

**Assessing the Biodiversity of Insects at
Litzinger Road Ecology Center**

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Introduction

Insects are the most diverse group of organisms on the planet with over one million described species (Gullan and Cranston 2005). However, these numbers represent less than the actual species richness of insects (Gullan and Cranston 2005). There are many species left for taxonomists to describe. Assessing the biodiversity of insects is of vast importance.

Insects are crucial for such ecosystem functions as nutrient recycling, pollination, seed dispersal, maintenance of plant community composition and structure, food for vertebrates, and maintenance of animal communities via transmission of diseases of large animals and predation and parasitizing of smaller animals (Gullan and Cranston 2005). There are insects that are considered keystone species because if they became extinct, the wider ecosystem might collapse (Gullan and Cranston 2005). For example, in tropical soils termites convert cellulose which suggests they are keystone species in tropical soil structuring (Gullan and Cranston 2005).

In addition knowledge of insects is important for human survival. Certain insects can damage our health, domestic animals, agriculture, and horticulture (Gullan and Cranston 2005). Others greatly benefit our society. They contribute to the food we eat or materials that we require (Gullan and Cranston 2005). For example, honey bees not only provide us with honey, they are also important pollinators performing a “free” service which if man had to do would cost several billion dollars annually in the United States (Gullan and Cranston 2005). Some insects such as predatory beetles or parasitic wasps, control pests by keeping their populations in check (Gullan and Cranston 2005). In

addition, insects are a valuable venue for biological control of invasive or exotic species (Gullan and Cranston 2005).

Furthermore, insects are useful for understanding general biological processes (Gullan and Cranston 2005). Studies of hymenopteran insects such as ants and bees have helped us understand the evolution and maintenance of social behaviors such as altruism (Gullan and Cranston 2005). Knowledge of general biological processes is important for the advancement of science as a whole as well as public and ecological sustainability. Finally, because insects are so numerous they have an important impact on our environment and our lives (Gullan and Cranston 2005).

Given all the support for the importance of insects to our ecosystems and our lives, it is critical that all people have access to, awareness, and knowledge of insects. However, this is not possible without accessible means of study.

Research Objectives

One way the study of insects can be made accessible to various researchers and the public is through collections and cataloguing of their biodiversity. Therefore, the research objective of this project was to conduct a biodiversity study of the insects present at Litzsinger Road Ecology Center. The study included collecting and cataloguing insects found on the property at various locations. The major goal of this project was to provide a general understanding of the biodiversity of insects located at LREC, and to organize this information in a format that is useful for educational and research purposes.

Materials and Methods

Materials

The following materials were used to conduct this study: Nets, pitfall traps, small garden shovels, a kill jar containing potassium cyanide, acetone, forceps, a GPS unit, glassine envelopes, insect pins, labels, a microscope, a spreading board, cardboard insect boxes, and insect display cases.

Methods

In order to fulfill the goals of the project and answer the research question, several methods were employed. First, three different methods of collecting were conducted at LREC over the course of the study. Collection occurred from May 2008 to July 2008. Specific collection times were as follows: May 16th, May 22nd, May 30th, June 5th, June 12th, June 24th, and July 18th. Collections occurred in several locations at LREC in order to obtain representative samples of the diversity of insects on the property. The locations of collection in this study were the prairie including mid-prairie and the edge of the prairie and forest area including the edge of the forest and mid-forest.

The two of the three methods of collecting conducted during this study were used most frequently because they were found to be the most successful in yielding large numbers of insects. These two methods were forms of netting. The first was conducted by searching for insects and then swinging at them with the net. The second form of netting employed involved sweeping vegetation. Sweeping involves swinging the net from side to side across various forms of vegetation (Triplehorn and Johnson 2005). Insects were removed from the nets using forceps, and then placed into a jar containing either potassium cyanide or acetone to be sacrificed. These jars are known as kill jars. This

method of sacrificing ensures that the specimen remains intact until it can be pinned (Triplehorn and Johnson 2005). Some insects were also transported back to the lab in glassine envelopes for temporary storage before pinning.

A third collection method conducted was the use of pitfall traps. These traps were made of plastic containers with holes in the bottom covered by a lid that was placed approximately an inch above the plastic container (Triplehorn and Johnson 2005). Toothpicks were stuck into opposite sides of the lid and then pushed into the ground, which allowed the lid to be suspended above the plastic container. Eight traps were buried in the ground having their tops even with the ground level (Triplehorn and Johnson 2005). Traps were placed in different locations around the property including the prairie and the forest. Kill jars were also used for sacrificing in this method.

Insects were taken immediately back to the lab. Once back in the lab, insects were sorted and pinned or point mounted. Then insects were given collection labels. After all of the insects were pinned, they were then identified to order and family. A Leica MZ12 microscope was used to inspect specimens for identification. Finally, specimens were grouped according to identifications and placed in either insect display cases or cardboard insect boxes for preservation.

Results and Discussion

The netting collection methods yielded higher numbers of insects than the pitfall traps. In total 7 orders were identified including 40 families (Table 1). Only two of these orders and one family were represented in the pitfall traps. One individual from the order Coleoptera and the family Carabidae (Ground beetle) was found in the pitfall trap, and several individuals from the order Collembola (Springtails) were observed in the pitfall

traps. However, due to difficulties encountered in collecting them, none were preserved in the collection. All other specimens and orders were collected by conducting one of the two methods of netting. The orders and families collected during this study are represented in Table 1.

The most frequently collected individuals and the individuals collected in the greatest quantities were found in the families Aphididae (Aphids or Plantlice) Cicadellidae (Leaf hoppers), and Miridae (Plant or Leaf bugs) all within the order Hemiptera. All three of these families contain a number of serious plant pest species. Pest species in the family Aphididae cause a curling or wilting of the plant by their feeding, and they can also serve as vectors for several plant diseases (Triplehorn and Johnson 2005). They are most often pests of cultivated plants (Triplehorn and Johnson 2005). Pest species in the family Cicadellidae cause five major types of injury to plants

- 1) Some species will remove large amounts of sap and reduce or destroy the chlorophyll in the leaves.
- 2) Other species disrupt the regular physiology of the plant.
- 3) A few species oviposit into green twigs, causing the terminal part of the twig to die.
- 4) Still others act as vectors of organisms that cause plant diseases.
- 5) Finally, some species will cause stunting and leaf curling that result from preventing growth underneath the leaves where they feed (Triplehorn and Johnson 2005).

Pest species in the family Miridae most often attack cultivated plants (Triplehorn and Johnson 2005). In the future, a study at LREC could focus on identifying if the species of these three families found on the property are those that are potentially harmful to the vegetation at LREC.

Table 1. – Orders and families found on LREC property. Collection method and important information about each family is also identified.

Order	Family	Collection Method	Information*
Coleoptera	Cantharidae	Netting	<ul style="list-style-type: none"> • Elongate and soft-bodied • Head visible from above • Found on flowers • Predators
	Carabidae	Pitfall trap	<ul style="list-style-type: none"> • Vary in size, shape, color-most dark shiny and flattened • Found under stones, logs, leaves, bark, or debris or running on ground. • Nearly all are predators and many are beneficial
	Coccinellidae	Netting	<ul style="list-style-type: none"> • Small/brightly colored • Head concealed from above • Predators of aphids • Found on vegetation
	Crysolmelidae	Netting	<ul style="list-style-type: none"> • Many brightly colored • Feed on flowers • Many can be pests of cultivated plants
	Curculionidae	Netting	<ul style="list-style-type: none"> • Have a snout • Plant feeders • Many serious plant pests • Many colored like bark or dirt
	Dermestidae	Netting	<ul style="list-style-type: none"> • Small, oval, or elongate-oval, usually hairy or covered with scales • Mostly scavengers of animal or plant products, some feed on flowers • Some pests found in homes • Beneficial- remove dead organic matter
	Elateridae	Netting	<ul style="list-style-type: none"> • Can “click” and jump • Body elongated, parallel-sided, and rounded at each end • Most black or brown • Live on flowers, under bark, or on vegetation • Larvae are destructive- feed on newly planted seeds and roots of some plants; some predators
	Lampyridae	Netting	<ul style="list-style-type: none"> • Many with a “tail-light”(light producing organ) • Elongate and soft-bodied • Head largely or entirely covered from above • Found on vegetation during the day
	Languriidae	Netting	<ul style="list-style-type: none"> • Narrow and elongate • Feed on leaves and pollen of plants • Larvae are stem-borers- can cause damage to plant

Table 1 continued

	Mordellidae	Netting	<ul style="list-style-type: none"> • Body wedge-shaped and hump-backed • Head bent down and abdomen pointed at the end • Black or mottled gray • Found on flowers; some predators
	Phalacridae	Netting	<ul style="list-style-type: none"> • Oval, shining, convex • Usually brownish • Adults feed on pollen
	Scarabidae	Netting	<ul style="list-style-type: none"> • Vary greatly in size, color and habits • Heavily bodied, oval or elongate, usually convex • Many feed on dung or decomposing plant materials; some live in nests or burrows of vertebrates, ants, or termites; some feed on fungi; many feed on plant materials • Some pests
	Staphylinidae	Netting	<ul style="list-style-type: none"> • Slender and elongate with a large portion of the abdomen showing • Most black or brown • Found in decaying material, under stones and other objects on the ground, along shores of streams, in fungi, leaf litter, and in nests of birds, mammals, ants, and termites • Most are predators
Collembola	Unknown	Pitfall trap	<ul style="list-style-type: none"> • Have a furcula (spring on the end of their body) that propels them through the air • Very small • Most live in soil, leaf litter, under bark, in decaying logs, and in fungi • Feed on decaying plant material, fungi, and bacteria • Few species cause damage in gardens or greenhouses
Diptera	Culicidae	Netting	<ul style="list-style-type: none"> • Mosquitoes; long proboscis • Females bloodsucking-bite humans and serve as vectors in several human diseases • Larvae are aquatic • Most active at night or twilight or in the shade • During the day found in hollow trees or under culverts
	Rhagionidae	Netting	<ul style="list-style-type: none"> • Medium-large, head rounded, abdomen long and tapering, legs long • Many with spotted wings; body brownish or gray, some black • Common in woods; usually found on foliage • Predators of small insects
	Sciaridae	Netting	<ul style="list-style-type: none"> • Usually blackish • Generally live in moist shady places • Larvae live in fungi; some attack plant roots
	Syrphidae	Netting	<ul style="list-style-type: none"> • Many brightly colored and resemble bees or wasps • Adults common on flowers; hover a lot • Larvae- many predators on aphids, others live in nests of social insects, some in decaying vegetation or rotting wood, some feed on growing plants

Table 1 continued

Hemiptera	Tipulidae	Netting	<ul style="list-style-type: none"> • Many mistaken for large mosquitoes • Body elongate and slender; long legs; wings long and narrow • Live in damp habitats with abundant vegetation • Many larvae are aquatic; some live in soil, fungi, mosses, or decaying wood • Most larvae feed on decomposing plant materials, some predators, some feed on roots of young plants
	Aphididae	Netting	<ul style="list-style-type: none"> • Small, soft-bodied • Pear-like shape, pair of cornicles (secreted defensive fluid) at the end of abdomen, long antennae • Suck sap from stems or leaves of plants • Many serious pests of cultivated plants
	Berytidae	Netting	<ul style="list-style-type: none"> • Body slender and elongate; long and slender legs and antennae • Live on vegetation; feed on plants • Brownish color
	Cercopidae	Netting	<ul style="list-style-type: none"> • Small; resemble frogs in shape; hop • Usually brown or gray • Feed on shrubs, trees, and herbaceous plants • Some are pests of grasses, clover, and trees
	Cicadellidae	Netting	<ul style="list-style-type: none"> • Various forms, colors, and sizes; many brightly colored • Have one or more rows of spines on the hind tibiae • Live on almost all types of plants; feed on leaves • Many important pest species
	Coreidae	Netting	<ul style="list-style-type: none"> • Most medium-sized-large, elongate, and dark colored • Have scent glands that give off distinct odor • Most plant feeders; some predators
	Cydnidae	Netting	<ul style="list-style-type: none"> • Look like small stink bugs; oval with spiny tibiae • Black or reddish brown and small • Found beneath stones or boards, in sand, or about the roots of grass tufts • Feed on roots of plants; will come to light at night
	Dictyopharidae	Netting	<ul style="list-style-type: none"> • Head is prolonged anteriorly into a long process • Grass feeders; found in meadows
	Membracidae	Netting	<ul style="list-style-type: none"> • Large pronotum covers head and extends over abdomen often in peculiar shapes • Feed on trees and shrubs; some on grass and herbaceous plants as nymphs • Only a few are pests (damage done from egg laying)
	Miridae	Netting	<ul style="list-style-type: none"> • Soft-bodied, various colors • Found on vegetation almost everywhere • Most are plant feeders; some predators • Some pests of cultivated plants
Pentatomidae	Netting	<ul style="list-style-type: none"> • Round or ovoid shaped; many brightly colored • Produce a bad odor • Most are plant feeders; some predators 	

Table 1 continued

Hymenoptera	Reduviidae	Netting	<ul style="list-style-type: none"> • Some black or brownish; many brightly colored • Head usually elongate; many have a widened abdomen in the middle • Most are predators; some bloodsucking and bite people
	Rhyarochromidae	Netting	<ul style="list-style-type: none"> • Dull colored • Spines on front femur • Feed on mature seeds
	Tingidae	Netting	<ul style="list-style-type: none"> • Small • Dorsal surface elaborately sculptured- looks like lace • Plant feeders- herbaceous plants and trees • Some do considerable damage to trees
	Apidae:Apinae	Netting	<ul style="list-style-type: none"> • Digger bees, bumble bees, honey bees, and orchid bees • Various forms • Bumble bees- robust; black and yellow; relatively large; important pollinators; nest in ground; deserted mouse nests, or bird nests • Honey bees- golden brown coloration; important pollinators; usually nest in hollow tree; can communicate with each other through dances
	Braconidae	Netting	<ul style="list-style-type: none"> • Usually relatively small • Beneficial- parasites of other insects • Biology very diverse
	Cynipidae	Netting	<ul style="list-style-type: none"> • Make galls (an abnormal growth on a plant; may be various shapes) in twigs, flowers, or leaves ; larvae develops inside the gall • Use a wide variety of host plants for egg laying
	Formicoidea	Netting	<ul style="list-style-type: none"> • Ants • Occur practically everywhere in terrestrial habitats- one of the most successful insect groups • All eusocial- most colonies contain 3 castes: queens, males, and workers • Most nests in North America are found in the ground • Feeding habits vary ex) some carnivores, some herbivores, some feed on fungi, sap, or nectar
	Halictidae	Netting	<ul style="list-style-type: none"> • Small to moderate sized, often metallic in color • Most nest in burrows in the ground • Diverse in social biology • Bees
	Ichneumonidae	Netting	<ul style="list-style-type: none"> • One of the largest families in Insecta • Adults vary in size, form, and color; most are slender ; long antennae • Most are parasitoids- larvae feeds and develops on one host that it eventually kills • Most are solitary
Torymidae	Netting	<ul style="list-style-type: none"> • Somewhat elongate • Some are parasites and some feed on plants (attack caterpillars, gall insects, and seeds) 	

Table 1 continued

Mantodea	Liturgusinae	Netting	<ul style="list-style-type: none"> • Large, slow moving, modified front legs • Front femur and tibiae have strong spines and are fitted for grasping prey • Head is freely movable- can look over their shoulders • Predators of other insects- lie in wait for prey with front legs in an upraised position (gives them their common name “praying mantis”)
Orthoptera	Tridactylidae	Netting	<ul style="list-style-type: none"> • Tiny crickets • Adults encountered in spring and early summer • Not very economically important

- All Information is taken from Triplehorn and Johnson 2005.

Significance of Research

This research project is of significance to LREC as well as the general public and other researchers. Given the importance of studying the biodiversity of insects because of their impact on the functioning of ecosystems and our livelihood, this project will benefit LREC by providing a beginning list of the biodiversity of insects on the property. This list also has the potential to be of interest to additional researchers who want to study insects found on the biodiversity list as well as researchers at the LREC. In addition, the biodiversity list provided by this study helps identify insects on the property that may be pests that are detrimental to the vegetation found on the property. Finally, the research project benefits the general public by serving as an education tool. Display cases of insects can be used to educate the general public about entomology. The list of biodiversity will enable staff and researchers at the LREC to point out insects that can be found on the property, use the methods employed in this project to collect them for classes, and have classes that focus on collecting and identifying insects found on-site. The accompanying Power-point slide show including pictures and important information

about most of the families found on the property, will provide staff and researchers at LREC an additional tool to educate visitors about insects that they might encounter on the property.

Literature Cited

Gullan, P.J., & Cranston, P.S. (2005). *The Insects: An outline of Entomology*. Malden : Blackwell Publishing.

Triplehorn, C. A., & Johnson, N. F. (2005). *Borror and DeLong's Introduction to the Study of Insects*. Belmont: Thomson Brooks/Cole.