clepsydra *
Aeshna tuberculifera
Aeshna umbrosa
Anax junius
Gomphaeshna furcillata

Calopterygidae

Calopteryx maculata

Coenagrionidae

Amphagrion saucium
Argia fumipennis
Chromagrion conditum
Enallagma civile
Enallagma ebrium
Enallagma hageni
Ischnura posita
Ischnura verticalis
Nehalennia irene

Corduliidae

Cordulia shurtleffi
Dorocordulia libera *
Somatochlora walshii

Gomphidae

Gomphus exilis
Gomphus spicatus
Hagenius brevistylus
Ophiogomphus rupinsulensis

Lestidae

Lestes dryas
Lestes eurinus *
Lestes disjunctus
Lestes unguiculatus
Lestes vigilax

Libellulidae

Celithemis elisa
Leucorrhinia frigida
Leucorrhinia intacta
Leucorrhinia proxima
Leucorrhinia glacialis
Ladona julia
Libellula luctuosa *

Libellula pulchella
Libellula quadrimaculata
Nannothemis bella
Plathemis lydia
Sympetrum costiferum
Sympetrum danae
Sympetrum internum
Sympetrum obtrusum
Sympetrum rubicundulum
Sympetrum vicinum

Orthoptera

Acrididae

Arphia sulphurea *
Booneacris glacialis *
Camnula pellucida
Chloealtis conspersa *
Chorthippus curtipennis
Chortophaga viridifasciata *
Dissosteira carolina
Melanoplus bivittatus
Melanoplus borealis *
Melanoplus islandicus
Melanoplus sanguinipes
Melanoplus stonei
Orphulella speciosa
Spharagemon collare
Trimerotropis huroniana
Trimerotropis verruculata

Gryllidae

Allonemobius fasciatus *
Gryllus pennsylvanicus

Rhaphidophoridae

Ceuthophilus meridionalis

Tetrigidae

Tetrix ornate
Tetrix subulata

Tettigoniidae

Conocephalus fasciatus
Orchelimum gladiator

Hemiptera

Acanthosomatidae

Elasmucha lateralis

Corimelaenidae

Galgupha aterrima

*Galgupha ovalis**

Pentatomidae

Acrosternum hilare
Apoecilus bracteatus
Banasa dimidiata
Chlorochroa persimilis
Coenus delius
*Euschistus ictericus**
Euschistus servus
Euschistus tristigmus
Holcostethus limbolarius
*Picromerus bidens**
Podisus serieventris
Stiretrus fimbriatus
Thyanta custator accerra

Scutelleridae

Eurygaster alternatus
Homaemus aeneifrons
*Phimodera binotata**

Coleoptera

Cerambycidae

*Anelaphus parallelus **
Bellamira scalaris
Callimoxys sanguinicollis
Cyrophorus verrucosus
*Enaphalodes rufulus **
Eutrichillus biguttatus
Leptura plebeja
Leptura subhamata
Microgoes oculatus
Molorchus bimaculatus
Orthosoma brunneum
Parandra brunnea
Pygoleptura nigrella
Saperda calcarata
*Saperda mutica **
Saperda populnea moesta
Stictoleptura canadensis
*Strangalepta abbreviata **
Tetraopes tetraophthalmus
*Trigonarthris minnesotana **
*Trigonarthris proxima **
Typocerus velutinus
*Urographis fasciatus **

Chrysomelidae

Acalymma vittatum
*Altica browni?**
*Altica canadensis**
*Altica chalybea**
Altica corni
Altica subplicata
Anomoea laticlavata
Calligrapha multipunctata
Calligrapha spiraeae
Chalepus walshi
Chrysolina quadrigemina
Chrysochus auratus
Chrysomela scripta
Cryptocephalus calidus
Cryptocephalus notatus
*Deloyala guttata**
Derocrepis carinata
Diabrotica undecimpunctata
Diachus auratus
Diachus catarius
Disonycha alternata
*Disonycha arizonae**
*Distigmoptera apicalis**
*Donacia fulgens?**
Donacia pubescens
Entomoscelis americana
Exema canadensis
Labidomera clivicollis
Leptinotarsa decemlineata
*Lexiphanes saponatus**
*Ophraella notata**
Pachybrachis cephalicus
Pachybrachis nigricornis
Pachybrachis peccans
*Phratora purpurea**
Pyrrhalta alni
Pyrrhalta decora
Trirhabda canadensis

Coccinellidae

Anatis mali
*Anisosticta bitriangularis**
Brachiacantha ursina
Chilocorus stigma
Coccinella novemnotata
*Coccinella septempunctata**

Coccinella transversoguttata
*Coccinella trifasciata**
*Coleomegilla maculata**
Cycloneda munda
Harmonia axyridis
Hippodamia convergens
Hippodamia parenthesis
Hippodamia quinquesignata
Hippodamia variegata
*Hyperaspis binotata**
*Mulsantina hudsonica**
Psyllobora vigintimaculata
Scymnus sp.

Lepidoptera

Hesperiidae

Ancyloxypha numitor
Carterocephalus palaemon
Erynnis icelus
Erynnis juvenalis
Euphyes bimacula
*Euphyes conspicua**
Euphyes ruricola
*Poanes viator **
Poanes hobomok
Polites mystic
Polites themistocles
*Polites origenes **
Polites peckius
Thymelicus lineola
*Wallengrenia egeremet **

Lycaenidae

Callophrys niphon
Callophrys polios
Callophrys augustinus
Celastrina ladon
Celastrina neglecta
Cupido comyntas
Feniseca tarquinius
Glaucopsyche lygdamus
Lycaena dorcas
Lycaena phlaeas
Satyrrium calanus
Satyrrium titus
Satyrrium liparops
Satyrrium acadicum

Nymphalidae

Aglais milberti
Cercyonis pegala
Coenonympha tullia
Danaus plexippus
Junonia coenia
Lethe eurydice
Lethe anthedon
Limenitis arthemis astyanax
Limenitis archippus
Nymphalis antiopa
Phyciodes coctya
Speyeria cybele
Speyeria atlantis
Speyeria aphrodite

Papilionidae

Papilio canadensis
Papilio polyxenes

Pieridae

Euchloe olympia
Colias eurytheme
Colias philodice
Colias interior
Pieris rapae
Pieris oleracea

Hymenoptera

Vespidae

Ancistrocerus adiabatus
*Ancistrocerus albophaleratus**
Ancistrocerus antilope
Ancistrocerus catskill
Ancistrocerus unifasciatus
*Ancistrocerus waldenii**
Dolichovespula arctica
Dolichovespula arenaria
Dolichovespula maculata
*Dolichovespula norvegicoides**
*Eumenes crucifera**
Euodynerus foraminatus
*Euodynerus leucomelas**
*Parancistrocerus pennsylvanicus**
Polistes fuscatus
Stenodynerus fundatiformis
Symmorphus albomarginatus
*Symmorphus canadensis**

Vespula consobrina
Vespula flavopilosa
*Vespula vulgaris**

Formicidae

Formicinae

Camponotus herculeanus
*Camponotus nearcticus**
Camponotus novaeboracensis
*Camponotus pennsylvanicus**
Formica argentea
Formica aserva
Formica difficilis?*
Formica glacialis
Formica impexa?*
*Formica incerta**
Formica lasioides
*Formica neogagates**
*Formica pallidefulva**
*Formica pergandei**
*Formica rubicunda**
*Formica subaenescens**
Formica subsericea
Lasius alienus
Lasius cf. niger
Lasius nearcticus

Dolichoderinae

*Dolichoderus mariae**
*Dolichoderus plagiatus**
Dolichoderus pustulatus
Tapinoma sessile

Myrmicinae

Aphaenogaster rudis
Crematogaster cerasi
*Crematogaster lineolata**
Leptothorax AF-can
*Leptothorax AF-erg**
*Monomorium minimum**
Myrmica AF-scu
Myrmica americana
Myrmica brevispinosa
Myrmica detritinodis
Myrmica fracticornis
Myrmica incompleta
*Myrmica punctiventris**
*Stenamma diecki**
*Temnothorax ambiguus**

*Temnothorax curvispinosus**

*Temnothorax texanus**

Diptera

Tabanidae

Chrysops vittatus

Chrysops aberrans

*Chrysops montanus**

*Chrysops delicatulus**

Chrysops sordidus

Chrysops sackeni

*Chrysops frigidus**

*Chrysops macquarti**

*Chrysops univittatus**

Chrysops cuclux

Chrysops excitans

*Chrysops aestuans**

*Chrysops cincticornis**

*Chrysops mitis**

*Chrysops carbonarius**

*Tabanus atratus**

*Tabanus catenatus**

*Tabanus marginalis**

*Tabanus similis**

Hybomitra zonalis

Hybomitra sodalis

*Hybomitra pechumani**

Hybomitra lasiophthalma

Hybomitra nuda

Hybomitra lurida

Hybomitra trepida

*Hybomitra epistates**

*Hybomitra affinis**

Bombyliidae

Bombylius atriceps

Bombylius mexicanus

Bombylius pygmaeus

*Apolysis stigma**

*Poecilognathus sulphureus**

*Tmemophlebia coquilletti**

*Systoechus vulgaris**

*Lepidophora lutea**

*Poecilanthrax tegminipennis**

*Poecilanthrax alcyon**

Exoprosopa fascipennis

*Exoprosopa fasciata**

*Dipalta banksi**
*Paravilla separata**
*Chrysanthrax dispar**
*Villa arenicola**
Villa lateralis
*Villa nigra**
*Villa pretiosa**
*Villa nigricauda**
*Hemipenthes comanche**
*Hemipenthes seminigra**
Hemipenthes sinuosa
Hemipenthes webberi

Syrphidae

Allograpta obliqua
Blera analis
Blera nigra
Brachyopa ferruginea
Brachyopa flavescens
Chalcosyrphus nemorum
*Chalcosyrphus piger**
Orthonevra pictipennis
Cheilosia shannoni
Cheilosia wisconsinensis
Chrysogaster parva
Chrysogaster sinuosa
*Epistrophella emarginatus**
Eristalis anthophorina
Eristalis arbustorum
Eristalis dimidiata
*Eristalis hirta**
*Eristalis stipator**
Eristalis tenax
Eristalis transversa
Eupeodes americanus
Eupeodes latifasciatus
Eupeodes luniger
Eupeodes perplexus
Helophilus fasciatus
Helophilus latifrons
Lejota cyanea
*Lejops chrysotomus**
Lejops lineatus
Sphegina rufiventris
*Melanostoma mellinum**
*Paragus haemorrhous**
Platycheirus confusus

Platycheirus hyperboreus
Platycheirus manicatus
Platycheirus obscurus
*Platycheirus quadratus**
*Pyrophaena granditarsis**
Rhingia nasica
Sericomyia militaris
Sericomyia chrysotoxoides
Sphaerophoria contigua
Sphecomyia vittata
Spilomyia fusca
*Spilomyia sayi**
Syritta pipiens
Syrphus rectus
*Syrphus ribesii**
Parasyrphus nov. sp.
Temnostoma alternans
Temnostoma balyras
*Temnostoma barberi**
Temnostoma trifasciatus
Temnostoma vespiforme
Toxomerus geminatus
*Toxomerus marginatus**
Xylota angustiventris
Xylota ejuncida
*Xylota subfasciata**