

# Flying Insect Survey Observatory Park 2010

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The purpose of this study was to observe the kinds and numbers of flying insects sampled from two locations at Observatory Park during the 2010 summer season. The other aim of the study was to maintain a voucher specimen collection that could be housed with the Cleveland Museum of Natural History. The collection from Observatory Park, 2010, will remain as a reference of comparison to other specimens in their collection from the region and will remain a viable source for future research.

Perhaps the most useful aspect of this study is to provide a baseline of flying insect diversity at Observatory Park, at least in the area sampled. In addition to insect biodiversity, implicit in the collection of these insects is seasonal shift in population numbers and occurrence. With the movement of climate change, for example, this data could be useful in future comparisons of diversity and abundance.

Secondly, there is the sheer wonder of looking at creatures that are the size of a mote of dust to the naked eye, that are almost impossible to capture without the inadvertent intervention of a malaise trap. To see creatures so small, as in the case of Platygasterids (Hymenopteran parasites of Cecidomyiid gnat larvae) that the rules of aerodynamics no longer apply, is remarkable. They are so tiny, that the air in which they fly is, for them, viscous, so that they must row themselves like a boat through water. I can't expound on the physics of relative density of air with respect to the scale of a body; most profound is the scale and range of ecological niche and mode of dispersal.

## Methods

Insects were collected using a malaise trap, a standard tool for monitoring insect populations that might not otherwise be observed. Two locations were selected in May, 2010 in consultation with Tami Gingrich. The first location (Location 1, figure 1) was an old field habitat of approximately 100 yards in diameter, ringed by trees and adjacent wetland. The second location (Location 2, figure 2) was a narrow open corridor (access road) between woodland and a pond on the site of a former beaver dam.

The traps were set up in early morning, usually around 7am and left for the day. They were retrieved near sunset. The trapping dates were: June 18, July 19, August 20, and September 18, 2010. Naphthalene was used as a killing agent in the collecting jar. Naphthalene was chosen because it was the only "safe" agent recommended for use by BioQuip with their component plastic collecting jars (other materials like ethyl alcohol or ethyl acetate would dissolve the plastic). The other alternative killing agents that I avoided using were cyanide and vapoona. Unfortunately, the naphthalene was not as effective and so the entire collecting jar was placed in the freezer after returning home from a trapping day.

As outlined in the proposal for this study, all the insects collected were mounted for permanent storage in museum-quality drawers (figure 3) and are to be housed with the Cleveland Museum of Natural History's Department of Invertebrate Zoology. I contacted Tom Pucci, of CMNH, who is a Braconid wasp specialist, and he has agreed to accept the donation of mounted specimens into their permanent collection.

The advantages to having specimens being housed at CMNH is that they will be well-maintained by museum curatorial staff and that they will have the opportunity to be examined by potentially many entomologists. My knowledge of the diversity of insect taxonomy is limited. The keys and other identification references that were used yielded, for the most part, identification to family level (see bibliography). Hopefully, my own taxonomic appraisal of the specimens collected will be either corrected or confirmed or carried further to lowest taxonomic level by those with greater expertise.

A total of 6 insect drawers and resultant pinning trays were purchased to contain the specimens collected. Each specimen has locality and GPS coordinate labels as well as taxonomic labels. After all the specimens had been mounted and identified to nearest taxon, the different taxa and their numbers were recorded and that data entered into Excel spreadsheets for further analysis (Table 1).

## **Results and Discussion**

It is difficult to make assertions about the relative numbers, and presence or absence of different insects between the two locations and trapping dates. There were, after all, only four trapping dates, and although I tried to maintain consistent technique, there were different weather conditions on each collecting day. I believe there is significant difference between location ecotypes and there is at least a glimpse of population dynamics of some insects through the progression of a season from June to September. The data presented in Table 1 sufficiently illustrate the trends of some seasonal and habitat differences. I will therefore limit my discussion of results to providing some profile and perspective to the kinds of insects that were collected.

The presence of certain insects reflects the kind of habitat in which the traps were placed. And, in the case of parasitoids collected, their host insects are very specific and further reflect not only the habitat, but the indirect presence of the host insect.

The insects in Table 1 are listed in phylogenetic order. The total number of insects collected from both locations over the four trapping days was: 1,476. Most of the insects collected were very small (0.5 to 6 mm) and were glued to paper points. Dipterans were the predominant insect collected, representing 43 families. In second place were the Hymenopterans, with 19 families.

### **Diptera**

As Diptera was the order of insects best represented in the study, it seems only fitting to begin discussion there. Diptera is divided into three Suborders: Nematocera, Brachycera, and Cyclorrhapha. Suborder Nematocera (Long-Horned Flies) are considered the most primitive group of dipterans, phylogenetically speaking. Nematocera comprises approximately a third of the North American species of flies (24 of 107 families). Well-known members of Nematocera

include crane flies, midges, black flies and mosquitoes. As a group, they are recognized by their antennae, which are usually many-segmented and sometimes plumose. They also tend to have delicate, long legs.

Suborder Brachycera is comprised of 18 families, with more than 4,650 North American species. These are more robust in body type with usually three-segmented antennae, but sometimes five-segmented. Generally, flies in this suborder are predacious on other insects. Their larvae are either parasitic or predacious. Some well-known representatives of this group include: Horse Flies and Deer Flies, Snipe Flies, Mydas Flies, Robber Flies, and Long-Legged Flies to name a few.

Suborder Cyclorrhapha have three-segmented antennae with an arista, or hair-like process emerging from usually the third segment. These flies are generally very small, often bristly and stout-bodied. Cyclorrhapha is further divided into two major divisions: the Aschiza and Schizophora (Muscoïd Flies). The division is centered on head morphology (Aschiza have no frontal suture, whereas Schizophora do have a pronounced frontal suture) and wing venation. Division Aschiza includes six families of more than 1500 North American species. They include such families as Humpbacked Flies, Big-Headed Flies and Hover Flies. Schizophora has 59 families and over 5600 species in North America. There is some contention among dipterists as to the placement of species among families. Some morphological characteristics overlap among families. Within Schizophora, there is yet further subcategorization: Acalypterate and Calypterate Flies. The calypter is a lobe (sometimes two) at the base of the wing just above the haltere (i.e, the little club-like appendage which is derived from what used to be the hind wing in the ancient progenitor of the Fly; the halteres beat in opposition to the beat frequency of the two wings).

There were nine families from the Suborder Nematocera collected: Tipulidae (Crane Flies), Psychodidae (Moth Flies), Culicidae (Mosquitoes), Thaumaleidae (Solitary Midges), Ceratopogonidae (Biting Midges or No-See-Ums), Chironomidae (Midges), Mycetophilidae (Fungus Gnats), Sciaridae (Dark-Winged Fungus Gnats), and Cecidomyiidae (Gall Midges). All of these families are associated with water, or at least moist conditions. It is not surprising that they were collected from locations 1 and 2, both being wet or adjacent to wet habitats.

I found one Thaumaleid species. They are thought to be only five species in North America, and are considered rare. They are associated with vegetation along streams. The most prominent characteristic of these Solitary Midges, besides their size, is the way their small heads emerge very low on the thorax.

The Culicids and Ceratopogonids found me before I ever finished setting up the malaise traps. I don't know why only one mosquito was trapped versus the 41 no-see-ums. No-see-ums are very small, hence the name, with blood-sucking habits. Many species suck the blood of other insects as ectoparasites and have been known to attack mantids, dragonflies, some moths, crane flies and even mosquitoes. Ceratopogonid larvae are aquatic or semi-aquatic. They have been found in sand, mud, decaying vegetation and water filled tree holes.

Mycetophilids (Fungus Gnats) are a large group of more than 600 North American species. As their name implies, they are associated with fungus and are generally found in moist habitats with decaying vegetation and fungus. Most of the larvae feed in fungus, moist soil and decaying plant material, although the larvae of some species are predacious. Similarly, Sciarids (Dark-Winged Fungus Gnats) occur in shady moist places and occupy some of the same ecological niches as the mycetophilids.

Cecidomyiids (Gall Gnats) were well represented in both locations throughout the summer. They are tiny flies with long legs, relatively long antennae and with highly reduced wing venation. The larvae of most of the more than 1200 North American species create galls on plants. Most of them feed on plant material, while a few live in decaying organic material and a smaller portion still are predacious on aphids, scale insects and other very small insects.

The next group of dipterans collected from the Suborder Brachycera, were: Stratiomyidae (Soldier Flies), Tabanidae (Horse and Deer Flies), Rhagionidae (Snipe Flies), Scenopinidae (Window Flies), Mydidae (Mydas Flies), Asilidae (Robber Flies), Acroceridae (Small-Headed Flies), Bombyliidae (Bee Flies), Empididae (Dance Flies), and Dolichopodidae (Long-Legged Flies).

Two Stratiomyids (Soldier Flies) were collected from Location 2 on July 18<sup>th</sup>. Soldier Flies are medium-sized and are often found on flowers. Their appearance and behavior are wasp-like. There are around 240 North American species in this family utilizing a wide variety of habitats. The larvae of many species are aquatic and some have been found feeding on algae, or on decaying materials, or on other small aquatic organisms. There are other species that have been found in dung, under bark or rotting vegetation.

Tabanidae was another well-represented group of flies collected in June and July. It is a large family of more than 300 North American species. The larvae of most species are aquatic. The adults, especially deer flies, are typically found in the area in which the larvae occur (i.e., swamps and marshes). Females take blood meals, while the males usually feed on pollen and nectar.

Similarly, in the first half of the summer (June and July) there were six Robber Flies collected. There are nearly 1000 species of Asilidae in North America. This is a family of agile hunters that typically catch their prey of smaller insects on the wing. They are often very fuzzy and resemble bumblebees or in other cases, less hirsute and more wasp-like. All are extremely visual and alert. Their larvae live in soil, decaying wood and other plant material and feed mainly on the larvae of other insects, and in some cases are ectoparasites of certain species of beetle grubs.

One Acrocerid (Small-Headed Fly) was collected at Location 1 in June. They are uncommon flies with around 50 species in North America, with most of those occurring in the Southwest. They are unusual in that they have such small heads in proportion to the rest of their body. The adults of some species have no mouthparts and presumably don't feed as adults. The larvae are internal parasites of spiders. The larvae hatch from eggs laid on vegetation and attach themselves and ultimately enter the body of a spider. The fly has been found to pupate in the host spider's web.

One Bombyliid (Bee Fly) was collected from Location 2 in June. Bombyliidae is a very large family with more than 750 species in North America. They are bee mimics, often with banded abdomens or are very fuzzy, like bumblebees. Some have spotted or speckled wings like the individual collected (*Anthrax irroratus*). They also have very long, attenuated wings and some have a very long proboscis. They are usually found on flowers as adults feeding on nectar. The larvae are parasites mostly of other insect larvae: butterflies and moths, wasps, bees, beetles and in some cases grasshopper eggs. One interesting behavior of the females of some species of Bombyliids, is to hover over a hole or crevice, then quickly dip and eject an egg into the hole or crevice. The eggs hatch and the larvae crawl into the nest of whatever host species.

Another fly that is commonly seen in hovering groups that move up and down together is the Dance Fly (Empididae). This is another large family of more than 700 species in North America. Almost all empidids are predacious, often catching other small flies on the wing like their cousins, the Asilids. Others feed on nectar. They have long tapering abdomens and their heads appear to be all eye, with their mouthparts appearing like a very sharp “beak.” Besides their characteristic aerial behavior, the male empidid catches and presents an insect to the female prior to mating. Some species actually wrap the gift in a silk bag and others in a mucous-like bubble. There is at least one species that presents only the wrapping, no gift inside. Larvae may be found under bark, in soil, in decaying vegetation or in water. The larvae are predacious on other small insect larvae, presumably. Some aquatic larvae of empidid are known to feed on black fly larvae and pupae.

By far, the most abundant group of dipterans collected was from the family Dolichopodidae (Long-Legged Flies). Long-Legged Flies are small metallic green to greenish blue with, of course, long legs. They are agile runners and fliers. They are predacious on smaller insects, and are commonly found near swamps and streams, in woodlands and in open fields and meadows. Adults from the genus *Dolichopus* can skate across the water surface with their fast long legs, catching mosquito larvae. Dolichopodid larvae can occur in water or mud, and in decaying vegetation of various sorts, from wood to grass stems, and are considered mostly predacious, although little is known of their habits. The family is a large one, comprising more than 1,270 North American species.

Another fly that showed up in both locations in June and then again in August and September was the Humpbacked Fly (Phoridae). There are more than 370 species in North America with a very diverse range of ecological niches. They are very small flies and have a distinctive humpbacked shape, with the hind femora characteristically flattened giving them the appearance of good jumpers. Most have been found in association with decaying vegetation but some others have been found in decaying animal matter, fungus, others still are internal parasites of other insects and even parasitic commensals in ant or termite nests.

After having discussed the Small-Headed Fly (Acroceridae), there is also its cephalic counterpart, the Big-Headed Fly (Pipunculidae). Only one specimen was collected in Location 1 in August. They are uncommonly collected, despite the roughly 105 species known in North America. The larvae are mostly parasites of leafhoppers and planthoppers.

A large number of Syrphid Flies (Hover Flies) were collected in June from both locations. Location 1 yielded twice the number collected in Location 2. It is another very large family, comprised of more than 950 species in North America. Syrphid flies are generally bee or wasp mimics and are often found around flowers, where they feed on pollen and nectar. Their hovering flight behavior is a well-known characteristic of the family. They occupy a diverse range of ecological niches. Some are predacious, some live in decaying wood, and others live in aquatic environments that are often too polluted for other aquatic animals to survive. The larvae of aquatic species have a long breathing tube, like a snorkel. Some others feed on living plants.

Micropezid (Stilt-Legged) Flies occur in moist places. Four specimens were collected, three of which were from Location 1. There are 27 species in North America. Micropezids have long legs and long, narrow bodies giving them an ant-like appearance. Many are known to be ant or wasp mimics. Little is known about the habits of the larvae, but they are associated with decaying vegetation.

Black Scavenger Flies (Sepsidae) were collected throughout the summer in low numbers. They are associated with excrement and rotting vegetation. Sepsids are very small, generally black and shiny. The adults move their wings in a rowing motion while they walk. Many species have a small dark spot along the leading margin of the wing near its tip. There are 27 known species in North America.

A steady presence of Small Dung Flies (Sphaeroceridae) can be seen in Table 1, with a peak of numbers collected in mid to late summer. These are small brownish-black flies that are also very bristly. They are common in wet habitats near excrement. I don't know if the peak in numbers represents a seasonal emergence of adults, or if there was a pile of animal droppings near the trap. There are about 118 species in North America.

Although there weren't many Fruit Flies (Drosophilidae) collected, there was a consistent presence throughout the summer. Fruit flies seem very common and household, but it is a large and diverse family of more than 180 species in North America. Not all drosophilids are fructivores. In fact, many are attracted to and consume yeast growing on fruit or vegetables. But there are also species that are predacious on aphids, mealybugs and other small homopterans, while others are ectoparasites on caterpillars.

There were two spikes in numbers of Chloropidae, in early summer and then again in late summer. These are small, sometimes brightly colored in yellow and black. It is a large group of 268 species in North America. They are commonly found in moist, grassy meadows. Some live in living grass stems, others in decaying vegetation or excrement, while others are parasitic or predacious. There are some pest species of cereal crops and of livestock.

Another relatively uncommonly collected fly was the Clusiid Fly (Clusiidae). There are perhaps 15 species in North America. They are small flies, usually 3-4 mm long, often with smoky colored wings. One of its morphological characteristics is the enlarged, elongated oral vibrissae (two setae on either side of and slightly above of the mouth). In clusiids, these oral vibrissae project forward like tusks. The larvae occur in decaying wood and under bark. Apparently, the larvae are able to jump.

Calliphorids (Blow Flies) were reasonably common in both locations. They are a large and diverse group of flies, the most recognizable are the Greenbottle (*Lucilia*) or Bluebottle (*Cynomya*) Flies. Most species of calliphorid are scavengers of decaying plants and animals and excrement. Some species of *Pollenia* are parasites of earthworms.

Another opportunist scavenger collected in both locations is the Flesh Fly (Sarcophagidae). In fact, the similarity between calliphorids and sarcophagids has led some taxonomists to combine them into one family (Metopidae). Sarcophagids are generally robust and bristly flies with gray and black stripes on their thorax and abdomen. The adults tend to be attracted to sugary substances, like nectar or fruits, but the larvae are another matter. They can be found in a wide diversity of ecological niches, most notably, decaying animal material and excrement. Some species are parasites of other insects, while others are parasites on animals, living under the skin like a Bot Fly. There is one group of sarcophagids that lay their eggs in the nests of bees and wasps, feeding on the provisions within the nest.

## Hymenoptera

The next most diverse group of insects collected was from Hymenoptera. This order contains bees, wasps, ants, sawflies and a wide array of parasitoids. Hymenoptera is divided into two main suborders: Symphyta (sawflies, horntails, and wood wasps) and Apocrita (Ichneumonids, Braconids, a whole host of parasitoids, wasps, ants and bees...basically, everything else). There were no specimens from Symphyta collected in either location. But there was a good representation of the balance of the order.

Fifteen Braconid wasps were collected throughout the summer from both locations. This is a huge family of over 1700 species in North America. They are small and parasitic. Identification of Braconids is difficult. They are very similar to smaller Ichneumonid wasps, but besides being more stout bodied, one chief difference is that they spin a silken cocoon on the outside of the host insect. The host insect is also extremely varied, encompassing most of the orders of Insecta. The family is divided into 21 subfamilies.

Ichneumonid wasps are even more diverse, with more than 3100 species in North America. Ichneumonids and Braconids are in the subfamily Ichneumonoidea. Many ichneumonids have a long and slender abdomen, often with a long and trailing ovipositor. The family is divided into 24 subfamilies. Those that parasitize wood boring beetles have very long ovipositors for depositing eggs inside the trunk of a tree. In fact, some can push their hair-like ovipositor through  $\frac{3}{4}$  inch of wood.

To me, some of the most interesting and beautiful wasps are the very tiny parasitoids and tinier still, the hyperparasitoids. These small parasitic wasps are divided into 6 subfamilies: Chalcidoidea (Chalcids), Cynipoidea (Gall Wasps), Evanoidea (Ensign Wasps), Pelecinoidea, Proctotrupeoidea and Bethyloidea. Many have incredible sculpting of the exoskeleton with pits and grooves, shiny and/or metallic. Some are very compact and stout-bodied, thickly armored with wide heads and thoraces, others are very slender and fragile in appearance. Most of these tiny parasitic wasps were collected in ones and twos from both locations at Observatory Park. The wing venation is highly reduced in these wasps, and the wings generally have a hair-like fringe around the margins.

One Eulophid was collected from Location 1 in June. This family has more than 600 species in North America. They are generally 1-3 mm in length. Many eulophids have metallic coloration. They are parasites of a wide variety of insect hosts. Some eulophids are hyperparasites. In fact there are some species where the females are known to parasitize scale insects, whereas the males are hyperparasites that feed on parasites of scale insects, even females of their own species.

Two Eupelmid wasps were collected from Location 2 in September. There are 88 species in North America. They are parasites of a wide variety of insects, including some spiders. They have been observed to be good jumpers, but apparently have to tumble and stagger before settling.

The Perilampids were collected singly throughout the summer, mostly from Location 1. These are very stout bodied chalcids. They are often metallic green, with a broad head and thorax that appear thickly armored and pitted, while the abdomen is often smaller, shiny and triangular. Most perilampids are hyperparasites. The eggs are laid on foliage and emerge larvae and wait for a passing caterpillar or other host-specific insect. The larva attaches itself and burrows into the insect. If it does not encounter a parasite inside the insect, it does not develop, or it can wait

until it encounters a parasite inside the host insect. Odder still, it will remain inactive inside the host insect until the parasite host pupates and then it will attack the pupa. Perilampids are hyperparasites of the pupae of tachinid flies, braconids and ichneumonids.

There was a pair of Torymidae Wasps from Location 1 in August. This group is mostly parasitic on other insects, including mantid eggs, gall insects and some caterpillars, but some also feed on seeds. As a family characteristic, they are more elongated and are often metallic green, 2-4 mm in length and with a prominent ovipositor.

A total of 10 Pteromalids were collected. Seven were collected in the earlier part of the summer and then 3 in September. They are often metallic green or bronze or black. This is another large family of about 340 species. They are parasitic as larvae, but also as adults in many cases. The adults feed on body fluids that seep from the host insect after being punctured by the wasp's ovipositor.

There were 7 Eurytomids (Seed Chalcids) collected in the first half of the summer from both locations. They are very similar in appearance to the perilampids, being stout-bodied and with a pitted and thick thorax, but the head, thorax and antennae are sometimes hairy and their abdomens are more rounded or oval. Eurytomids are parasitic, but some are also plant feeders, that will form galls in the stems of some plants.

Two Chalcids (Chalcididae) were found in the first half of the summer, both from Location 1. They have a distinct appearance with extremely swollen and toothed hind femora. They are slightly larger than some of the previously discussed families, approaching almost 7mm. They are parasitic on a wide of insect hosts and some are also hyperparasites of tachinid flies and ichneumonids.

Another group of minute parasitoids collected throughout much of the summer was from the family Playgasteridae. They are shiny and black with long, 10-segmented antennae that arise from very low on the face, very near the mouth. One of the stranger phenomena associated with some members of this family is polyembryony. As many as 18 larvae have been observed emerging from one egg.

The last superfamily in this sequence of parasitic wasps is Bethyloidea. One family from this group, Chrysididae (Cuckoo Wasps) was found in Location 2 in June. These are brilliant metallic green to bluish violet in color. Their exoskeleton is often deeply punctate and sculpted with waves and grooves. They are generally larger than most of the previous parasitoids discussed, more the size of a sweat bee. Most of the chrysidids are external parasites of late instar wasp or bee larvae.

There were a number of ants collected in the traps from both locations. They were mostly winged reproductives from the subfamilies Myrmecinae and Dolichoderinae. Myrmecinae is the largest subfamily of ants with more than 300 species in North America. They are best recognized by the two-segmented pedicel between the thorax and abdomen. Dolichoderinae is a smaller group of ants consisting of about 19 species in North America. They are mostly southern in distribution and can create a foul smell when disturbed. Two ants from Formicinae were determined to be *Formica exsectoides* (Allegheny Mound Ant) and *Formica subsericia*, both common eastern species. There are 86 species of *Formica* in North America.

There were five Sphecid wasps collected during the summer. This is another very large and diverse family with more than 1100 species in North America. They are mostly solitary wasps,

but there are some species that exhibit a degree of social behavior. The most recognizable sphecids are the mud daubers, blue-black wasps that gather mud to make their nests. They have a wide array of nesting habits, however. Some nest in ground burrows, others in hollow plant stems and other pre-existing cavities. There are species that construct their own nests from mud, while still others are cleptoparasites and will lay their eggs in the nests of other species. They are predatory wasps. Some have very specific prey that they exclusively hunt. Many have a taste for spiders. *Pemphredon* species hunt and stock their nests with aphids, in particular. *Philanthus* species specialize in other wasps and bees. *Crabro* species capture and stock flies for their larder.

There was a significant number (40) of Sweat Bees (Halictidae) collected in the first half of the summer. This is a familiar insect to many people. They are usually metallic green or bronze colored. They are primarily ground nesters. There are as many as 500 species of halictids in the east. As a group, they are important pollinators. There is at least one genus of halictid that is a cleptoparasite of other bees.

## **Coleoptera**

The next most diverse group collected in the study was beetles, representing eight species. Coleoptera is THE most diverse group of insects or of any other animal on the planet. There are more than 24,000 species in 113 families in North America alone. Interestingly, almost all were collected in June.

Appropriately, there were two specimens of Marsh Beetles (Helodidae) from Location 2 in June. They are very small beetles, 5 mm and under, with more than 30 species in North America. The larvae are aquatic and feed on microorganisms.

One Click Beetle (Elateridae) was collected and four Throscid Beetles, which at first sight appear to be click beetles. They are much smaller than click beetles and their antennae are often club-shaped. There are about 27 species of throscid beetles in North America compared to the more than 800 species of Elateridae. The larvae live in moist rotting wood and are thought to be predacious.

There were three 14-spotted Ladybugs collected. This is a non-native species that was introduced in the 1960's and has become established in the northeast.

There were 7 Lampyrids (Fireflies) collected in June from both locations. There are probably about 200 species of Lampyridae in North America. There were five *Photinus* species collected, perhaps the most recognizable genus. The adults of both sexes produce the familiar yellow flash. The larvae live in the soil and are thought to feed on earthworms. There was one *Lucidota atra* and another *Lucidota* sp. They are diurnal lampyrids that do not luminesce and are found in open woodland. There was also one *Photuris* specimen collected from Location 2. They are commonly associated with wetland meadows and marshy areas. The females of some *Photuris* species mimic the flashing sequence of *Photinus* females, luring *Photinus* males whereupon they are eaten.

A related family to Lampyridae is Cantharidae (Soldier Beetles). One cantharid, *Podabrus* sp., was collected from Location 2. There are more than 100 species in this genus in North America. They are known to feed on aphids and/or their honeydew.

There were a total of four Checkered Beetles (Cleridae) collected from both locations in June. With more than 300 species in North America, this is a large family. Most of them are banded orange and black or yellow and black, giving them a wasp-like appearance. They are mostly predators of other insects. There are some cases of the larvae acting as parasites of bees, developing in grasshopper egg pods, and some are pollen feeders.

The only beetle not collected in June was a Curculionid (Weevil) that was collected in Location 2 in September. The curculionids are another very large and diverse family of more than 3,000 species in North America. The collected individual is from the subfamily Entiminae, the “broad-nosed weevils.” This one is covered in microscopic bronze colored scales. As far as is known, all curculionids are vegetarians.

## Hemiptera

A large number of Cicadellids (Leafhoppers) were collected. There were 47 collected in June, 7 in July, 1 in August and then another spike of 65 in September. I was not able to identify more than a couple below subfamily, so I couldn't speculate whether these numbers represented adult emergence of a local population or migration from another location. There are about 2,500 species in North America. They are extremely diverse and all are plant feeders. They are known jumpers and some can migrate very long distances. They have complicated courtship behaviors, where coloration and posture play an important role, as well as sound vibration. Leafhoppers can communicate their presence to other leafhoppers on the same plant by use of drumming organs (tymbals on the underside their abdomens). Vibrations are transmitted through leaves or stems of plants on which they are feeding. The resulting vibrations are received and recognized as a potential mate or as a fellow species.

## Lepidoptera

Given the size range of most of the insects collected, I was surprised to have collected a number of butterflies (Lepidoptera), which I would have thought too large to fit through the funnel of the collecting jar. There were only three families represented: Pieridae (Sulphurs and Cabbage Butterflies), Hesperidae (Skipper Butterflies), and Nymphalidae (Brush-Footed Butterflies).

There was an alarming number (60) of Hesperiid butterflies from Location 1 in June; 59 of those were *Thymelicus lineola*, a non-native skipper that feeds on timothy grass. It is suggestive of part of the plant makeup of that location, but also the large number of these skippers that are being supported. There was one other *Polites sp.*

Pearl Crescents (*Thymelicus lineola*) were collected in June and then again in September from Location 1, suggesting a possible second generation. The larvae feed on asters.

There were two species of Pierids collected in June from Location 1. There were four *Pieris rapae* (Cabbage White) and one *Colias philodice* (Clouded Sulphur). The cabbage white is a species introduced from Europe in the 19<sup>th</sup> century. The clouded sulphur is one of 18 native species whose larvae feed on legumes.

Finally, there was a consistent presence of Microlepidoptera Moths from both locations, although in small numbers. It suggests these are more diurnal fliers.

## Collembola

I was somewhat surprised to find very tiny Springtails (Collembola) from Location 2 in August and September. They appear to belong to the genus *Seira*, which are known to disperse on the wind. They are flightless, but they are so very tiny, they can simply float through the air. As springtails are known jumpers with the aid of their furcula, perhaps these individuals initiated their “flight” by springing from vegetation into the wind.

## Psocoptera

There were a few Psocopterans (Barklice and Booklice) collected from Location 1. The individuals were Psocids (Common Barklice). There are 62 species in North America. At first glance, they look like neuropterans, but their heads are much wider, with large chewing mouthparts and with simpler wing venation. They are known to feed on lichen, fungus, molds, or otherwise scavenge. Psocids are often found on the trunks of trees (maples in particular) in the spring, grazing in “herds.”

## Concluding Remarks

The pleasure and wonder of looking at such small, obscure and fantastic animals as represented in this collection and seen under magnification, is something I wish everyone could have the opportunity to experience. When viewed under a stereo dissecting microscope, they cease to be invisible buzzing gnats and “flies” and suddenly become very distinct, bizarre and beautiful animals.

My thanks to the Geauga Park District for granting me this opportunity.

## Bibliography and Online Resources

Borror, DeLong and Triplehorn. *An Introduction to the Study of Insects*, 5<sup>th</sup> edition. Saunders College Publishing, 1981.

Eaton and Kaufman. *Kaufman Field Guide to Insects of North America*. Houghton Mifflin Company, 2007.

White. *A Field Guide to the Beetles of North America*. Houghton Mifflin Company, 1983.

Opler and Malikul. *A Field Guide to Eastern Butterflies*. Houghton Mifflin Company, 1992.

[www.bugguide.net](http://www.bugguide.net)

[www.diptera.info/](http://www.diptera.info/)

**Table 1. Flying Insect Survey Results, 2010  
Observatory Park, Geauga County, Ohio**

| Order               | Superfamily | Family | Subfamily | Genus/species                        | 18-Jun                  | 18-Jun                   | 19-Jul                  | 19-Jul                   | 20-Aug                  | 20-Aug                   | 18-Sep                  | 18-Sep                   | Total |
|---------------------|-------------|--------|-----------|--------------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------|
|                     |             |        |           |                                      | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam |       |
| <b>COLLEMBOLA</b>   |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Entomobyridae                        |                         |                          |                         |                          |                         | 1                        |                         | 1                        | 2     |
|                     |             |        |           | <i>Seira sp.</i>                     |                         |                          |                         |                          |                         | 1                        |                         | 1                        | 2     |
| <b>PSOCOPTERA</b>   |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Psocidae sp.                         |                         |                          |                         |                          | 1                       |                          | 2                       |                          | 3     |
| <b>THYSANOPTERA</b> |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Thripidae sp.                        | 2                       |                          |                         |                          | 1                       |                          | 1                       |                          | 4     |
| <b>ODONATA</b>      |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Coenagrionidae                       | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|                     |             |        |           | <i>Argia sp.</i>                     | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
| <b>TRICHOPTERA</b>  |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Lymnophilidae sp.                    |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
| <b>ORTHOPTERA</b>   |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Acrididae                            |                         |                          |                         | 1                        |                         |                          |                         |                          | 1     |
|                     |             |        |           | <i>Melanoplus bivittatus</i>         |                         |                          |                         | 1                        |                         |                          |                         |                          | 1     |
| <b>HEMIPTERA</b>    |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Cercopidae sp.                       | 2                       | 2                        |                         |                          |                         |                          |                         |                          | 4     |
|                     |             |        |           | Cicadellidae                         | 18                      | 29                       |                         | 7                        | 1                       |                          | 12                      | 53                       | 120   |
|                     |             |        |           | Typhlocybinae sp.                    | 12                      | 25                       |                         | 7                        |                         |                          |                         |                          | 44    |
|                     |             |        |           | Cicadellinae sp.                     | 6                       |                          |                         |                          | 1                       |                          | 12                      | 53                       | 72    |
|                     |             |        |           | <i>Draculacephala sp.</i>            |                         | 2                        |                         |                          |                         |                          |                         |                          | 2     |
|                     |             |        |           | <i>Coelidia sp.</i>                  |                         | 2                        |                         |                          |                         |                          |                         |                          | 2     |
|                     |             |        |           | Aphididae sp.                        |                         |                          |                         |                          |                         |                          | 1                       | 5                        | 6     |
|                     |             |        |           | Pentatomidae                         |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|                     |             |        |           | <i>Podisus sp.</i>                   |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
| <b>COLEOPTERA</b>   |             |        |           |                                      |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                     |             |        |           | Helodidae sp.                        |                         | 2                        |                         |                          |                         |                          |                         |                          | 2     |
|                     |             |        |           | Elateridae                           |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|                     |             |        |           | <i>Melanotus sp.</i>                 |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|                     |             |        |           | Throscidae                           |                         | 4                        |                         |                          |                         |                          |                         |                          | 4     |
|                     |             |        |           | Coccinellidae                        | 3                       |                          |                         |                          |                         |                          |                         |                          | 3     |
|                     |             |        |           | <i>Propylea quatuordecimpunctata</i> | 3                       |                          |                         |                          |                         |                          |                         |                          | 3     |

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Observatory Park, Geauga County, Ohio**

| Order | Superfamily | Family | Subfamily | Genus/species             | 18-Jun                  | 18-Jun                   | 19-Jul                  | 19-Jul                   | 20-Aug                  | 20-Aug                   | 18-Sep                  | 18-Sep                   | Total |
|-------|-------------|--------|-----------|---------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------|
|       |             |        |           |                           | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam |       |
|       |             |        |           | Lampyridae                | 2                       | 5                        |                         |                          |                         |                          |                         |                          | 7     |
|       |             |        |           | <i>Photinus sp.</i>       | 1                       | 4                        |                         |                          |                         |                          |                         |                          | 5     |
|       |             |        |           | <i>Lucidota atra</i>      |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Lucidota sp.</i>       | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Photuris sp.</i>       |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Cantharidae               |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Podabrus sp.</i>       |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Cleridae sp.              | 3                       | 1                        |                         |                          |                         |                          |                         |                          | 4     |
|       |             |        |           | Curculionidae             |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|       |             |        |           | <i>Entiminae sp.</i>      |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|       |             |        |           | <b>LEPIDOPTERA</b>        |                         |                          |                         |                          |                         |                          |                         |                          |       |
|       |             |        |           | Pieridae                  | 5                       |                          |                         |                          |                         |                          |                         |                          | 5     |
|       |             |        |           | <i>Pieris rapae</i>       | 4                       |                          |                         |                          |                         |                          |                         |                          | 4     |
|       |             |        |           | <i>Colias philodice</i>   | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Hesperiidae               | 60                      | 1                        |                         |                          |                         |                          | 1                       |                          | 62    |
|       |             |        |           | <i>Polites sp.</i>        | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Thymelicus lineola</i> | 59                      |                          |                         |                          |                         |                          |                         |                          | 59    |
|       |             |        |           | Nymphalidae               | 7                       |                          |                         | 1                        |                         |                          | 4                       |                          | 12    |
|       |             |        |           | <i>Phyciodes tharos</i>   | 7                       |                          |                         | 1                        |                         |                          | 4                       |                          | 12    |
|       |             |        |           | Crambidae sp.             | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Microlepidoptera          | 3                       | 3                        |                         | 2                        | 1                       | 7                        | 1                       | 1                        | 18    |
|       |             |        |           | <b>DIPTERA</b>            |                         |                          |                         |                          |                         |                          |                         |                          |       |
|       |             |        |           | Tipulidae sp.             | 2                       | 4                        |                         |                          |                         |                          | 1                       |                          | 7     |
|       |             |        |           | Psychodidae               |                         | 1                        |                         |                          |                         |                          | 2                       |                          | 3     |
|       |             |        |           | Culicidae                 |                         |                          |                         |                          |                         |                          | 1                       |                          | 1     |
|       |             |        |           | <i>Aedes sp.</i>          |                         |                          |                         |                          |                         |                          | 1                       |                          | 1     |
|       |             |        |           | Thaumaleidae sp.          |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|       |             |        |           | Ceratopogonidae           |                         | 2                        | 2                       | 13                       | 9                       | 3                        |                         | 12                       | 41    |
|       |             |        |           | Chironomidae sp.          | 5                       | 1                        |                         |                          |                         |                          | 1                       |                          | 7     |
|       |             |        |           | Mycetophilidae sp.        | 4                       | 4                        |                         | 2                        | 5                       | 5                        | 2                       | 5                        | 27    |
|       |             |        |           | Sciaridae sp.             | 4                       | 1                        | 1                       | 2                        | 4                       |                          | 7                       | 5                        | 24    |
|       |             |        |           | Cecidomyiidae sp.         | 4                       | 9                        | 11                      | 1                        | 2                       | 6                        | 6                       | 10                       | 49    |

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|-------|-------------|--------|-----------|-----------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------|
|       |             |        |           |                             | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam |       |
|       |             |        |           | Stratiomyidae sp.           |                         |                          |                         | 2                        |                         |                          |                         |                          | 2     |
|       |             |        |           | Tabanidae                   | 27                      | 19                       |                         | 19                       |                         |                          |                         |                          | 65    |
|       |             |        |           | <i>Tabanus trimaculatus</i> | 2                       | 1                        |                         | 1                        |                         |                          |                         |                          | 4     |
|       |             |        |           | <i>Tabanus lineola</i>      | 7                       | 5                        |                         | 1                        |                         |                          |                         |                          | 13    |
|       |             |        |           | <i>Chrysops flavidus</i>    | 3                       | 5                        |                         |                          |                         |                          |                         |                          | 8     |
|       |             |        |           | <i>Chrysops sp.</i>         | 16                      | 8                        |                         | 17                       |                         |                          |                         |                          | 41    |
|       |             |        |           | Rhagionidae                 |                         | 3                        |                         |                          |                         |                          |                         | 1                        | 4     |
|       |             |        |           | Scenopinidae sp.            |                         |                          |                         |                          |                         | 1                        |                         |                          | 1     |
|       |             |        |           | Mydidae                     | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Mydas sp.</i>            | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Asilidae                    | 2                       | 2                        |                         | 2                        |                         |                          |                         |                          | 6     |
|       |             |        |           | <i>Laphria sp.</i>          |                         | 1                        |                         | 1                        |                         |                          |                         |                          | 2     |
|       |             |        |           | <i>Promachus sp.</i>        | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Holocephala sp.</i>      | 1                       | 1                        |                         | 1                        |                         |                          |                         |                          | 3     |
|       |             |        |           | Acroceridae sp.             | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Bombyliidae                 |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Anthrax irroratus</i>    |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Empididae                   |                         | 3                        |                         | 4                        |                         |                          |                         | 3                        | 10    |
|       |             |        |           | Dolichopodidae sp.          | 78                      | 119                      | 18                      | 116                      | 17                      | 10                       | 18                      | 15                       | 391   |
|       |             |        |           | Phoridae sp.                | 2                       | 10                       |                         |                          | 11                      | 7                        | 5                       | 5                        | 40    |
|       |             |        |           | Pipunculidae sp.            |                         |                          |                         |                          | 1                       |                          |                         |                          | 1     |
|       |             |        |           | Syrphidae                   | 40                      | 20                       |                         | 4                        | 3                       |                          | 2                       | 1                        | 70    |
|       |             |        |           | <i>Toxomerus sp.</i>        | 26                      | 8                        |                         |                          |                         |                          |                         |                          | 34    |
|       |             |        |           | <i>Sphaerophoria sp.</i>    | 8                       | 4                        |                         |                          |                         |                          |                         |                          | 12    |
|       |             |        |           | <i>Xylota sp.</i>           | 6                       | 2                        |                         |                          |                         |                          |                         |                          | 8     |
|       |             |        |           | <i>Allograpta sp.</i>       |                         | 4                        |                         |                          |                         |                          |                         |                          | 4     |
|       |             |        |           | <i>Syrphus rubesii</i>      |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Chalcosyrphus sp.</i>    |                         |                          |                         |                          | 1                       |                          | 1                       |                          | 2     |
|       |             |        |           | <i>Helophilus sp.</i>       |                         |                          |                         |                          |                         |                          | 1                       |                          | 1     |
|       |             |        |           | Conopidae                   | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | <i>Myopa sp.</i>            | 1                       |                          |                         |                          |                         |                          |                         |                          | 1     |
|       |             |        |           | Micropezidae sp.            | 1                       | 1                        |                         |                          | 1                       |                          | 1                       |                          | 4     |

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|--------------------|-------------|--------|-----------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------|
|                    |             |        |           |                          | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam |       |
|                    |             |        |           | Otitidae sp.             |                         |                          |                         |                          | 1                       |                          |                         |                          | 1     |
|                    |             |        |           | Tephritidae sp.          | 1                       |                          |                         |                          | 1                       |                          | 1                       |                          | 3     |
|                    |             |        |           | Driomyzidae sp.          |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|                    |             |        |           | Sepsidae sp.             | 1                       |                          | 4                       | 1                        |                         | 2                        | 1                       | 1                        | 10    |
|                    |             |        |           | Sciomyzidae sp.          | 2                       |                          |                         |                          | 2                       |                          | 2                       | 1                        | 7     |
|                    |             |        |           | Lauxaniidae sp.          |                         |                          |                         |                          |                         |                          | 1                       |                          | 1     |
|                    |             |        |           | Chamaemyiidae sp.        | 3                       | 1                        |                         |                          |                         |                          |                         | 1                        | 5     |
|                    |             |        |           | Piophilidae sp.          |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|                    |             |        |           | Lonchaeidae sp.          | 3                       | 1                        |                         | 1                        | 7                       |                          | 1                       | 5                        | 18    |
|                    |             |        |           | Sphaeroceridae sp.       | 6                       | 1                        | 5                       | 6                        | 25                      | 32                       | 1                       | 5                        | 81    |
|                    |             |        |           | Ephydriidae sp.          | 4                       | 4                        |                         |                          |                         |                          |                         |                          | 8     |
|                    |             |        |           | Drosophilidae sp.        | 1                       | 5                        |                         | 4                        | 6                       |                          | 3                       | 5                        | 24    |
|                    |             |        |           | Chloropidae sp.          | 8                       |                          | 17                      | 1                        |                         | 3                        | 1                       | 14                       | 44    |
|                    |             |        |           | Clusiidae sp.            | 1                       |                          |                         | 2                        | 1                       |                          |                         |                          | 4     |
|                    |             |        |           | Heleomyzidae sp.         | 3                       |                          |                         | 2                        |                         |                          |                         |                          | 5     |
|                    |             |        |           | Muscidae                 | 5                       | 2                        |                         | 2                        |                         |                          | 4                       | 3                        | 16    |
|                    |             |        |           | <i>Musca sp.</i>         | 5                       | 2                        |                         |                          |                         |                          | 4                       |                          | 11    |
|                    |             |        |           | Calliphoridae            | 5                       |                          |                         | 6                        | 7                       |                          | 2                       | 11                       | 31    |
|                    |             |        |           | <i>Pollenia sp.</i>      | 3                       |                          |                         | 4                        | 1                       |                          | 2                       | 5                        | 15    |
|                    |             |        |           | <i>Lucilia sp.</i>       | 2                       |                          |                         | 2                        | 1                       |                          |                         | 4                        | 9     |
|                    |             |        |           | <i>Lucilia sericata</i>  |                         |                          |                         |                          | 2                       |                          |                         |                          | 2     |
|                    |             |        |           | <i>Calliphora sp.</i>    |                         |                          |                         |                          | 3                       |                          |                         | 1                        | 4     |
|                    |             |        |           | <i>Calliphora vicina</i> |                         |                          |                         |                          |                         |                          |                         | 1                        | 1     |
|                    |             |        |           | Sarcophagidae            | 5                       | 1                        |                         | 2                        | 4                       |                          | 3                       | 10                       | 25    |
|                    |             |        |           | <i>Sarcophaga sp.</i>    | 5                       | 1                        |                         | 2                        |                         |                          |                         |                          | 8     |
|                    |             |        |           | Tachinidae sp.           | 1                       | 1                        |                         | 1                        |                         |                          | 1                       |                          | 4     |
|                    |             |        |           | <i>Zelia sp.</i>         |                         | 1                        |                         |                          |                         |                          |                         |                          | 1     |
|                    |             |        |           | <i>Voria sp.</i>         |                         |                          |                         | 1                        |                         |                          |                         |                          | 1     |
| <b>HYMENOPTERA</b> |             |        |           |                          |                         |                          |                         |                          |                         |                          |                         |                          |       |
|                    |             |        |           | Braconidae               |                         | 4                        | 1                       | 3                        | 1                       | 1                        | 5                       |                          | 15    |
|                    |             |        |           | Ichneumonidae sp.        | 5                       | 11                       | 1                       | 6                        |                         | 5                        | 4                       | 5                        | 37    |
|                    |             |        |           | <i>Pimpla sp.</i>        |                         |                          |                         |                          |                         | 1                        |                         |                          | 1     |

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|--------------|-------------|--------|-----------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------|
|              |             |        |           |                                | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam | Location 1<br>Old Field | Location 2<br>Beaver Dam |             |
|              |             |        |           | Eulophidae sp.                 | 1                       |                          |                         |                          |                         |                          |                         |                          | 1           |
|              |             |        |           | Eupelmidae sp.                 |                         |                          |                         |                          |                         |                          |                         | 2                        | 2           |
|              |             |        |           | Perilampidae sp.               | 1                       |                          | 1                       |                          | 1                       | 1                        |                         |                          | 4           |
|              |             |        |           | Torymidae                      |                         |                          |                         |                          |                         | 2                        |                         |                          | 2           |
|              |             |        |           | Pteromalidae sp.               |                         | 5                        | 2                       |                          |                         |                          | 1                       | 2                        | 10          |
|              |             |        |           | Eurytomidae sp.                |                         | 3                        | 2                       | 2                        |                         |                          |                         |                          | 7           |
|              |             |        |           | Chalcididae sp.                | 1                       |                          | 1                       |                          |                         |                          |                         |                          | 2           |
|              |             |        |           | Proctotrupoidea sp.            | 1                       |                          | 1                       |                          |                         |                          | 1                       |                          | 3           |
|              |             |        |           | Platygasteridae sp.            | 2                       | 2                        |                         | 1                        |                         | 1                        |                         |                          | 6           |
|              |             |        |           | Chrysididae                    |                         | 3                        |                         |                          |                         |                          |                         |                          | 3           |
|              |             |        |           | Formicidae sp.                 |                         |                          | 2                       | 2                        |                         | 1                        | 2                       | 7                        | 14          |
|              |             |        |           | <i>Formica exsectoides</i>     |                         |                          |                         | 1                        |                         |                          |                         |                          | 1           |
|              |             |        |           | <i>Formica subsericia</i>      |                         |                          |                         | 1                        |                         |                          |                         |                          | 1           |
|              |             |        |           | Dolichoderinae                 |                         |                          |                         |                          |                         | 1                        |                         |                          | 1           |
|              |             |        |           | Myrmecinae sp.                 |                         |                          |                         |                          |                         |                          | 2                       | 7                        | 9           |
|              |             |        |           | Tiphiidae                      |                         |                          | 1                       | 1                        |                         |                          |                         |                          | 2           |
|              |             |        |           | Vespidae                       |                         |                          |                         |                          |                         | 2                        | 1                       |                          | 3           |
|              |             |        |           | <i>Dolichovespula maculata</i> |                         |                          |                         |                          |                         | 2                        |                         |                          | 2           |
|              |             |        |           | <i>Vespula maculifrons</i>     |                         |                          |                         |                          |                         |                          | 1                       |                          | 1           |
|              |             |        |           | Sphecidae                      | 1                       | 1                        |                         | 1                        | 1                       | 1                        |                         |                          | 5           |
|              |             |        |           | <i>Pemphredon sp.</i>          | 1                       |                          |                         |                          |                         |                          |                         |                          | 1           |
|              |             |        |           | <i>Philanthus sp.</i>          |                         |                          |                         | 1                        |                         |                          |                         |                          | 1           |
|              |             |        |           | <i>Crabro sp.</i>              |                         |                          |                         |                          | 1                       |                          |                         |                          | 1           |
|              |             |        |           | Halictidae sp.                 | 5                       |                          | 10                      | 25                       |                         |                          |                         |                          | 40          |
|              |             |        |           | Megachilidae sp.               |                         |                          |                         | 2                        |                         |                          |                         |                          | 2           |
|              |             |        |           | Apidae                         |                         |                          | 1                       |                          |                         |                          |                         |                          | 1           |
|              |             |        |           | <i>Anthophora sp.</i>          |                         |                          | 1                       |                          |                         | 1                        |                         |                          | 2           |
|              |             |        |           | <i>Apis mellifera</i>          | 1                       |                          |                         |                          |                         |                          |                         |                          | 1           |
| <b>TOTAL</b> |             |        |           |                                | <b>345</b>              | <b>298</b>               | <b>81</b>               | <b>248</b>               | <b>115</b>              | <b>93</b>                | <b>103</b>              | <b>193</b>               | <b>1476</b> |