ABACHRYSA EUREKA (BANKS) (NEUROPTERA: CHRYSOPIDAE): EGG, FIRST INSTAR LARVA AND BIOLOGICAL NOTES

A Senior Honors Thesis

by

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ABSTRACT

Abachrysa eureka (Banks) (Neuroptera: Chyrsopidae): Egg, First Instar Larva and Biological Notes (April 2007)

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Based on museum-held and field-collected specimens new data are presented regarding the distribution, adult phenology and first-instar larva of the uncommon green lacewing *Abachrysa eureka*. It was found that this species is broadly distributed across the southeastern United States, from Texas to the east coast south to Florida and north to South Carolina. There are multiple short duration emergence periods which vary with latitude. This species appears to be a typical chrysopid in various biological aspects, such as the occurrence of a stalked egg and placement of debris on the backs of larva.

I wish to dedicate this thesis to my grandparents, George and Mary Tokar and Ike and Stella Catanach, for encouraging me to go outside and play with insects; to my parents, Bob and Rosie Catanach, for supporting my love for all things wild; and to my sister and brother, Maria and Tommy “Eddie” Catanach for putting up some strange family vacations and dinner conversations. I also dedicate this thesis to my co-heir apparent Jonathan Alan Cammack for making sure I survived my undergraduate career while having fun along the way.

ACKNOWLEDGEMENTS

I wish to first thank my Honors Research Fellow's advisor Dr. John Oswald. Dr. Oswald's assisted throughout this project in many different ways, including providing literature, collecting specimens, offering rearing suggestions, and revising the papers. I also thank Mr. Ed Riley for collecting some of the *Abachrysa* specimens used in this study, and Dr. Brad Vinson, Mr. Jonathan Cammack and the TAMU Genetics Department for assistance in providing specimens for feeding trials. Dr. Norm Penny (CAS) not only provided specimen data from the CAS collection, but also shared his database documenting all *A. eureka* records known to him. This served as a model for the database used to manage spatial and temporal data for this project. We thank the following curators/collection managers for access to specimens and/or data on *Abachrysa* material in their care (for expansions of collection acronyms see Table 1): Cheryl Bar (EMEC), Victoria Bayless (LSAM), Oliver Flint (USNM), David Goodger (BMNH), Shawn Kelly (UCFC), Terry Schiefer (MEM), Kristin Simpson (UMRM), Cecil Smith (UGCA), Michael Wall (SDMC), and Shawn Winterton (CSCA). Finally, I thank the Texas A&M University Office of Honors Programs and Academic Scholarship for support of this project through the Undergraduate Research Fellows

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I. INTRODUCTION[1]

A Brief Description of *Abachrysa eureka*

Abachrysa eureka (Banks, 1931) [*Chrysopa*] (Neuroptera: Chrysopidae: Chrysopinae: Belonopterygini) is an uncommon, non-green, green lacewing distributed broadly throughout the southeastern United States. It is currently the only described species in the genus *Abachrysa*, and little is known about the biology or phenology of any of its life stages. Adults are poorly represented in collections and are generally thought to be rare in the field, although our work suggests that this apparent rareness may be an artifact of narrow periods of adult emergence and persistence.

Green lacewings, family Chrysopidae, are widely-distributed members of the order Neuroptera. Neuroptera are small to moderately-large insects with four membranous wings. These wings are characterized by the presence of more branches and crossveins than typical insects. All chrysopids are predacious as larva, while adults have been documented to be predators or non-feeding. Although *Abachrysa eureka* has only been known for about eighty years, it is actually a very conspicuous insect, with its striking black, white and orange coloration pattern deviating strongly from the greenish coloration typical of most chrysopids.

Abachrysa eureka has previously been reported from Arkansas, Florida, Georgia, Mississippi and Texas (Banks 1931, 1938; Bickley & MacLeod 1956; Agnew et al.

[1] This thesis follows the style and format of T*he Annals of the Entomological Society of America.*

1981; Brooks & Barnard 1990). This range is not contiguous and, based on suspected habitat preferences, other areas of the southeastern U.S. should also support this species.

No published information exists on the immature stages of *Abachrysa eureka*, although the species is known to have been reared from egg to adult at least once (unpublished records of Ellis MacLeod in the possession of JDO). Based on the known ant associations of other larval belonopterygine chrysopids (the tribe in which *A. eureka* is placed), e.g., *Italochrysa* (Nicoli Aldini 1998; Principi 1946) and *Nacarina* (Weber 1942), it is suspected that the larvae of *Abachrysa* may live in association with ants, but this has yet to be confirmed. The feeding habits of adult *Abachrysa* are also unknown.

Objectives for this Thesis

This goal of this study is to more accurately and fully understand the ecological patterns and biology of *Abachrysa eureka*. The four main objectives of this research project were: (1) to determine more completely the natural range of *Abachrysa eureka*, (2) to document the seasonal emergence pattern(s) of its adults, (3) to investigate the feeding habits of its larvae and adult, and (4) to describe its egg and larval instars.

A more accurate determination of the range of *A. eureka* is needed because published range records are incomplete, even with respect to state occurrence records. Using data from entomological research collections located throughout the country, I hope to discover more completely the emergence pattern(s) of the species as a whole.

This thesis is divided into two chapters. The first – Spatial and Temporal Distribution – focuses on the acquisition and analysis of spatial and temporal data for *A.*

eureka. The second – Biological and Behavioral Observations -- focuses on the biology of this species.

II. SPATIAL AND TEMPORAL DISTRIBUTION

Introduction

Accurate spatial and temporal distributions are critical for understanding the biology and phenology of species. These data have many fundamental applications, including the prediction of possible habitat and prey preferences and the determination of optimal collecting times for different life stages.

Materials and Methods

Data relevant to the geographical and temporal distributions of *A. eureka* were obtained from entomological research collections across the U.S. (Table 1), focusing on collections located in or near the known range of the species, and collections known to have strong holdings of related taxa.

Table 1. List of insect collections contacted or visited to acquire data. Not all collections had *Abachrysa eureka* specimens or replied to requests for data.

AMNH	USA, New York, New York, American Museum of Natural History
ANSP	USA, Pennsylvania, Philadelphia, Academy of Natural Sciences
AUEM	USA, Alabama, Auburn, Auburn University
BMNH	United Kingdom, London, The Natural History Museum
CAS	USA, California, San Francisco, California Academy of Sciences
CSCA	USA, California, Sacramento, California State Collection of Arthropods
CUAC	USA, South Carolina, Clemson, Clemson University
EMEC	USA, California, Berkeley, University of California, Essig Museum of Entomology
FSCA	USA, Florida, Gainesville, Division of Plant Industry, Florida State Collection of Arthropods
INHS	USA, Illinois, Champaign, Illinois Natural History Survey
LSAM	USA, Louisiana, Baton Rouge, Louisiana State University, Louisiana State Arthropod Museum
MEM	USA, Mississippi, Mississippi State, Mississippi State University
NCSU	USA, North Carolina, Raleigh North Carolina State University Insect Collection
SDMC	USA, California, San Diego Natural History Museum
SEMC	USA, Kansas, Lawrence, University of Kansas, Snow Entomological Museum
SFAC	USA, Texas, Nacogdoches, Stephen F. Austin State University
TAMU	USA, Texas, College Station, Texas A&M University Insect Collection
TTRS	USA, Florida, Tallahassee, Tall Timbers Research Station
UAAM	USA, Arkansas, Fayetteville, University of Arkansas, Department of Entomology, The Arthropod Museum
UABD	USA, Alabama, Tuscaloosa, University of Alabama
UCFC	USA, Florida, Orlando, University of Central Florida
UGCA	USA, Georgia, Athens, University of Georgia
UMIC	USA, Mississippi, Oxford, University of Mississippi
UMRM	USA, Missouri, Columbia, University of Missouri, W.R. Ennis Entomology Museum
USNM	USA, District of Columbia, Washington, National Museum of Natural History
UTEX	USA, Texas, Austin, Department of Biology
VMNH	USA, Virginia, Martinsville, Virginia Museum of Natural History
VTEC	USA, Virginia, Blacksburg, Department of Entomology

E-mails were sent to the curator of each collection requesting information about any *A. eureka* specimen held in the collection. The collection information requested can be broken up into four categories: location information (state, county, city, and latitude and longitude; as available), collecting data (collecting date or date range, collector's name, and collecting method), specimen data (life stage, sex and identifier), and insect collection data (what museum it is deposited in). Frequently, multiple specimens would have the same collecting event data (meaning all data were the same), so for practical proposes they could be treated as a single unit when determining spatial and temporal distributions. In some cases, partial data were recorded if not all data were available. *Abachrysa eureka* is easy to identify based on color and pattern, but if there was any questions about the identification collection managers were instructed to send specimens to us for identification.

The collected data were integrated into an Excel spread sheet provided by Dr. Norm Penny, a neuropterist with the California Academy of Science, for organization and tracking. Rather than recording individual specimens in this sheet, collecting events were used and the number of specimen of each sex was recorded. Each record was assigned a collection ID number to insure that records could be returned to their original order. Collection data formats were standardized across all records to allow comparisons to be made among specimens from different museums. All dates were placed in a standard format, then assigning to a numerical week of the year. This allowed the data to be compared and analyzed on a weekly basis in order to identify seasonal

trends. Counties of collection were determined for specimens that had site locality data but which did not have county data on the label.

These data were then analyzed to determine spatial distribution patterns and, in combination with temporal data, to look for variations in temporal distribution by state. Totals of 397 specimen records and 224 collecting events were used in this part of the study (Table 2). The majority of the specimens were from either Florida or Texas, although Alabama was also well represented. The remaining states, Arkansas, Georgia, Louisiana, Mississippi, and South Carolina had substantially fewer specimen records.

Table 2: Locality summary of specimens used in this thesis

	Specimens	Collecting Events
Alabama	72	36
Arkansas	6	5
Florida	114	66
Georgia	9	5
Louisiana	41	24
Mississippi	38	35
South Carolina	2	2
Texas	115	51
Total	397	224

Interactions between spatial and temporal distributions were investigated by comparing temporal data against specimen data represented as both specimen counts and collecting event counts. Each of these comparisons was then graphed in four ways against the distribution data: (1) all localities, (2) localities grouped by state [states with

<20 records were excluded as not sufficiently informative], (3) localities grouped into three latitudinally delimited bands. The last grouping was included because many southeastern states encompass a wide range of latitudes. Because insect development is strongly influenced by day length and temperature, it was thought that a latitudinal grouping of localities might reflect more natural phenology patterns. Counties were partitioned into three groups -- northern, central and southern --- based on their latitudes (Figure 1). Lines were drawn so that no counties with *Abachrysa* records were placed in more that one group. They also split the distribution approximately into thirds.

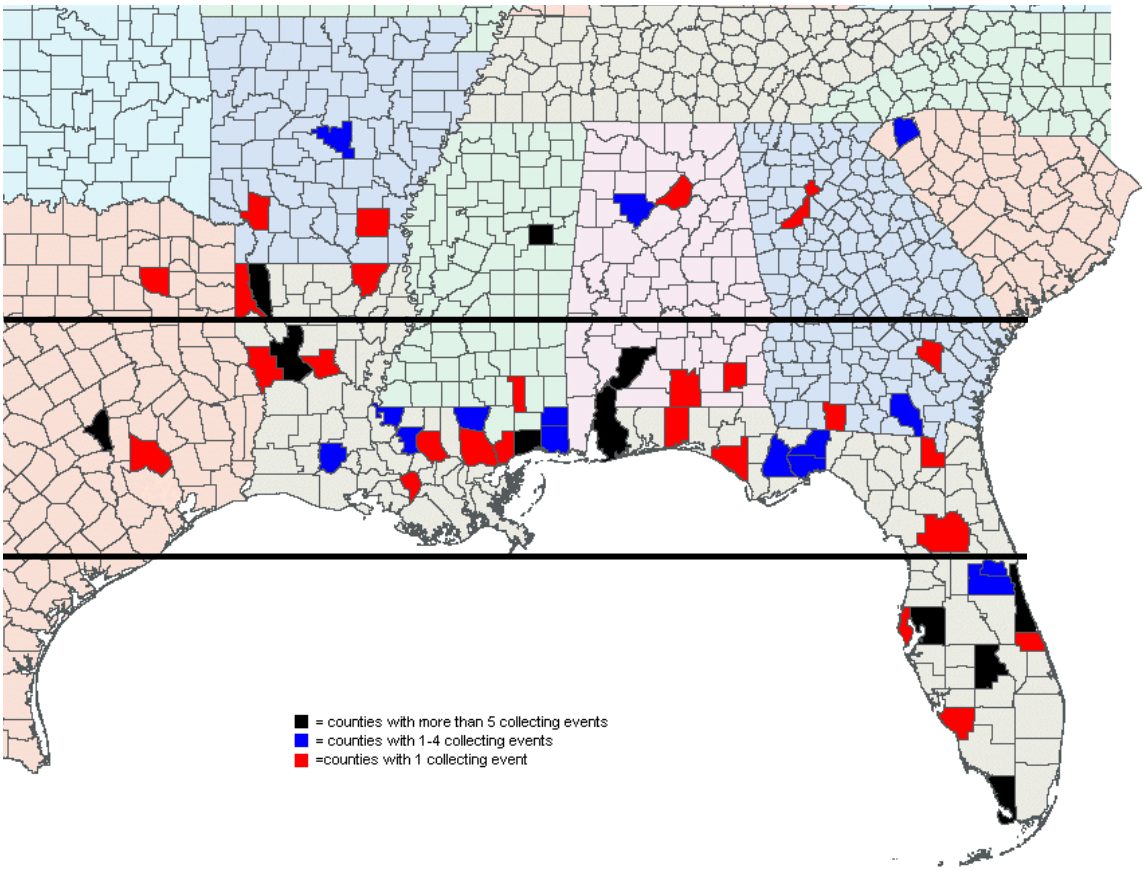

Figure 1: Distribution of *Abachrysa eureka* by county in the southeastern United States. Counties are color coded to show the number of collecting events per county. The horizontal black lines show the division of counties into the northern, central, and southern latitudinal groupings.

Spatial Patterns

Specimen distribution data show that *Abachrysa eureka* has now been collected in eight contiguous states (Figure 1). Three of these are new state records: Alabama, Louisiana and South Carolina. Based on these records, *Abachrysa* appears to be

restricted to, but widely distributed across, the southeastern United States (Figure 2). The expanded distribution of *A. eureka* documented here ranges from Brazos County, Texas (western limit), to Indian River County, Florida (eastern limit), and from Monroe County, Florida (southern limit) to Pickens County, South Carolina (northern limit). I expect that future collecting will reveal a more continuous distribution at the county level, and perhaps the discovery of this species in some adjacent states (e.g., Tennessee and North Carolina). Most collections took place in a few counties: Baldwin (Alabama), Highlands (Florida), Harrison and Oktibbeha (Mississippi), and Brazos (Texas). The larger numbers of specimens collected in these counties are thought to represent collection biases, as these counties contain either wildlife refuges, research stations or major universities (all of which tend to lead to above-average local collecting effort).

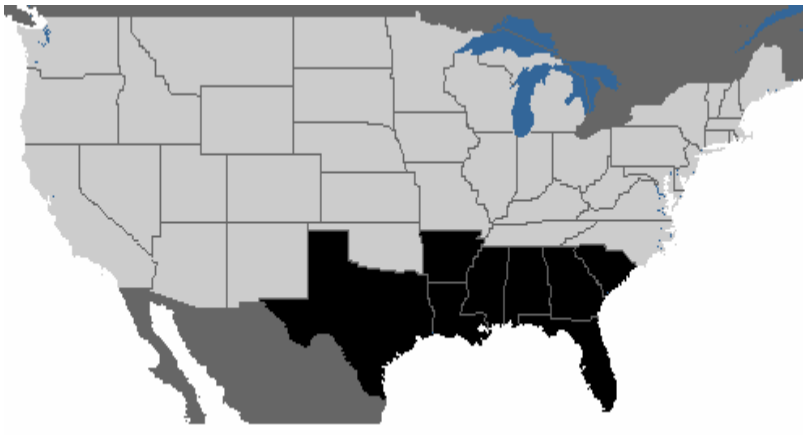

Figure 2. Distribution of *Abachrysa eureka* by state

Temporal Patterns

Analysis of adult collecting dates across the full collecting range of *Abachrysa* showed three different collection collecting peaks: well-defined peaks in the summer and fall collecting and a less well-defined collecting peak in late spring (Figure 3). The summer collecting peak occurred in August while the fall collecting peak lasted from mid September to early October. Spring collecting was not as tight, lasting from the end of April into early June. All three collecting peaks are also evident when the data are aggregated by collecting event, rather than specimen count (Figure 4).

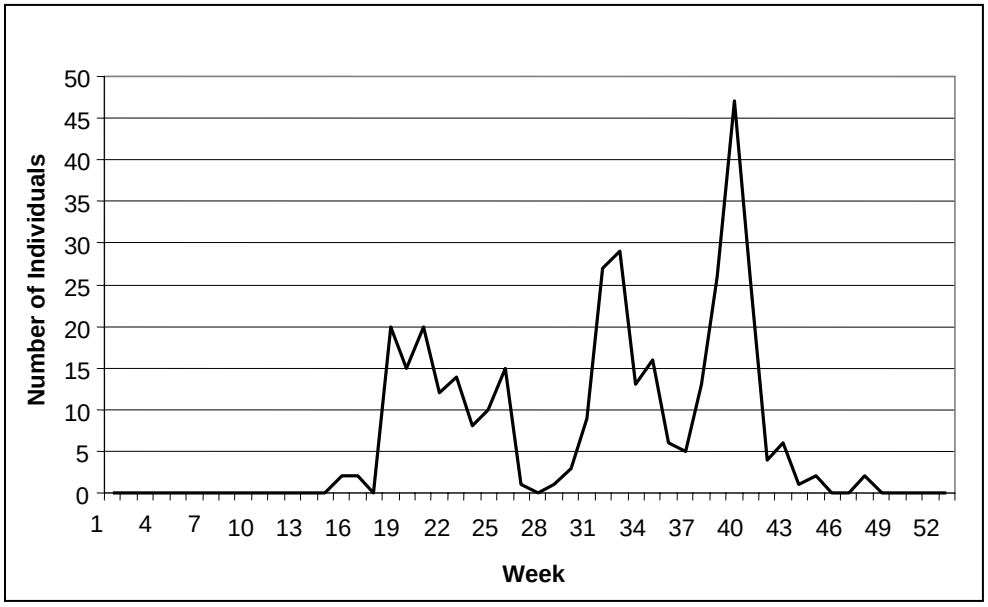

Figure 3: Number of individual *Abachrysa eureka* collected by week throughout the southeastern United States. For reference week 19 corresponds to 12 May and week 40 corresponds to 6 October.

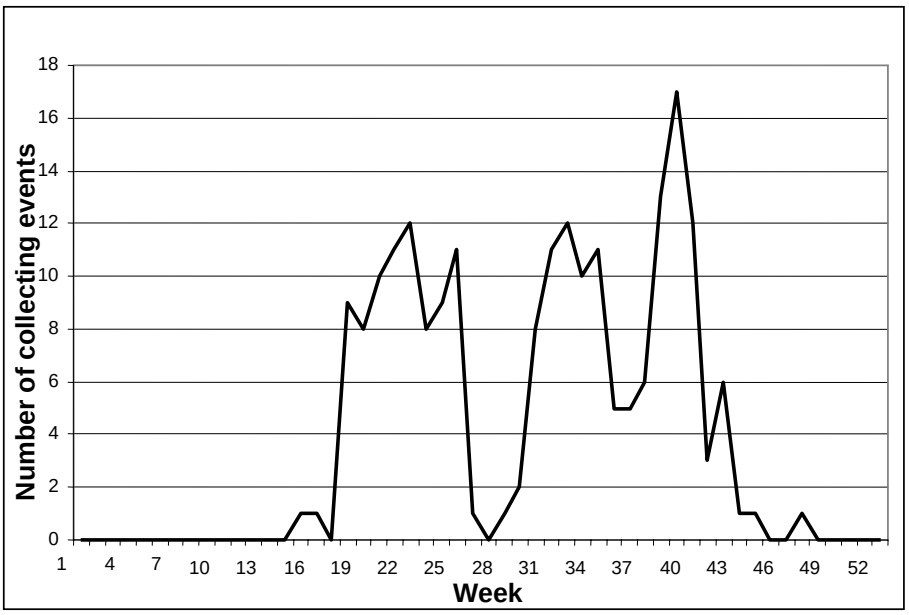

Figure 4: Number of *Abachrysa eureka* collecting events recorded by week across its entire range. For reference week 19 corresponds to 12 May and week 40 corresponds to 6 October.

Analysis of collecting-date data by state revealed that each of the three major peaks corresponded primarily to collections in a different state (Figure 5). The well-defined, late summer peak was found to consist primarily of specimens collected in Alabama, while material collected in Florida accounted for most of the late spring peak. Texas specimens were found to constitute the major component of the fall collection peak. These observations were also evident when the data were aggregated by collecting event (Figure 6).

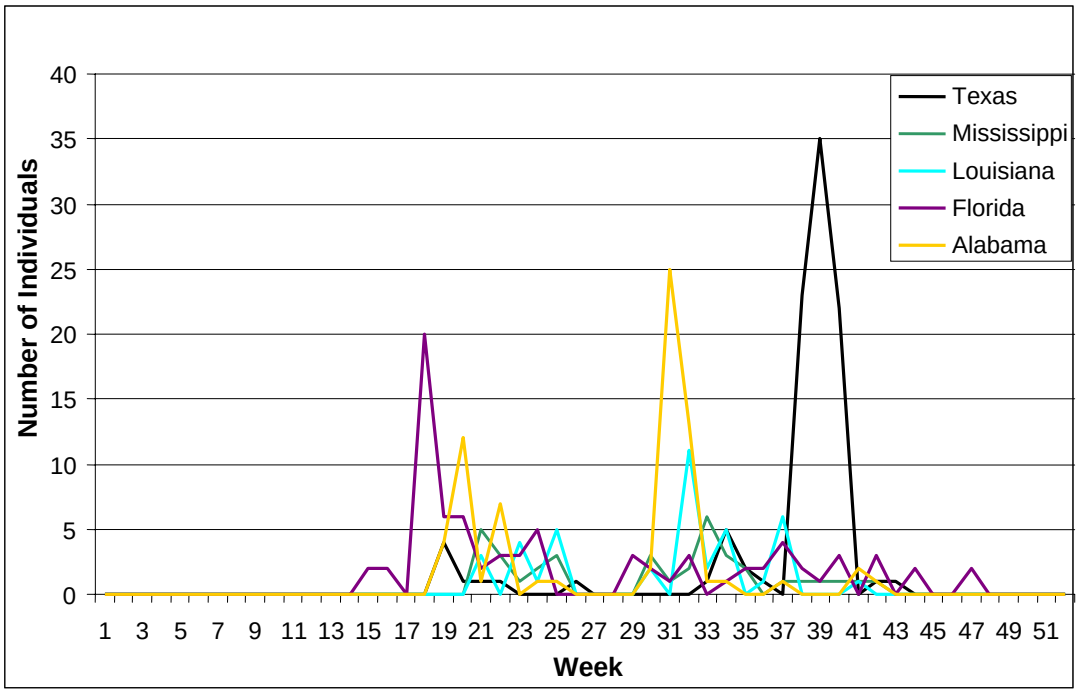

Figure 5: Number of *Abachrysa eureka* specimens collected by week in selected states.

For reference week 19 corresponds to 12 May and week 41 corresponds to 15 October.

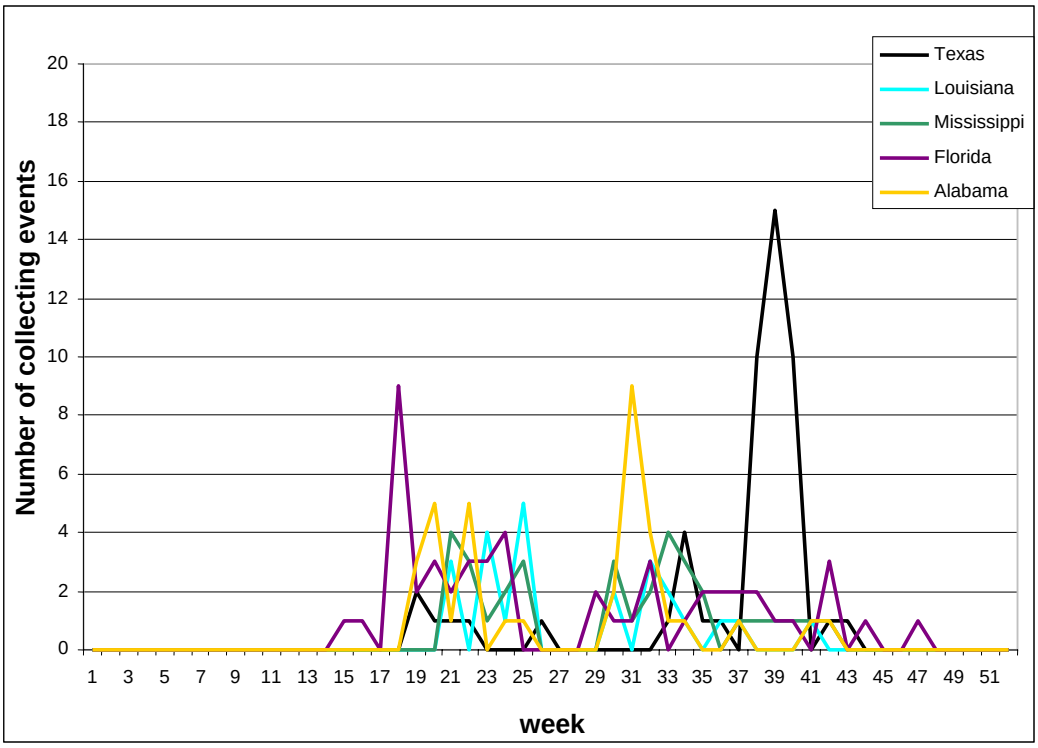

Figure 6: Number of *Abachrysa eureka* collecting events by week in selected states. For reference week 19 corresponds to 12 May and week 41 corresponds to 15 October.

Analysis of collecting-date data by latitudinal region revealed some variation among the regions (Figure 7). The southern region had both the earliest and latest collecting dates and a much earlier collecting peak than the other two regions (Figure 7). In the southern region, after an initial peak in mid May there were small numbers of specimens collected throughout the year (through the end of November), but there was no fall peak. The central region had a spring peak a few weeks after the southern region peak then four additional peaks over the course of the year through the end of October.

In this region there were peaks in the late spring and early summer (of similar size and a few weeks apart), followed by a substantially larger peak in August, a small peak in early September, and the largest peak at the end of September lasting through early October. The northern region had two main peaks of similar size, one in early June (a few weeks after the first central region peak) and the second in mid August. Between those peaks there were smaller numbers of insects collected, with no single week with more than three specimens.

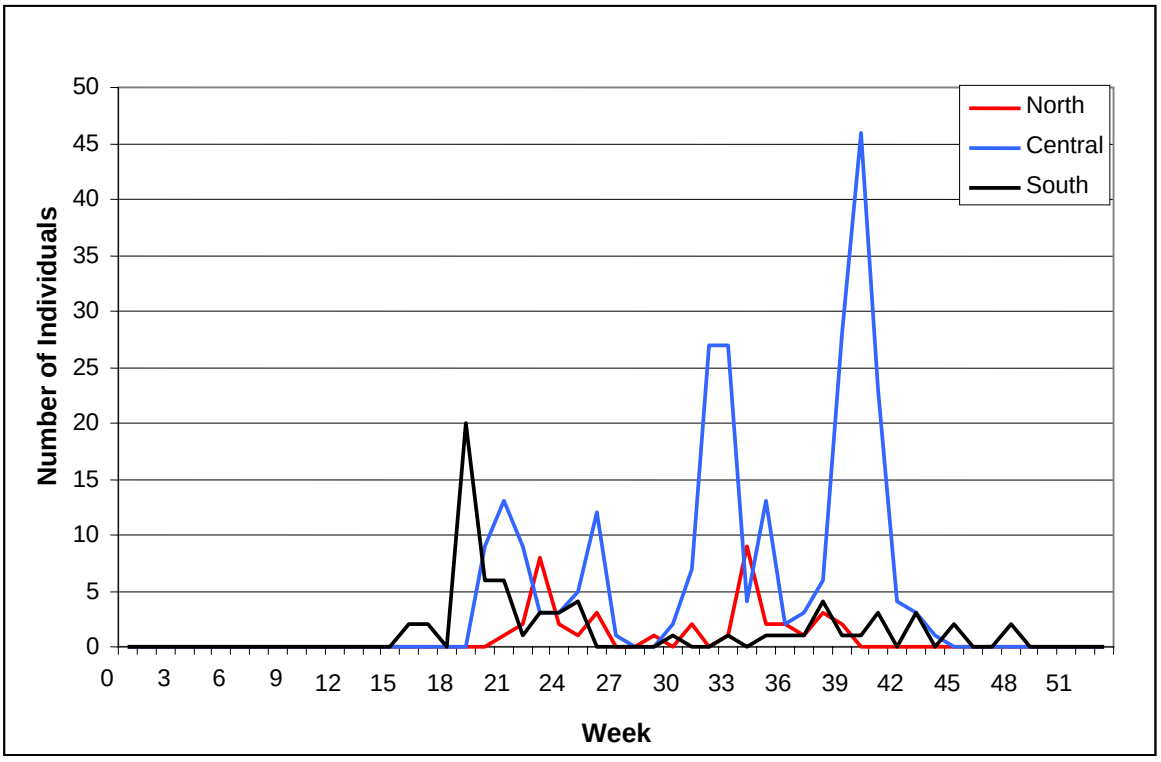

Figure 7: Number of *Abachrysa eureka* specimens collected by week in three latitudinal regions.

A similar pattern was evident when the data were aggregated by collecting event (Figure 8), but the difference in the relative height of the peaks was reduced

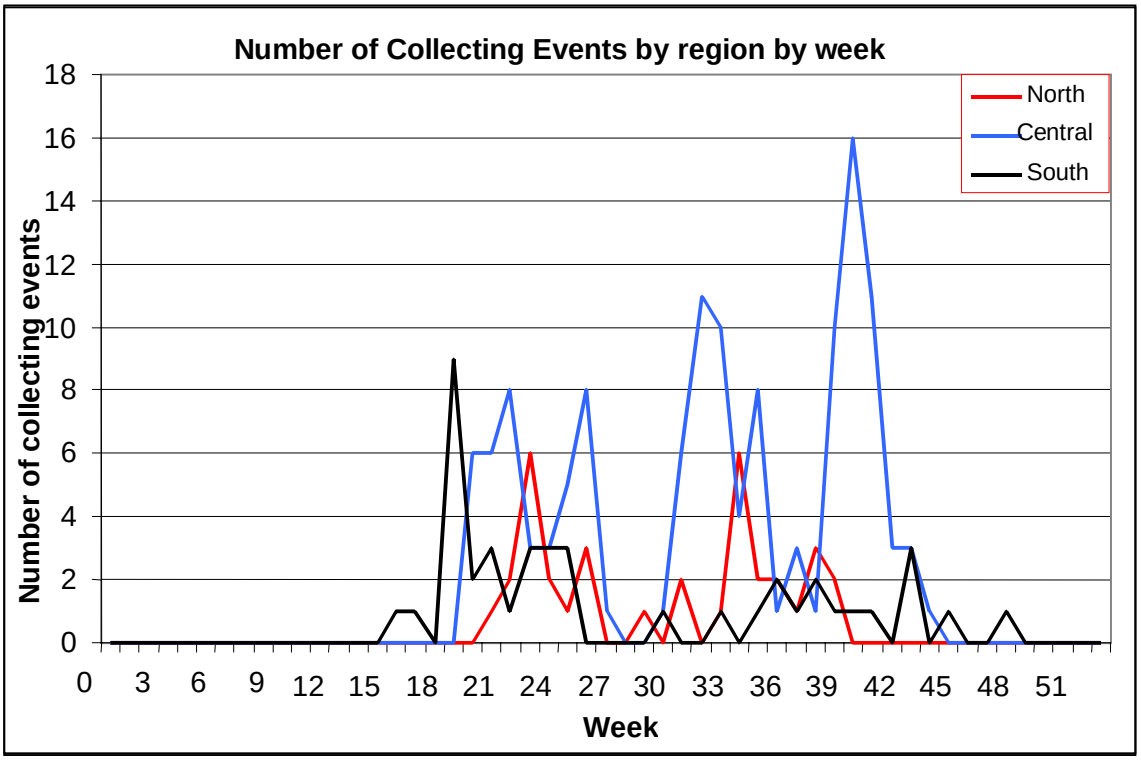

Figure 8: Number of *Abachrysa eureka* collecting events by week in three latitudinal regions.

Discussion of Results

Distinct differences are apparent in the collecting dates of *Abachrysa eureka* specimens collected at different localities -- differences that are probably closely tied to the collecting dates of this species in different geographical regions. As would be expected, southern region collections started earlier in the year and continued later into the year when compared to more northern region collections. Central region collection dates were intermediate between those of the northern and southern regions, and contained more distinct peaks. Instead of a single peak (like the southern region) or a bimodal distribution (like the northern region), there were five peaks of varying sizes, the largest of which occurred in the fall. However, examination of these data at the state level shows that of the fall collections all but one occurred in Texas. This could mean that Texas is following a different trend, which is substantiated by examining the data when grouped by state. This grouping clearly shows that Texas has a bimodal distribution in which there is a small spring peak and a much larger fall peak.

It is possible that the resulting pattern is skewed by the large number of central region records, when compared to the other two retions. The central region encompasses a large variety of longitudes as most of the collecting events were not grouped as occurred in Florida. many of which are represented by a relatively large number of specimens and collecting events. This could lead to the belief that there are many peaks all occurring throughout the region while in truth there are a couple of peaks in each of the longitudinal regions which are all offset from each other

In general the temporal results agreed with what had been suspected. Latitudinal effects on insect collecting times would be logical due to the effect of temperature and light on insect developmental time. It is also expected that the northern areas of a species' range would have collecting periods closer to the summer, while those in more southerly areas are likely to be spread throughout the year. As Texas is on the westernmost edge of the known range of *Abachrysa*, the fact that it appears to be following a slightly different trend then other areas in its region is not surprising.

While it at first appeared that there were three peaks with each successive peaks being larger, once the data were parsed into groups based on spatial information it became clear that different areas were experiencing different trends. This was evident both when examining state level data and latitudinally grouped data. Collections from comparatively northern latitudes occurred most frequently in the early and late summer, while the southern region showed a large peak in the spring followed by low but study numbers throughout the rest of the year.

III. BIOLOGICAL AND BEHAVIORAL OBSERVATIONS

Introduction

From previous collecting experience mid September was known to be a good time to start looking for *Abachrysa* in College Station. Since most specimens were collected at mercury vapor light, and this method is conducive to collecting live specimens, this was the method implemented. Based on the temporal distribution records for Texas it was determined that mid to late September would be the optimal time to start collecting. Lights were run nightly starting in mid September and continued nightly until the weather was no longer conducive to light collecting: too cold, wet, or windy. Adult insects were collected and maintained in hopes of inducing oviposition of fertile eggs for study.

Materials and Methods

Acquiring adults

Adult *Abachrysa eureka* specimens were collected at light sheets employing mercury vapor lights at two locations in College Station, Texas, USA, over a period of about a month- from 16 September to 14 October. These light sheets were run in relatively wet areas of the post oak savanna ecoregion. Specimens were collected from the sheets in both the evening (ca. 2000 – 2400 hr) and the early morning (ca. 0600-0700 hr). Adults were captured live into small vials and brought back to the lab for processing and rearing. Each adult was assigned a unique identification number and females were placed individually into oviposition chambers consisting of small canning jars with fine

mesh lids. A white paper liner was placed around the inside circumference of each jar as a removable oviposition surface. A small pellet of cotton (ca. 1 cm^3), moistened daily with tap water, was provided for hydration; no other food was provided to the adults. The few males collected were rotated among the female oviposition chambers at approximately 24 hours intervals in an attempt to ensure that all females were mated. All adults were maintained in this manner until they died naturally, when their dates of death were recorded.

Acquiring eggs

Eggs were generally laid on either the paper oviposition surfaces provided or on the mesh tops of the oviposition chambers, although a few eggs were found on the bottoms of the jars or on twigs that had been provided to some females. Eggs were removed from the oviposition chambers either upon death of the female or, in some cases, daily. Eggs were detached from their oviposition surfaces by clipping their stalks. For rearing, individual eggs were placed on their sides in rearing chambers consisting of two-dram vials sealed with two-holed rubber stoppers. A thin paper tissue (Kimwipes ®) was stretched across the vial opening under the stopper to prevent larvae from entering/escaping through the stopper holes. The rearing chambers were maintained in vial racks at about 21ºC on a lab table receiving both natural and artificial light. The chambers were checked daily and dates of larval emergence recorded.

Acquiring larvae

Hatched larvae were maintained in the same rearing chambers as their eggs. After hatching, a small piece of moistened paper tissue (Kimwipes ®) was placed inside each larval rearing vial (to maintain humidity and provide a source of water) together with possible food items. A variety of food items were introduced including aphids, fire ants (*Solenopsis invicta*), fruit flies (*Drosophila melanogaster*), other *Abachrysa* larva, and an artificial diet. These items were placed into the rearing chamber and left until they died. Larvae were checked daily and their dates of death recorded.

Summary of specimens

Voucher specimens of both the field collected adults and first instar larva are deposited in the Texas A&M University Insect Collection. A total of 188 eggs were oviposited, of which 153 hatched (about 81% of eggs). Forty-six females and 7 males were collected and brought into the lab. There was also one specimen of unknown sex which was killed and consumed by an ant lion adult kept in the same transport jar.

Table 3: Summary of *Abachrysa eureka* specimens acquired in Fall of 2007.

Number of adult females collected	46
Number of adult males collected	7
Number of eggs laid	188
Number of larva hatched	153

Measurements of eggs and larva were taken under a dissecting microscope with a scale bar in the eye piece. This was then calibrated using a 0.1mm ruler. Adults were measured using this method, or for larger structures, with a millimeter ruler.

Description of Egg

Egg: fusiform, clearly “pointed” at each end; length 1.45-2.7 mm (n=50 eggs, mean=2.05 mm, sd=0.392 mm), width (maximum diameter) 0.4-0.75 mm (n=48 eggs, mean=.723 mm, sd=0.068 mm); color pale blue-gray; chorion smooth or perhaps minutely granular, without evident patterning; stalk attached slightly subterminal on one side of egg; micropyle terminal, at end of egg opposite stalk attachment; unviable eggs light green in color with chorion generally deformed and shriveled.

Egg stalk: erect to slightly arched, not drooping, tapering minutely from base to apex, circular to oval in cross-section; length (stalk + egg) 5.5-11.73 mm (n=50 stalks, mean=10.54, stalk without apparent color; surface smooth, apparently coated with a sticky secretion (inferred from shiny stalk surface and minute pieces of debris adhered along stalk); one egg per stalk.

Biological and Behavioral Notes

Eggs and larvae produced

Twenty-one females oviposited in the oviposition chambers, and of these only one did not produce any first instar larvae. Fecundity ranged from 1 to 26 eggs/female. The average was about 9 eggs per female. *Larval eclosion.* Six eggs were observed in the process of hatching. The first instar larva emerged from the eggs through an emergence slit located about one-quarter of the way down from the top (micropylar end) of the egg. Larvae took approximately two hours to fully emerge from the chorion of the egg, often stopping for an extended period of time after the head and legs had been pulled free before completing eclosion by withdrawing the abdomen. Because eclosion was observed from eggs that had been clipped from their natural stalks, there were no opportunities to observe any special behaviors that may have been associated with descent of the stalk.

Aggregation of recently hatched larvae

Although most eggs were confined individually to rearing chambers prior to the eclosion of their larvae, the larvae from one group of eggs from a single female eclosed prior to being separated. These larvae were subsequently observed within six hours of hatching clustered in a small group of ca. 15 individuals in a space about 1 cm in diameter on the mesh stretched across the opening of the oviposition chamber. This grouping was located outside of the egg stalk grouping from which the larvae had emerged and about 2 cm from the nearest egg stalk. The larvae in this group showed no

signs of aggression or cannibalism, but were moving around in this small area. There was also no evidence of cannibalism later, when smaller first instar larva were placed into rearing chambers with larger first instar larva in hopes of inducing feeding behavior.

Debris carrying

Within an hour of emerging, larva were often observed to place the (clipped) empty egg chorion, with its attached stalk stub, on their backs, often with the stalk perpendicular to the body of the insect so the egg case was held upright. When small bits of moist soil were placed in the rearing vials (which were initially empty except for the bit of moistened paper), larvae would typically remain on top of the soil. No attempts to burrow into the soil were observed. The larvae would cover themselves with small grains of soil or other debris and then sit in small depressions on the soil surface. Some larvae were offered small sticks to climb on (up to ca. 12 cm long), and they would utilize these at times. Such larvae were observed crawling most or all of the way up the sticks and perching on them. Larvae were not personally observed placing debris on their backs, so no detailed account of this behavior can be reported. These observations indicate that *Abachrysa eureka* can be characterized as a debris-carrying larva. The sedentary nature of the first instar larvae, and the absence of burrowing behaviors, suggest that the larvae of *Abachrysa eureka* may be natural inhabitants of the litter layer of the ground surface in forested environments, a conclusion that is at least consistent with the lack of reports of larvae of this genus from the aerial parts trees and shrubs, where the majority of chrysopid larvae are found. The generally sedentary habit of the

first instar may also suggest a predator with more of an inactive sit-and-wait strategy, rather that the active searching behavior characteristic of most chrysopid larvae.

Larval feeding

In an effort to identify prey species that might be suitable for lab rearing of *Abachrysa* larvae, five to ten newly emerged larva were offered a single potential food item in their rearing chambers. These potential food items included small Aphididae spp. (species unknown; field collected), fire ant pupae (from local lab colonies), fruit fly larvae (from local lab colonies), other first instar *Abachrysa eureka* larvae, and an artificial fly diet consisting of equal parts sugar and powdered milk. No feeding was observed on any of these potential food items. One larva was observed to approach and probe a fire ant pupa, but the larva moved away with out feeding. This was the only interest shown in any of the items by the larva. As *A. eureka* are hypothesized to live in the soil or leaf litter, small amounts of field collected moist soil were added to several rearing chambers to see if such soil contained suitable microorganisms for feeding. There was however no evidence of feeding. All reared larvae died apparently without feeding and before molting to the second instar. First instar larval *Abachrysa eureka* lived from 1 to 10 days post hatching. The average lifespan was 5 days.

IV. SUMMARY, CONCLUSIONS, AND FUTURE WORK

Summary and Conclusions

While there is still much to be learned about the biology of *Abachrysa eureka*, clear patterns exist regarding the temporal distribution of this species. A more accurate (and contiguous) state-level range has been documented and wild specimens have been maintained in captivity until oviposition and first instar emergence. Three new state distribution records were added. Brazos County was identified at the westernmost known locality of this species, possibly indicating that this species is limited to forest and/or savannah ecotypes, something that is not found even a short distance west of Brazos County.

The temporal pattern was dependent on latitude, with the southern and northern regions exhibiting substantially different patterns. In the south there was a single peak early in the year followed by small, frequent collections through the end of November. Northern areas showed a strong bimodal pattern with two equal peaks in early and late summer. The central region did not fall clearly into either of these patterns. It exhibited five peaks of varying sizes, but when these data were examined for Texas alone (the state that made up the bulk of the central region collections for the highest peak), it was also found to have two peaks, a small spring one and a larger fall one.

Adults collected at light could be induced to oviposit in captivity. Eggs field-captured females were fertile in most cases and first instar larva would typically hatch out within two weeks. No food items were found for the larvae however and all died before molting to the second instar.

Future Work

There are many possible directions for this research to head. I plan on finishing my redescription of the adult and larva, including high quality drawings of various morphological features. I also hope to find the food items utilized by larval *Abachrysa eureka* by testing a variety of native ants with ranges similar that of to *A. eureka*. I also hope to do a mark-recapture study of *A. eureka* in College Station to estimate the population, as it seems to be quite high during peak emergence times. As part of this work I would also like to follow wild adults in hopes of observing oviposition in the field and other behaviors not seen in the lab. I will also try to refine the temporal patterns based on both latitude and longitude in hopes of better understanding the pattern occurring in the central region. Lastly, I would like to more accurately determine the range of this species by gathering more county records and attempting to collect specimens from counties where they are likely to occur, but are not yet documented.

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2008 M.S, Entomology. Texas A&M University, College Station, Texas. Expected completion date: December 2008

2006 B.S., Wildlife and Fisheries Science and Entomology (double major) Texas A&M University, College Station, Texas. Specialization in Wildlife Ecology and Management.

Professional Interests:

Research. Biosystematics of insectas, particularly Auchenorrhyncha; phylogenetic relationships and classification of Cicadellidae; use of insects (particularly Cicadellidae) as indicators of ecosystem health; methods for efficient collection and survey of insects, particularly auchenorrhynchans; curation and management of systematics collections.

Professional Experience:

Teaching Assistant, Biodiversity and Biology of Insects, Texas A&M University, Department of Entomology, Texas A&M University, College Station, Texas, January 2007-present

Student Worker, Small Upland-Bird Research Facility, Texas A&M University, College Station, Texas, May 2004 to present

Student Worker, Texas A&M University Insect Collection, Texas A&M University, College Station, Texas, May 2004 to December 2006

Seasonal Employee, The Peregrine Fund Aplomado Restoration Project, Marathon, Kent, Van Horn, Texas, Summers 2004-2006

Student Worker, Aggie Squirrel Project, Texas A&M University, College Station, Texas, September 2003 to December 2005

Collection Associate, The Heard Natural Science Museum and Wildlife Sanctuary, McKinney, Texas, June 2000 to June 2004 (volunteer)

Professional and Honor Organizations:

Entomology Collections Network
Entomological Society of America
Entomological Graduate Student Organization
Undergraduate Entomological Student Organization
The Wildlife Society
Texas Chapter of the Wildlife Society
Texas A&M Student Chapter of the Wildlife Society

Professional Service:

Coorganizer, Western Student Conclave of the Wildlife Society, Texas A&M University, College Station, Texas, March 2007

Professional Consultation:

Cicadellidae Identification, Department of Biology, Steven F. Austin State University, Nacogdoches, Texas, February 2006 (paid)

Honors and Awards:

The Wildlife Society, Annual Meeting, Quiz Bowl, 2006, 1st place
Texas Chapter of the Wildlife Societ,y Quiz Bowl, 2006, 1st place
University Undergraduate Research Fellows, Texas A&M University Honors College, 2006-2007
Texas Chapter of the Wildlife Society, Quiz Bowl, 2005, 1st place
Department of Wildlife and Fisheries Science, Sophomore Student of the Year, 2005
Western Student Conclave Undergraduate Poster Competition, 2004, 2nd place
Texas Chapter of the Wildlife Society Undergraduate Poster Competition, 2004, 2nd place

Intel International Science and Engineering Fair, Zoology Category, 2002, 2nd place
ExxonMobil Texas State Science and Engineering Fair, Zoology Category, 2nd place 2002
Dallas Morning News Regional Science and Engineering Fair, Zoology Category, 2002, 1st place, Grand Prize overall.
Dallas Morning News Regional Science and Engineering Fair, Zoology Category, 2001, 2st place.

Grants and Contracts:

NSF LSAMP-UGR (issued by Texas A&M University) Variations in Pecan cultivars grown in a common garden and their interactions with Fall Web Worms. $2400 PI: Karan L. Watson, I was picked to work with Julio Bernal as the grant recipient for the Entomology Department to plan and perform the research

Paper Presentations:

"Handling the components of a monograph, using *Westwoodia* (Hymenoptera: Ichneumonidae) as an Example." Karl Roeder, Matt Yoder, Krishna Dole, Jacques Dubois, Kira Zhaurova, Therese Catanach, and Robert Wharton. Poster Presentation, NSF/PEET VI meeting, Athens, Georgia, March 2006

"Biology and ecology of *Abachrysa eureka* (Neuroptera: Chrysopidae)." Therese A. Catanach and John D. Oswald" Poster Presentation, Student Research Week, College Station, Texas, March, 2007

"A survey of the auchenorrhynchan (Hemiptera) of Dominica, West Indies." Therese Catanach and Jonathan Cammack. Entomological Society of America, Indianapolis, Indiana, December 2006

"Prey items collected from barn owl pellets in Texas." Poster Presentation, The Wildlife Society Annual Meeting, Anchorage, Alaska, September 2006

"Leafhoppers as an Indicator of Prairie Health" Entomological Society of America, Ft. Lauderdale, Florida, December 2005

"Leafhoppers as an Indicator of Prairie Health" Wildlife and Fisheries Student Symposium, College Station, Texas, April 2005

"Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Student Research Week, College Station, Texas, March, 2004

"Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Western Student Conclave of the Wildlife Society, Lubbock, Texas, March, 2004

"Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Texas Chapter of the Wildlife Society, Kerrville, Texas, February, 2004

"Leafhoppers as an Indicator of Prairie Health" North America Prairie Conference, Kirksville, Missouri, June 2002

"Use of Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Intel International Science and Engineering Fair, Louisville, Kentucky, 2002

"Use of Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Intel ExxonMobil Texas State Science and Engineering Fair, Arlington, Texas, 2002

"Use of Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Dallas Morning News Regional Science and Engineering Fair, Dallas, Texas, 2002

"Use of Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Intel ExxonMobil Texas State Science and Engineering Fair, Austin, Texas, 2001

"Use of Leafhoppers as an Indicator of Prairie Health" Poster Presentation, Dallas Morning News Regional Science and Engineering Fair, Dallas, Texas, 2001