10-2-2014

The Wandering Spider Guild of Webb County, Texas

Monica Trevino

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A Thesis

by

MONICA CHRISTINA TREVINO

Submitted to Texas A&M International University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

May 2014

Major Subject: Biology

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Approved as to style and content by:

Chair of Committee,	Dan Mott
Committee Members,	Neal McReynolds
	Fernando Quintana
	George Clarke
Head of Department,	Dan Mott

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DEDICATION

I dedicate my thesis to my father, Cornelio Trevino Jr., who is no longer with us. He tried to hold on long enough to see my son and me graduate. Even though you did not see this Dad, I finished. It was with your support, strength, encouragement and love that I was able to complete this chapter of my life. I also dedicate this to my son, Robert Gonzalez, who has always believed in me. Thanks babe for keeping me grounded. I am so proud of you.

ABSTRACT

The Wandering Spider Guild of Webb County, Texas (May 2014)

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Chair of Committee: Dr. Dan Mott

Analysis of 10 years of spider collecting in Webb County, Texas has yielded 549 specimens in 21 genera and 55 species. This study was performed to establish similarities and relationships among wandering spiders of south Texas in Webb County and to identify the members of the wandering spider guild. The families included in this guild are the Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae. Wet pitfall traps and hand collecting were utilized in the gathering of the specimens. Spiders were identified using the most recent literature and allowed for an examination of the interactions of the members of this guild based on frequency of collection. There were 549 specimens, 55 species, and 21 genera of the 5 different families that were collected from 2003 to 2012. The spiders in these families are all part of the same spider guild, the wandering spider guild. . The families of spiders that were the most numerous in the collection were the Gnaphosidae and Corinnidae. All of the specimens, 344 males and 205 females, were collected in Webb County, South Texas and were collected in wet pit-fall traps and through hand collecting. Although all 5 families were represented in the collections, the Gnaphosidae were the most prevalent. Most of the specimens did not appear during the month of August due to it being the hottest month of the year. The frequency of the species and specimens was relatively low

during the months of December and January because it is the coldest time of the year in Webb County, Texas.

ACKNOWLEDGMENTS

I would like to thank my committee chair, Dr. Dan Mott, and my committee members, Drs. McReynolds, Quintana, and Clarke, for their guidance, support, and criticism of the manuscript throughout the course of this research. Extra special thanks goes to Dr. Mott for his enormous amount of assistance, understanding and consideration. I would like to thank the Department on Biology and Chemistry, Texas A&M International University, for the opportunity to do this research, Dr. Mott and Dr. McReynolds for providing me with environmental data from their own research and a very special thanks to the students who collected the specimens.

Thanks also goes out to my family, friends, colleagues and the department faculty and staff for making my time at Texas A&M University a great and unforgettable experience. For all of this assistance and the people that gave it to me, I am most grateful. Finally, thanks to my parents, Cornelio and Minerva Trevino, for their support and to my son, Robert, for his encouragement, patience, understanding and love.

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INTRODUCTION

According to The World Spider Catalog, Version 14.5, as of December 13, 2013 there are 3924 genera and 44540 species of spiders in the world (Platnick 2013). Although spiders are seen as timid creatures, they are one of the top invertebrate predators regardless of the habitat. They have many uses such as spider silk, venom, and medical research and their importance to the ecology. This study examined the five families of wandering spiders located in Webb County, Texas. Although numerous families are found locally, the focus of this analysis was on the following: Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae. This is determined by the use of the same resources and methods of foraging. Although all these families are primarily nocturnal, the genera *Castianeira* (Clubionidae), *Micaria* and *Sergiolus* (Gnaphosidae) are diurnal and ant-mimicking species. The families of spiders that were the most numerous in the collection were the Gnaphosidae and Corinnidae. All of the specimens were collected in Webb County, South Texas and were collected in wet pit-fall traps and through hand collecting. The area of the study site is of the Tamaulipan Biotic Province. Characteristics of males and females were examined with a dissecting microscope. Although a variety of families are found locally, the focus of this study was on the families of the wandering spider guild.

Tamaulipan Biotic Region.—The areas of study were in the Tamaulipan Biotic Region which is located in Texas south of the Balcones fault line (Blair 1950) This is a unique ecosystem that is found only in south Texas and northeastern Mexico Many plants and animals that are in this area are not found anywhere else in the United States. This ecoregion begins on the Coastal Gulf Plain and continues on the eastern part of the Coahuila state in Mexico at the base of Sierra Madre Oriental.

Thesis formatted for the Journal of Arachnology.

It proceeds eastward to encompass the northern half of the state of Tamaulipas and move into the United States through the southwestern side of Texas. It is made up of semi-arid brush land and the vegetation in the area is drought resistant. Of the few wetlands that exist, most are short-lived. Biological diversity is influenced by the variability in temperature, soils, and precipitation. This region is characterized by having low precipitation of about 3.51 cm and high average temperatures on average 60 ° C (Blair 1950). An important characteristic is that the native vegetation type in this area is mesquite-grassland. The few species that account for the majority of the brush vegetation are mesquite *(Prosopis glandulosa),* various species of *Acacia* and *Mimosa,* granjeno *(Celtis pallida),* guayacan *(Poriiera angustifolia),* cenizo *(Leucophyllum frutescens),* and white brush *(Aloysia gratissima),* prickly pear *{Opuntia lindheimeri),* tasajillo *{Opuntia leptocaulis),* and *Condalia* and *Castela.* (Blair 1950). The vegetation in the areas of the collecting sites is described as thorny brush (or chaparral) (Blair 1950). Plants in the sites included black brush (*Acacia rigidula*), guajillo (*Acacia berlandier*i), honey mesquite (*Prosopis glandulosa*), Texas prickly pear cactus (*Opuntia engelmannii*), tasajillo (*Opuntia leptocaulis*), strawberry cactus (*Echinocereus enneacanthus*), cenizo (*Leucophyllum frutescens*), guayacan (*Guaiacum angustifolium*), leather stem (*Jatropha dioica*), lotebush (*Ziziphus obtusifolia*), Spanish dagger (*Yucca treculeana*), and other plant species (McReynolds 2012).

Guilds.—Guilds are non-phylogenetic groups of species that share one or a series of important resources (Cardoso et al. 2011). The guild concept refers to a group of species using the same resource in similar ways (Uetz et al. 1999). Hence, guilds form the basis of community and reflect taxonomic relationships (Mohsin et al. 2010). The wandering spiders are a guild because they respond similarly to changes in the environment, which can be made through their foraging strategies and similar use of resources independent of the specific taxonomic

composition, (Cardoso et al. 2011). Wandering spiders are dominant arthropod predators in many terrestrial communities (Mallis & Hurd 2005). In order to establish these families as a guild a few criteria must be satisfied according to Uetz et al. (1999). Do all the spiders in an area use the same type of resource? At what point do different foraging practices affect resource consumption and thereby restrain or split the same type of resources? Do these spiders belong to a greater guild (Uetz et al. 1999)? The families that will be investigated are wandering spiders and predominately nocturnal with the noted exceptions of the genera *Castianeira* (Clubionidae), *Micaria* and *Sergiolus* (Gnaphosidae) which are diurnal, but are placed in families that are nocturnal. They hunt on vegetation or the ground and capture their prey by actively pursuing them. This shared behavior supports an active running lifestyle can be maintained by feeding on plant nectar or other arthropods that sustain their level of activity (Bradley & Buchanan 2012). Of these hunting spiders Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae are sac spiders, meaning that they build silk sacs or retreats to hide when inactive. The families Clubionidae, Corinnidae, Liocranidae, and Miturgidae have spinnerets that are closely grouped that have a conical shape while Gnaphosidae have cylindrical spinnerets that are well separated (Bradley & Buchanan 2012).

Families.—The Clubionidae, "sac spiders", were formerly a wide-ranging family of sac spiders that included Corinnidae, Liocranidae, and Miturgidae. These original clubionids shared characteristics including eight eyes that were aligned in two rows, known as wandering predators, and made sac retreats within leaf litter, bark, or rocks. All the clubionids are of small to medium size and ecribellate. The Clubionidae contained several subfamilies including: Micariinae and Corinninae (Gertsch 1942). Presently, the Clubionidae contains 580 species in 16 genera, but are restricted to spiders of the genera *Clubiona* and *Elaver* in North America

(Richman & Ubick 2005). Octavius Pickard-Cambridge described the *Elaver* species in 1898, both of which are found throughout the eastern USA and southeast Canada (Richman & Ubick 2005).

The Corinnidae "corinnid sac spiders" consists of 1118 species in 93 genera and are globally distributed (Platnick 2013). Early studies placed this family in the Clubionidae (Simon 1897). These ground dwellers are found in leaf litter or underneath rocks. The most common genera are the *Castianeira*, *Corinna*, *Meriola*, *Phrurolithus*, *Phrurotimpus* and *Trachelas* (Ubick & Richman 2005). In the 1800s these spiders were part of the clubionids but were reclassified by Lehtinen (1967) because of a distinctive characteristic, ant mimicry. Corinnids have adaptions to color and modifications of the body that appear to resemble an ant's three segmented body and long narrow legs (Cushing 1997). Several genera of the Corinnidae are known to mimic ants, including *Castianeira* and *Mazax*. Corinninae included the groups Corinneae and Tracheleae, currently these groups are similar to the subfamilies of the same name with a few modifications. Previously a corinnid sub-family Micariinae, which are currently part of the Gnaphosidae, is known for ant mimicking spiders (Lehtinen 1967) while Liocraninae include the sub-family *Phrurolithinae* and the genus *Drassinella*. Recent studies place these taxa in the Corinnidae (Bosselaers & Jocque 2002). Changes were made by Reiskind (1969) that involved 12 species of *Castieneira* and 4 of *Mazax* that were located in United States, Mexico, Panama, and Costa Rica (Reiskind 1969). Within these changes many of the taxa that were once associated with the clubionids were placed into new subfamily Castianeirinae. Two different species, *Trachelas bispinosus* and *T. bicolor*, were previously in the Clubionidae family. It was found that the 29 species from North and Central America and the West Indies, the males in both groups have an embolus which is not a separate sclerite; instead, it is simply the pointed tip of the tegulum. In

females, the genitalia are generally not folded anteriorly (Platnick & Shadab 1974). In *T. bispinosus*, the male endites have lateral spurs; in the *T. bicolor*, the males lack spurs on the endites.

Gnaphosids, "ground spiders," consist of 2,162 species in 122 genera with common names such as "ground spiders" and "mouse spiders". These ground dwellers are found in the west and southwest United States and are widely distributed (Ubick 2005). Gnaphosids can be abundant in drier, open spaces and are rarely found in woody regions (Dippenaar-Schoeman & Jocqué 1997). They are nocturnal and cryptozoic and are often found under rocks or decomposing wood, in leaf litter, or running from one refuge to another.

Micaria is an exception in the family due to its profound ant mimicry, reduced and moderately separated ALS, and small size that can be from 1.86 to 2.37 mm (Gertsch 1935). Although previously related to clubionoid myrmecomorphs, which include the castianeirines and phrurolithines, they are currently placed in the Gnaphosidae (Platnick & Shadab 1988). They are sometimes mistaken for the prodidomids due to prominent similarities in leg elongation, tarsal trichobothria, and spinnerets (Platnick & Shadab 1976). Later in 1990 a study of spinneret morphology, the prodidomids were returned to their previous family status (Platnick 1990).

The Liocranidae, "liocranid sac spiders," currently has 172 species in 27 genera throughout the Nearctic regions of the US, a distribution similar to the gnaphosids. However, some have migrated into the Mojave Desert region or even the western and southwestern mountain region. Just like the Gnaphosidae, these spiders build silk sac retreat in leaf litter or under rocks. Being part of the Clubionidae previously, Simon (1897) reclassified the group as Liocraneae, one of four groups in the subfamily Liocraninae. Lehtinen (1967) raised three of the groups to family status and placed the Phrurolithinae in the Gnaphosidae due to the close relation

to *Micaria*. Platnick & Shadab (1988) rearranged Lehtinen's changes and placed this group back into Liocranidae (Platnick & Shadab 1989). Bosselaers & Jocqué (2002) conducted studies that showed the phrurolithines belong to the Corinnidae. The remaining four genera, *Ianduba*; *Mandaneta*; *Procopius*; and *Pseudocorinna*, appear more closely related to Corinnidae and will likely continue to be rearranged as these genera are further investigated.

The miturgids are known as the "long-legged sac spiders," consisting of 371 species in 28 genera. Miturgids are ground dwellers and wandering hunters that live in areas like forests, shrubs and in rocky deserts and can be found under rocks and plant litter. The most common genus is *Cheiracanthium*, which can be found in modern dwellings. Their large claw tufts can identify them. They are common in certain crops of agricultural interest (Peck & Whitcomb 1970). A difference that these spiders have from others is that they have white, sac-like, silken homes that vary in size and shape (Dippenaar-Schoeman & Jocqué 1997). Originally part of the Clubionidae, they were later moved to the group Miturgeae of the subfamily Liocraninae (Simon 1897). After Lehtinen's (1967) study the miturgids were raised to family status (Platnick & Shadab 1989; Bonaldo & Brescovit 1992; Dippenaar-Schoeman & Jocqué 1997) while others believe they should be returned to the Clubionidae (Deeleman-Reinhold 2001; Raven & Stumkat 2003). Many species of *Cheiracanthium* and *Strotarchus* were described in 1958 (Platnick & Shadab 1989). Platnick & Shadab (1989) emphasizes the inaccurate nature of much of the classification of the Miturgidae over the last century and blames the wide variation in specimen size, among other variations in characters as the reason for reshuffling (Platnick & Shadab 1989).

METHODS

Data collection.—A wet pitfall trap is a passive technique for collecting small animals, such as arthropods. Arthropods that enter or fall into a pitfall trap are incapable of escaping and killed by a preserving solution. Ground dwelling spiders are among the spider fauna that is most captured in pitfall traps and found in diverse habitats (Weeks & Holtzer 2000). Pitfall traps provide a continuous sample, but the activity level of spiders influences it. This method gives a closer estimate of total number of species in a community and is the best method for wandering spiders according to Uetz and Unzicker (1976). Several believed that this method is unreliable due to the difference in activity, hindrance of movement in habitat, and climate factors making this method useless (Uetz & Unzicker 1976). Some of the problems that could arise from using pitfall traps are errors in the results due to the design or placement of the traps (Uetz & Unzicker 1976). Using pitfall traps provides continuous specimens, but it is influenced by the level of activity of the specimens. The spider communities were sampled using pitfall traps and hand collecting. Pitfall traps were used for these ecological studies and worked as a form of passive collecting and is good for collecting wandering spiders. Other advantages are that the traps are small, portable, and replicable. They are also easy and quick to maintain, are flexibly positioned, and can be placed in many spaces in one area of study. Pitfalls consisted of plastic rain gutters (75 X 15 cm) that were placed in the ground and have a preservative, propylene glycol, in the trap as a capture and short-term preservative. Ten traps were buried into the ground so that the lip of the gutter was level with the ground all around the collection site. The preservative, propylene glycol, was a 50% solution made from RV antifreeze. Due to the arid nature of the collecting area other solutions are ineffective due to rapid evaporation. Wandering spiders avoid obstructions and if the trap is level the spider will topple into the preservative. A hand collection

method was also used for specimens found in the open or in areas that were not near a pitfall trap. The traps were checked weekly and all collected specimens were placed in 70% ethanol for storage. An identification label was included in the jars that were used in the collections for the date, collection site and name of researcher.

Collection sites.—Spiders were collected and sampled from different sites in Webb County, Texas. The specimens were collected on the campus of Texas A&M International University (TAMIU: 27°35'N, 99°26'W, elevation 147m). Other collection areas were between the Nature Trail and the Rio Grande on the campus of Laredo Community College (LCC: 27°51' N, 99°52' W, elevation 124m). More specimens were hand collected on a ranch near Webb, TX (27°80'N, 99°46'W, elevation 225m). The environment is comparable in all three areas (apart from LCC that was near water). The areas of the research are described as thorny brush (or chaparral) (Blair 1950). The introduced species of Buffel grass (*Cenchrus ciliaris*) is found in all collecting areas and the environment for LCC includes Carrizo (*Arundo donax*). For other vegetation in the areas refer to McReynolds (2012).

Identification.—Specimens were preserved in 70% ethanol and examined under 0.9-4X magnification of an Olympus ™SZ3060 microscope with a fiber optics light that has an illuminator of 15V 150 W halogen bulb that provides a light bright enough to have a clear and shadow free view. The collections of adult specimens were identified using the manual, Spiders of North America: An Identification Manual (Ubick et al. 2005), used mostly for families and genera, specific monographs, and a dissecting microscope. The epigyna were removed from specimens that were difficult to identify by magnification alone and cleared in clove oil to see characteristics of the female for identification purposes. The left palp was removed and examined in male specimens and placed on fine sand to hold the spider in place for ease in

viewing with the microscope. After identification was made a new label was placed in the specimen vial with the preserved spider that contained genus and species name, name of researcher that described the species, name of researcher that determined the species, the year the determination was made, plus the number and gender of the specimens in the vial. The data was recorded, for comparison in an Excel™ spreadsheet.

RESULTS

The 549 mature specimens obtained represented 55 species in 21 genera from the five families: Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae. The Gnaphosidae were the most abundant in number of species The Liocranidae was the least abundant family that was gathered throughout this study. The Clubionidae was represented by 1 species of 1 genus, *Elaver expecta*, for a total of 5 specimens (4 ♂, 1 ♀). The Corinnidae family is represented by 8 species of 5 genera, 134 specimens (70 ♂, 64 ♀), with the largest number from the species *Falconina gracilis*. The Gnaphosidae family is represented by 44 species of 13 genera, 382 specimens (255 ♂, 127 ♀). The Liocranidae family as represented by 1 species of 1 genus, *Neoanagraphis chamberlini* with 1 ♂ specimen. The Miturgidae family was also represented by 1 species from 1 genus, *Cheiracanthium inclusum* with a total of 12 specimens (1 ♂, 11 ♀) (Table 1). The five families that were gathered with the number of genera and species, different numbers of males versus females in the species, and months when they were collected for this study are shown. Each species was found at different months of the year. There were 5 species that made up more than 50% of the collection and were from the families Corinnidae and Gnaphosidae. *Falconina gracilis* was collected every month of the year except for August and was the most numerous species from the study with 81 specimens. *Cesonia bilineata* was collected every month except for June and December with 43 specimens. *Cesonia sincera* was collected every month except for August and had a total of 78 specimens collected. *Gnaphosa sericata* seems to be a little bit different from other species in this family. They made up 55 specimens from this collected mainly from July, August, and September. *Zelotes lasalanus* had 33 specimens and are active in this area regardless of the weather, except for September and December.

Table 1.—Specimen collection from Webb County, Texas.

Families	Species	♂	♀	Months Collected
Clubionidae				
	Elaver expecta	4	1	June, November
Corinnidae				
	Castianera descripta	17	5	April to October
	C. longipalpa	8	6	February to September
	C. occidens	1	0	September
	Falconina gracilis	35	46	January to October
	Phrurotimpus alarius	1	0	December
	P. borealis	3	2	March, August, November
	Septentrinna bicalcarata	4	1	March, July, September
	Trachelas tranquillus	1	4	March, April, June, September
Gnaphosidae				
	Callilepis imbecilla	7	1	March to April, June
	Camillina elegans	1	0	February
	C. pulcher	5	1	April, June to October
	Cesonia bilineata	35	8	February to April, July to November
	C. sincera	40	38	February to April, June, September to December
	Drassodes gosiutus	0	1	August
	Drassyllus antonito	0	10	February, March, April, June, July, November
	D. cerrus	3	0	February, November
	D. conformans	1	0	June
	D. depressus	0	1	June
	D. dromeus	0	1	June
	D. gynosaphes	0	1	October
	D. lepidus	4	2	February, August, September
	D. mexicanus	4	0	October, November

Table 1.—Specimen collection from Webb County, Texas, continued.

Families	Species	♂	♀	Months Collected
Gnaphosidae	*D. orgilus*	10	0	February, March, July, September, November, December
	D. prosaphes	1	0	April
	D. rufulus	1	0	July
	Gnaphosa altudona	1	0	April
	G. sericata	49	6	March, April, June, September to November
	Herpyllus bubulcus	3	0	February, November
	Micaria longipes	7	1	April, October, November
	M. nanella	3	0	February, December
	M. nye	6	4	February, July, September
	M. palliditarsa	1	0	July
	M. seminola	1	0	April
	M. triangulosa	7	5	March, April, September to November
	M. vinnula	3	0	February
	Nodocion floridanus	1	0	April
	N. rufithoracicus	7	1	March, April, June
	Sergiolus bicolor	1	0	April
	S. ocellatus	2	2	March, October
	Trachyzelotes lyonneti	9	16	March, April, June
	Urozelotes rusticus	2	1	April, June, October
	Zelotes aiken	1	0	March
	Z. duplex	4	6	June
	Z. gertschi	6	7	April to July, August, November
	Z. hentzi	9	1	March, April, June, August, September, November
	Z. lasalanus	27	6	January to April, June, July, September to November

Table 1.—Specimen collection from Webb County, Texas, continued.

Families	Species	♂	♀	Months Collected
Gnaphosidae	*Z. monachus*	3	1	April, September
	Z. pallidus	1	0	March
	Z. pseutes	2	1	July, October, November
	Z. reformans	0	4	March, July, August, September
	Z. sula	0	2	June
	Z. tuobus	0	2	August, December
Liocranidae				
	Neoanagraphis chamberlini	1	0	December
Miturgidae				
	Cheiracanthium inclusum	1	10	February, March, June, July, October to December
Total		344	205	549

The summary of the collection of the specimens for each month in Webb County, Texas (Figure 1). January had the lowest number, 10, of specimens that were collected but then there was an increase to 46 in February, followed by a surge in March, which had the highest number of specimens, 106 collected. A decline began to take place in April to 70 specimens collected and continued into June with 47 specimens. A slight growth occurred in July with 61 specimens, dropped in August to 31 specimens, and grew in September, the second most active month, with 73 specimens. October, November, and December just continued to fall in the number of specimens collected; 51, 43 and 11 respectively. The number of species that were collected was different for every month (Figure 2). In the month of January three species were collected.

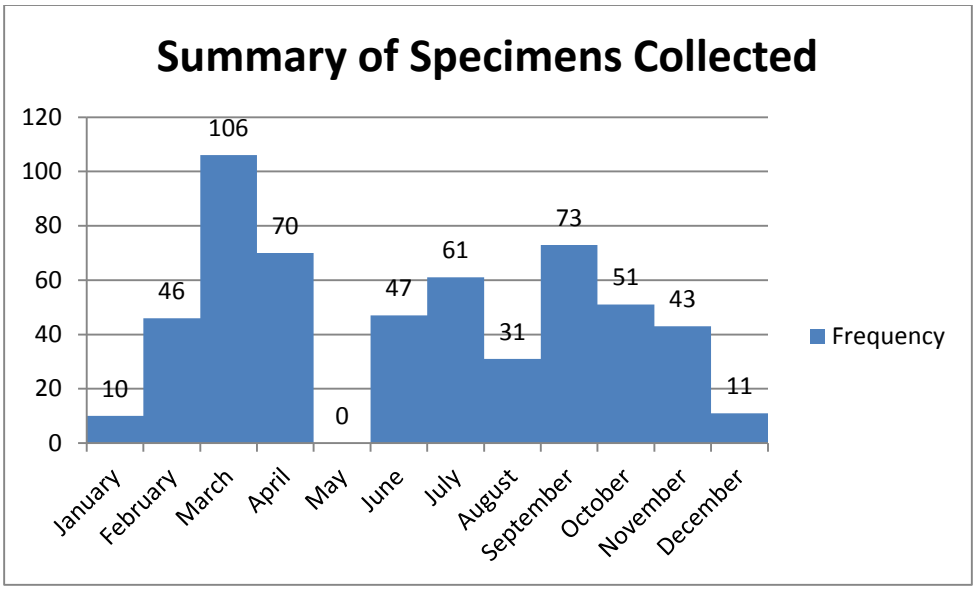

Figure 1.—Summary of specimens collected in Webb County, Texas histogram shows the frequency of spiders collected per month.

The number of species collected rose to 16 in February. March shows 22 different species were collected and for April the number rose to 23 species. June and July had 20 and 19 species that were gathered. The number of species decreased to 12 that were collected in the month of August. September had 12 different species in the collection and October had 16 species. November had 18 species and December had 8 species in the collection.

Guilds.—The study of guilds refers to a group of species that use the same resources in a similar way. These are ecological guilds that are non-phylogenetic groups of species that share one or more series of resources. The study of guilds is beneficial for the competing species that respond the same way to similar changes in the environment independently of taxonomic composition (Cardoso et al. 2011). The proposed guild classification is based on the wandering spider hunter families that were found in the Webb County area in south Texas. As mentioned above, subgroups were recognized within five families that include Clubionidae, Corinnidae,

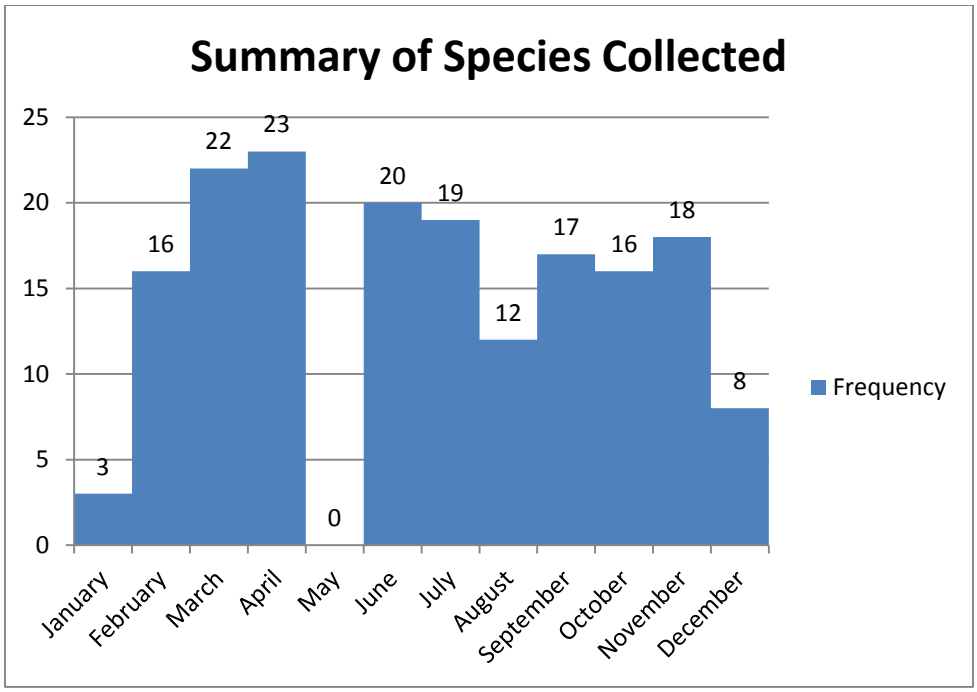

Figure 2.—Summary of species collected in Webb County, Texas histogram shows the number of species collected per month.

Gnaphosidae, Liocranidae, and Miturgidae because a few of their subfamilies exhibited different strategies, and treated these as equal to their families. Grouping of the spider guilds was created by the ecological key species that represent each family.

Wandering spiders constitute a guild in that they are all non-specific predators of arthropods (and thus exploit a single resource or similar resources) and are all hunting spiders (exploiting resources in a similar manner) (Uetz 1977). The dendogram shows how the families are wandering spiders that are separated into foliage or ground runners. Clubionidae and Miturgidae are wandering, nocturnal hunting, foliage runners; Liocranidae is the same but found on the ground. Corinnidae and Gnaphosidae are wandering, nocturnal hunting, ground runners, but have some species that are diurnal. *Castianeira* (Corinnidae), *Sergiolus* (Gnaphosidae),

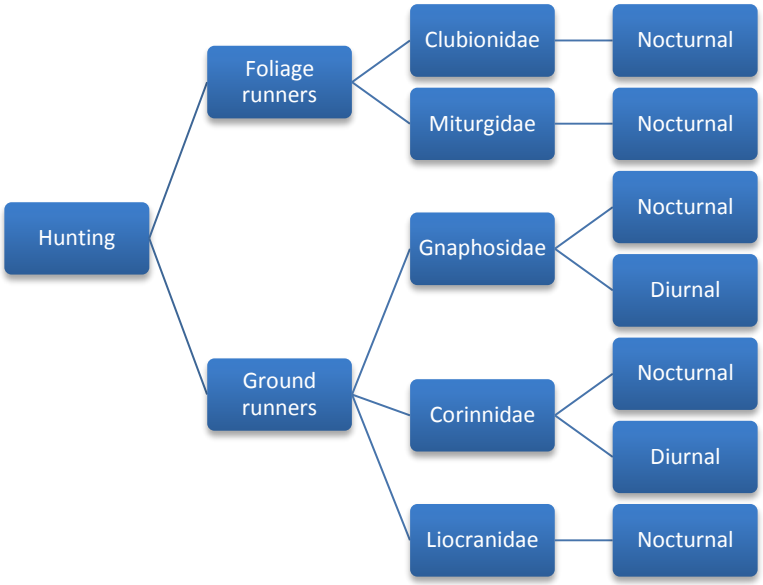

Figure 3.—Proposed wandering spider guilds of Webb County, Texas dendogram shows the placement of each family in the guild.

and *Micaria* (Gnaphosidae) are the diurnal, but are placed in families that are nocturnal. They do not spin webs, occupy silk retreats or burrows, and have similar morphological features. This is the wandering spider guild of Webb County.

Taxonomic and guild composition.—Guilds are non-phylogenetic groups of species that share one or a series of important resources (Cardoso et al. 2011). The term guild was coined in 1967 as a way of describing groups' functionally similar species in a community (Cardoso et al. 2011). Previously, corinnids, liocranids, and miturgids were closely related to the clubionids but have since been reclassified into different families. Currently, Corinnidae and Liocranidae are sister families; Gnaphosidae and Prodidomidae are also sister families; Clubionnidae is sister families with Anaphaenidae and Salticidae; but Miturgidae is placed with other Entelegynes as per the Tree of Life Web Project (Tree of Life).

The Clubionidae, containing 58 named species in 2 genera (Ubick et al. 2005), is called the "sac spiders" because they construct a condensed silk retreat each morning before they become inactive for the daytime. They are medium-sized, light-colored nocturnal spiders that hunt on the ground or in the shrubbery. They have touching conical spinnerets and claw tufts (Bradley & Buchanan 2012). They have pedipalps, segmented appendages in front of leg I, consisting of the same segments as the legs but without the metatarsus. The females have an epigynum that is the plate in front of the epigastric fold in females that covers the vulva. Clubionidae have notched trochanters that are ventral indentations on the distal margin on the second segment of the leg (Ubick et al. 2005).

The "corinnid sac spiders," containing 127 species in 16 genera, are fast running ground spiders that are either nocturnal; except *Castianeira* are diurnal. They have convergent cone-shaped spinnerets that are close and are mostly brown some may be colorful. They are known to mimic ants or wasps. They live in a tubular silk retreat often under rocks or other debris on the ground (Bradley & Buchanan 2012). *Falconina gracilis* has a median tegular process which is a protrusion of the tegulum. The tegulum is the main part of the palpal bulb that is recognizable by the sperm duct because it runs through it and overlies the subtegulum in which the dark-colored sperm reservoir is situated (Ubick et al. 2005)

The "stealthy ground spiders," (Gnaphosidae) containing 255 species in 24 genera, is dull colored that hunt on the ground and do not build a capture web. If they are seen in the open, it is usually due to the dashing from one shelter to another. Most of the species are nocturnal or active at dawn and dusk. The genus *Micaria* and *Sergiolus* are exceptions because they are antlike members that are often found in common ant areas, they are diurnal. They have anterior spinnerets that are cylindrical and broadly separated that are at the rear of the abdomen that emit

silk.

The Liocranidae, containing 11 species in 5 genera, are ground-living nocturnal hunters known as "liocranid sac spiders." They can be found in silken retreats in the leaf litter, under rocks, other debris, or even burrows of other animals (Bradley & Buchanan 2012). Their tarsal claws and have touching conical spinnerets characterize them. The claw tufts is a bunch of spatulate hairs at the end of the tarsi beneath the paired tarsal claws in spiders that lack a ventral unpaired claw. It is believed that this is an adaptation to obtain a grip on smooth surfaces (Deeleman-Reinhold 2001).

The Miturgidae, containing 12 species in 4 genera, are called the "long-legged sac spiders." It has touching conical spinnerets, claw tufts, and the behavior of building a silk retreat or sac. They are prowling, nocturnal, wandering spiders. The two species in the genus *Cheiracanthium* are active runners over foliage at night (Bradley & Buchanan 2012). *Cheiracanthium inclusum* have large claw tufts that are strongly developed and almost solely arboreal. The male cymbium is basally produced; it is the distal segment of the male pedipalp.

Statistical analysis.—A G-test was used to look for the association between females to males for the Corinnidae family throughout the months (Table 2). The ratio of females to males from February to March was a 11:11, April 5:7, June 15:8, July to August 10:16, September 9:14, October to November 10:7, December to January 4:7. The G-test was 6.0844462 with 6 degrees of freedom. There is no statistical significance of females to males throughout the months.

A G-test was used to look for the association between females to males for the Gnaphosidae family throughout the months (Table 3). The ratio of females to males from February to March was a 44:82, April 12:16, June 9:13, July to August 20:44, September 12:38,

Table 2.—Statistical analysis (FvsM) Corinnidae of the numbers of males and females by time of year.

			Feb-Mar	Apr	Jun	Jul-Aug	Sept	Oct-Nov	Dec-Jan
F		Corinnidae	11	5	15	10	9	10	4
M		Corinnidae	11	7	8	16	14	7	7
	G=	6.084446							
	df=	6							
	ns								

October to November 23:48, December to January 4:3. The G-test was 8.2533322 with 6 degrees of freedom. There is no statistical significance of females to males throughout the months.

A G-test was used to look for the association between Corinnidae to Gnaphosidae throughout the months (Table 4). The ratio of Corinnidae to Gnaphosidae in January was 8:1,

Table 3.—Statistical analysis (FvsM) Gnaphosidae of the numbers of males and females by time of year.

			Feb-Mar	Apr	Jun	July-Aug	Sept	Oct-Nov	Dec-Jan
F		Gnaphosidae	44	12	9	20	12	23	4
M		Gnaphosidae	82	46	13	44	38	48	3
	G=	8.253332							
	df=	6							
	ns								

February 3:40, March 19:86, April 12:58, June 23:22, July 20:39, August 6:25, September 23:50, October 15:35, November 2:36, and December 3:6. The G-test was 31.114262 with 8 degrees of freedom. There is significance between Corinnidae to Gnaphosidae throughout the months

because more corinnids were collected during the colder months and more gnaphosids were collected during the warmer months.

Table 4.—Statistical analysis of the numbers of Corinnidae and Gnaphosidae specimens collected by month.

	Jan	Feb	Mar	Apr	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Corinnidae	8	3	19	12	23	20	6	23	15	2	3
Gnaphosidae	1	40	86	58	22	39	25	50	35	36	6

G =	31.1143
df =	8
P	<0.001

DISCUSSION

During the course of this analysis of a 10-year collection of wandering spiders in Webb County, Texas five families were identified: Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae. Originally all of these families, except the Gnaphosidae, were part of the Clubionidae. These wandering spider families do not spin prey capture webs, but primarily use silk to build sac retreats. It was found that the prevalent family in Webb County, Texas was the Gnaphosidae, the hunter spiders (72.5%). Four species made up the majority of the collection for the gnaphosids (398 specimens): *Cesonia bilineata* (43 specimens) comprised 10.8% of the family and 7.8% of all the families; *Cesonia sincera* (78 specimens) had 19.6% of the family collection and 14.2% of all families together; *Gnaphosa sericata* (55 specimens) made up 13.8% of the gnaphosids and 10% of total collection; and *Zelotes lasalanus* (33 specimens) took 8.3% of its family and 6% of the whole collection. Corinnidae had 134 specimens (24.4%), *Falconina gracilis* was the most abundant species (81 specimens) collected in this family with 60.4% of the family and 14.8% of all the families combined. A total of 549 specimens (344♂, 205♀), 55 species and 21 genera of wandering spiders were collected from three study sites. Collections were taken throughout the year, except for May in which there was no collecting. Collecting resumed in June when the new semester began and new collectors were recruited. The family with the highest number of specimens in the collection was the Gnaphosidae and the family with the least was the Liocranidae.

Guild makeup.—By definition, ecological groupings of organisms that use resources in a similar manner is a guild (Uetz et al. 1999). These families make up a guild because they are of similar size, non-specific predators of arthropods (exploit a similar resource) and they are all wandering hunters (exploit the resources in a similar manner) (Uetz 1977). There are some

differences in the manner of their foraging as some forage primarily on the ground, Corinnidae, Gnaphosidae, Liocranidae, and others in foliage, Clubionidae and Miturgidae.

Guilds focus on all sympatric competing species regardless of their taxonomic relationship. This refers to species that occupy the same area without interbreeding, but still competing for the same resource in the same way. Lycosids, "wolf spiders," are also hunting spiders that pounce on their prey and have similar ways of acquiring resources. These spiders were not part of the study because they did burrows, several are undescribed in south Texas, and can be much larger, up to 35 mm.

The statistical analysis that was performed in the comparison of female to male for both the Corinnidae and Gnaphosidae family did not prove to be statistically significant. The comparison of Corinnidae to Gnaphosidae at each month did prove to be statistically significant. The Gnaphosidae are collected more during the warmer months and Corinnidae were collected more than the Gnaphosidae during the colder months.

CONCLUSION

In order to establish these families as a guild a few criteria must be satisfied according to Uetz et al. (1999): Do all the spiders in an area use the same type of resource? At what point do different foraging practices affect resource consumption and thereby restrain or split the same type of resources? Do these spiders belong to a greater guild? The families Clubionidae, Corinnidae, Gnaphosidae, Liocranidae, and Miturgidae are all wandering hunter spiders. All 5 families are nocturnal with the exception of *Castinaneira* (Corinnidae), *Sergiolus* and *Micaria* (Gnaphosidae), which are diurnal but are part of nocturnal families. They hunt on vegetation (Clubionnidae & Miturgidae) or on the ground (Corinnidae, Gnaphosidae, & Liocranidae) and capture their prey (other arthropods) by running up on them. This shared behavior supports an active running lifestyle, which they all share, which is maintained by feeding on plant nectar or other arthropods that sustains their constant movement. Another shared behavior is that they build silk sacs or retreats instead of webs that can be found in leaf litter, under bark or rocks, and foliage. A subdivision takes place in the families and separates into foliage runners and ground runners: clubionids and miturgids are foliage runners. Gnaphosids, corinnids, and liocranids are ground runners and hunt on the ground. According to Uetz (1977) wandering spiders are a recognized guild and others classified nocturnal running spiders as a guild (Uetz et al. 1999). Families of spiders are separated into hunting groups, and are further subdivided into clusters with obvious foraging similarities. Once the foraging has been established for the families, they are then divided based on the time of day they prefer to hunt. The wandering spiders are a guild because they respond similarly through their foraging strategies and similar use of resources regardless of the specific taxonomic composition. Guilds are significant because they are useful in comparative studies of competitive species in communities.

Specimen activity.—Of the 549 specimens that were collected, the Gnaphosidae made up 72.5% (398 specimens) and Corinnidae 24.4% (134 specimens). These two families made up 97% of the collection making these the dominant families from this 10-year survey of spider activity. The families that comprise the last 3% of the collection were the Clubionidae with 5 specimens, Liocranidae with 1 specimen and Miturgidae with 11 specimens. The number of specimens and species were different from one month to another (Table 5).

Table 5.—Monthly mean temperatures with number of specimen and number of species.

Monthly mean temperatures				
	High (^{0}C)	Low (^{0}C)	Specimens	Species
January	19	8	10	3
February	22	10	46	16
March	27	14	106	22
April	31	18	70	23
June	37	25	47	20
July	38	25	61	19
August	38	25	31	12
September	34	23	73	17
October	30	18	51	16
November	25	13	43	18
December	20	8	11	8

Falconina gracilis; *Trachelas tranquillus*; *Drassyllus antonito*; *Trachyzelotes lyonneti*; *Zelotes duplex*; *Z. gertschi*; *Z. sula*; and *Z. tuobus* were the species in the study that had more males than females. Males generally outnumber the females during spider collections, but the reasons for the females being more commonly collected in some species remains unclear. The percentage of species previously reported from the study area is 63.6%. One species is known to be introduced *Trachyzelotes lyonneti* from the Middle East (Platnick & Murphy 1984).

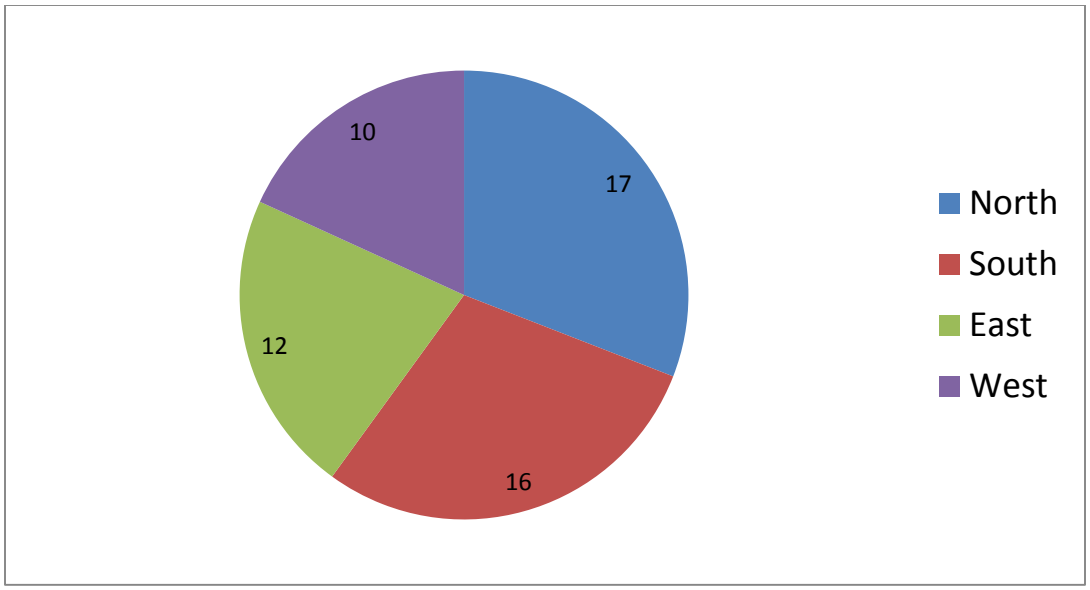

Figure 4.—Distribution of wandering spiders collected in Webb County, Texas.

Spider distribution.—Examination of the species collected (Figure 4) showed that 17 species from Webb County, Texas were of a northern distribution: *Elaver expecta*; *Phrurotimpus alarius*; *P. borealis*; *Trachelas tranquillus*; *Callilepis imbecilla*; *Drassyllus depressus*; *D. dromeus*; *Gnaphosa altudona*; *G. sericata*; *Herpyllus bubulcus*; *Micaria longipes*; *M. seminola*; *M. triangulosa*; *Nodocion rufithoracicus*; *Urozelotes rusticus*; *Zelotes gertschi*; and *Z. sula*.

A southern distribution was shown by 16 species: *Castianeira occidens*; *Falconina gracilis*; *Septentrinna bicalcarata*; *Camillina pulcher*; *Cesonia sincera*; *Drassodes gosiutus*; *Drassyllus lepidus*; *D. orgilus*; *D. prosaphes*; *Micaria nanella*; *M. vinnula*; *Trachyzelotes lyonneti*; *Z. pseutes*; *Cheiracanthium inclusum*.

An eastern distribution was shown by 12 species: *Castianera descripta*; *Camillina elegans*; *Cesonia bilineata*; *Drassyllus gynosaphes*; *D. rufulus*; *Nodocion floridanus*; *Sergiolus*

bicolor; *S. ocellatus*; *Zelotes aiken*; *Z. duplex*; *Z. hentzi*; *Z. pallidus* and *Neoanagraphis chamberlini*.

A western distribution was shown by 10 species: *Castianeira longipalpa*; *Drassyllus antonito*; *D. mexicanus*; *Micaria nye*; *M. palliditarsa*; *Zelotes lasalanus*; *Z. monachus*; *Z. reformans*; and *Z. tuobus*.

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