

SPIDERS IN EASTERN TEXAS COTTON FIELDS¹

D. A. Dean, W. L. Sterling and N. V. Horner

Department of Entomology
Texas A & M University
College Station, TX 77843

and

Department of Biology
Midwestern State University
Wichita Falls, TX 76308

ABSTRACT

The species of spiders from a cotton field agroecosystem were identified and their presence, abundance and distribution on the plant was determined. Ninety-seven species were found, with seven species comprising half of the total number collected. *Oxyopes salticus* Hentz was the most abundant, 23% of all spiders collected.

More species of orb weavers than of other spiders were found in the middle of the plant than elsewhere. Spiders that spin irregular webs were also found more often in the mid plant area but also were found all over the plant. Ambushing spiders were found mostly in the top of the plant and hunting spiders were found most often in pitfall traps. Web spinners were apparently more abundant than hunters during a cool, wet year while hunters appeared to be more abundant in a hot and dry year.

INTRODUCTION

The first step in determining the role of spiders in an agroecosystem is to identify the species present and determine their abundance and distribution on the crop. This study is part of a continuing project to determine the importance of spiders in Texas cotton fields.

Published information about spiders of cotton is rather limited. Whitcomb et al. (1963) studied the spiders of cotton in Arkansas and reported 143 species. Whitcomb and

¹This research was supported in part by the National Science Foundation and the Environmental Protection Agency through a grant (NSF GB 34718) to the University of California and Texas A & M University and Midwestern State University Research Foundation Grant MSU-1930. Continued support has been provided by EPA grant no. R-806277-01 and the Texas Agricultural Experiment Station under project H-2591. The findings, opinions and recommendations expressed herein are those of the authors and not necessarily those of the University of California, Texas A & M University, Midwestern State University, the National Science Foundation or the Environmental Protection Agency. This research was conducted in cooperation with SEA, USDA, and the Texas Department of Corrections. Approved for publication as TA 16884 by Director, Texas Agricultural Experiment Station.

Bell (1964) expanded the list to 160 species. They reported 23 species of salticids, the largest representation of any family. A total of 34 species of spiders were found in cotton from California by Leigh and Hunter (1969) but a list of the species was not included. Skinner (1974) reported 154 species from cotton in Alabama and Mississippi with 41 salticids present. He did not sample ground dwelling spiders nor do any nocturnal collecting. Aguilar (1976) reported that clubionids were most numerous in Peruvian cotton representing 29.3% of the total spiders collected, followed by thomisids (12.3%) and salticids (8.7%). Whitcomb et al. (1963) described the locations of some common spiders on cotton and showed that many species regularly inhabit a given part of the plant. In another study, LeSar and Unzicker (1978) described the locations of the most abundant spiders on soybean and also showed that certain species migrate to other parts of the plant at different times of the day.

Only two papers are known regarding spiders from cotton in Texas. Kagan (1943) lists 36 species; however, lycosids are not mentioned, indicating that only those species on the plant were collected. Pamanes-Guerrero (1975) studied the spiders of cotton in an insecticidally treated field near College Station, Texas. A small number of species was found (27), possibly due to the use of insecticides and only 15 were identified to species.

Spiders can be important predators of insect pests of cotton. Previous studies have shown that *Phidippus audax* Hentz, *Misumenops* spp., *Chiracanthium inclusum* (Hentz), *Oxyopes salticus* Hentz and *Aysha gracilis* (Hentz) all fed on eggs of *Heliothis virescens* (F.) under field conditions (McDaniel and Sterling 1979, 1982). These same species, including *Acanthepeira stellata* (Walckenaer) were also reported to feed on larvae of *H. virescens* (McDaniel et al. 1981). Whitcomb and Bell (1964) reported three spiders, *Latrodectus mactans* (F.), *P. audax* and *Xysticus* spp., feeding on adult boll weevils, *Anthonomus grandis* Boheman, while *O. salticus* was observed feeding on the cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), and *Lygus lineolaris* (Palisot de Beauvois). They also observed *A. stellata*, *Lycosa rabida* (Walck.), *Peuceitia viridans* (Hentz), and *Phidippus audax* feeding on larvae or adults of *Heliothis* spp. Other species of spiders were observed feeding on *Pectinophora gossypiella* (Sanders), *Alabama argillacea* (Hübner) and *Trichoplusia ni* (Hübner). Since it is known that spiders feed readily on cotton insect pests, it is important to determine their relative abundance and distribution within the plant, and determine the numerically dominant species.

Luczak (1960) used the terms dominant, influent and accessory to describe spider numbers. The dominant category was used for those spiders which comprised more than 10% of the total. Those comprising 2-10% of the total were classified as influents and those with less than 2% were termed accessories.

METHODS AND MATERIALS

Spiders were sampled in insecticidally untreated cotton fields during the 1978-1980 growing seasons at the Ellis Unit of the Texas Department of Corrections in Walker County near Huntsville, Texas. We also collected spiders from boll weevil pheromone traps (Mitchell and Hardee 1974), placed around the edge of the field, and by hand collecting from a cotton field near Navasota in Brazos County during early 1978. In Walker County, D-vac[®] suction samples (Dietrick 1961) and whole plant examinations were made weekly. A sweep net was used occasionally to augment the other methods. Pitfall traps used to sample ground dwelling spiders were examined ca. once a week. Collections and samples were taken during the daylight hours.

Twenty-five D-vac[®] samples, consisting of one meter of row each, were taken each week. Arthropods were killed with carbon tetrachloride soon after collection and returned to the laboratory for identification and counting. Spiders were preserved in 70% ethyl alcohol. About 20 samples of one meter of row were taken by whole plant examination on a weekly basis starting shortly after plant emergence and continuing until the crop was mature. Immature spiders were collected and returned to the laboratory where they were then reared to maturity on various insect prey, preserved in alcohol, and determined to species. Samples taken by D-vac[®] and whole plant examination were taken in a stratified-random pattern throughout the field.

Ethylene glycol was used in the six pitfall traps that were maintained throughout the growing season. The traps consisted of uncovered half-gallon plastic buckets. Trap catches were examined weekly when possible and specimens collected were preserved in alcohol. In 1978 pitfall traps were randomly placed in a cotton field in a manner described by Sterling et al. (1979). The traps in 1979 and 1980 were placed in an untreated field also used in studies reported by McDaniel and Sterling (1979, 1982). Traps were placed about 10 rows from the edge of the field and then every five rows and 20 m down the row forming a diagonal line across the field. Spiders were identified to species when possible. Lycosids were identified to species only when adults were present except for *Lycosa rabida* Walck. and *Schizocosa avida* (Walck.) which could be identified as immatures. No attempt was made to quantify absolute density of spiders in pitfall traps. However, total numbers of spiders counted in all three sampling methods were used to determine the percentage of the more abundant species.

RESULTS AND DISCUSSION

A list of the species collected, relative numbers present, time of season, and location on the plant are presented in Table 1. The relative numbers include: 1 = common, ca. 3 or more specimens per week; 2 = uncommon, ca. 6 to 40 specimens per season; and 3 = rare, 1 to 6 specimens per season. The time of season includes: Early = May to June; Mid = June to July; and Late = August to September.

Twenty-three different species of spiders were collected by D-vac[®] and 35 were captured in pitfall traps. Those species found on the ground were captured in pitfall traps but may also be found on the plant. Sixty-seven species were observed during whole plant examinations. Only 10 species were collected by all three sampling methods and six of these were among the most abundant.

Most of the spiders were collected in Walker Co., but the following species were collected from cotton in Brazos Co.: *Acanthepeira cherokee* Levi; *Castianeira gertschi* Kaston; and *Trachelas volutus* Gertsch. Ninety-seven species from 71 genera in 18 families were identified.

The spider species collected were grouped into four different guilds according to their method of obtaining prey. Web spinners included the following: Dictynidae, Theridiidae, Linyphiidae, Erigonidae, Hahniidae, Uloboridae, and Araneidae. Ambushing spiders belonged to the families Thomisidae and Philodromidae. The hunting spider families included Pisauridae, Lycosidae, Oxyopidae, Gnaphosidae, Clubionidae, Anyphaenidae and Salticidae. The families Filistatidae and Mimetidae were placed in a miscellaneous guild because their habits are unlike any of the previously mentioned families.

Table 1.—List of spiders in eastern Texas cotton fields (1978-80)

Spider	Rel. Nos.	Time of Season	Location
Filistatidae			
<i>Filistata hibernalis</i> Hentz	3	Early	Weevil trap
Uloboridae			
<i>Uloborus glomosus</i> (Walckenaer)	3	Late	Middle of plant
Dictynidae			
<i>Dictyna segregata</i> Gertsch & Mulaik	1	Early-late	Entire plant, ground
<i>Dictyna volucripes</i> Keyserling	3	Early-mid	Terminal
Theridiidae			
<i>Achaearanea globosa</i> (Hentz)	3	Early	Cotton field
<i>Anelosimus studiosus</i> (Hentz)	3	Mid	Terminal
<i>Argyrodes trigonum</i> (Hentz)	3	Mid-late	Mid plant
<i>Latrodectus mactans</i> (Fabricius)	2	Mid-late	Near base of plant
<i>Steatoda triangulosa</i> (Walckenaer)	3	Early	Cotton field
<i>Theridion australe</i> Banks	2	Early-late	Base of fruit bracts
<i>Theridion glaucescens</i> Becker	3	Late	Near base of plant
<i>Theridion murarium</i> (Emerton)	3	Early-late	Mid plant
<i>Tidarren sisypoides</i> (Walckenaer)	3	Late	Lower ½ of plant
Linyphiidae			
<i>Frontinella pyramitela</i> (Walckenaer)	3	Late	Mid plant
<i>Meioneta</i> sp.	3	Early	Plant
Erigonidae			
<i>Erigone autumnalis</i> Emerton	2	Early-late	Ground
<i>Erigone dentigera</i> O.P.-Cambridge	3	Mid	Terminal
<i>Grammonota texana</i> Banks)	3	Early-mid	Terminal, bracts of boll
Araneidae			
<i>Acacesia hamata</i> (Hentz)	3	Mid	Near top of plant
<i>Acanthepeira cherokee</i> Levi	3	Late Sept.	Cotton field
<i>Acanthepeira stellata</i> (Walckenaer)	1	Early-late	Near top of plant
<i>Argiope aurantia</i> Lucas	2-3	Mid-late	On web between plants
<i>Argiope trifasciata</i> (Forsk.)	2-3	Mid-late	On web between plants
<i>Cyclosa turbinata</i> (Walckenaer)	2-3	Mid-late	Mid plant, on web
<i>Eriophora ravilla</i> (C.L. Koch)	3	Late	Cotton field
<i>Eustala anastera</i> (Walckenaer)	3	Early	Weevil trap, plant
<i>Gea heptagon</i> (Hentz)	3	Mid	Ground
<i>Hyposinga rubens</i> (Hentz)	3	Early	Cotton field
<i>Mangora gibberosa</i> (Hentz)	2-3	Late	Top ½ of plant
<i>Mecynogea lemniscata</i> (Walckenaer)	3	Early-late	Near top of plant
<i>Metazygia wittfeldae</i> (McCook)	3	Mid	Cotton field
<i>Micrathena gracilis</i> (Walckenaer)	3	Early	On web between plants
<i>Micrathena sagittata</i> (Walckenaer)	3	Early	Plant
<i>Neoscona arabesca</i> (Walckenaer)	2-3	Early-late	Near top of plant
<i>Tetragnatha laboriosa</i> Hentz	1	Early-late	Top ½ of plant in web
Mimetidae			
<i>Mimetus hesperus</i> Chamberlin	3	Late	Near base of plant
Hahniidae			
<i>Neoantistea mulaiki</i> Gertsch	3	Early	Ground
Pisauridae			
<i>Dolomedes triton</i> (Walckenaer)	3	Early	Ground
Lycosidae			
<i>Allocosa</i> sp.	3	Early	Ground
<i>Lycosa helluo</i> Walckenaer	3	Early-late	Ground
<i>Lycosa rabida</i> Walckenaer	3	Mid	Ground
<i>Pardosa delicatula</i> Gertsch & Wallace	3	Early-late	Ground

Table 1.--(cont.)

Spider	Rel. Nos.	Time of Season	Location
<i>Pardosa milvina</i> (Hentz)	1-2	Early-late	Ground
<i>Pardosa pauxilla</i> Montgomery	1-2	Early-late	Ground
<i>Pirata seminola</i> Gertsch & Wallace	2	Early-late	Ground
<i>Schizocosa avida</i> (Walckenaer)	1-2	Early-late	Ground
Oxyopidae			
<i>Oxyopes apollo</i> Brady	3	Mid-late	Ground
<i>Oxyopes salticus</i> Hentz	1	Early-late	Entire plant
<i>Peucetia viridans</i> (Hentz)	1-2	Mid-late	Near top of plant
Gnaphosidae			
<i>Drassodes</i> sp.	3	Mid	Ground
<i>Drassyllus notonus</i> Chamberlin	2	Early-late	Weevil trap, ground
<i>Drassyllus</i> sp.	3	Early	Cotton field
<i>Gnaphosa sericata</i> (L. Koch)	3	Mid-late	Ground
<i>Nodocion floridanus</i> (Banks)	3	Early	Weevil trap
<i>Sergiolus ocellatus</i> (Walckenaer)	3	Late	In web in boll
<i>Synphosus paludis</i> (Chamberlin & Gertsch)	3	Late	Ground
Clubionidae			
<i>Castianeira gertschi</i> Kaston	3	Feb.	Ground
<i>Castianeira longipalpus</i> (Hentz)	3	Early-late	Ground
<i>Chiracanthium inclusum</i> (Hentz)	1	Early-late	Tube web, top of plant
<i>Syrisca affinis</i> (Banks)	3	Mid-late	Ground
<i>Trachelas deceptus</i> (Banks)	3	Early-late	Ground
<i>Trachelas volutus</i> Gertsch	3	Feb. & Mar.	Weevil trap
Anyphaenidae			
<i>Anyphaena</i> sp. prob. <i>celer</i> (Hentz)	3	Early	Weevil trap
<i>Aysha gracilis</i> (Hentz)	2	Early-late	Tube web, top of plant
<i>Teudis mordax</i> (O.P.-Cambridge)	3	Early	On web
<i>Wulfilia saltabunda</i> (Hentz)	3	Mid-late	Mid plant, ground
Thomisidae			
<i>Misumenoides formosipes</i> (Walckenaer)	3	Early-late	Near top of plant
<i>Misumenops asperatus</i> (Hentz)	3	Early	Near top of plant
<i>Misumenops celer</i> (Hentz)	1	Early-late	Near top of plant
<i>Misumenops oblongus</i> (Keyserling)	3	Early-late	Near top of plant
<i>Synema parvula</i> (Hentz)	3	Late	Near top of plant
<i>Tmarus</i> sp.	3	Late	Plant
<i>Xysticus auctificus</i> Keyserling	3	Early	Ground
<i>Xysticus elegans</i> Keyserling	3	Early	Near top of plant
<i>Xysticus funestus</i> Keyserling	2	Early-late	Near top of plant
<i>Xysticus texanus</i> Banks	3	Mid-late	Near top of plant
Philodromidae			
<i>Philodromus pratariae</i> (Scheffer)	3	Early-late	Near top of plant
<i>Thanatus formicinus</i> (Clerck)	3	Mid	Ground
<i>Tibellus duttoni</i> (Hentz)	3	Late	Plant
Salticidae			
<i>Admestina tibialis</i> (C. Koch)	3	Mid	Web in square
<i>Eris marginata</i> (Walckenaer)	3	Early-late	Weevil trap, entire plant
<i>Hentzia mitrata</i> (Hentz)	3	Late	Bract of boll
<i>Hentzia palmarum</i> (Hentz)	3	Early-late	Entire plant
<i>Lyssomanes viridis</i> (Walckenaer)	3	Early	Top of plant
<i>Marpissa formosa</i> (Banks)	3	Early	Weevil trap, ground
<i>Marpissa lineata</i> (C.L. Koch)	3	Early	Cotton field
<i>Metaphidippus exiguus</i> (Banks)	3	Apr.	Weevil trap

Table 1.—(cont.)

Spider	Rel. Nos.	Time of Season	Location
<i>Metaphidippus galathea</i> (Walckenaer)	2-3	Early-late	Weevil trap, entire plant
<i>Pellenes coecatus</i> (Hentz)	2	Mid-late	Ground
<i>Phidippus audax</i> (Hentz)	1	Mid-late	Weevil trap, entire plant
<i>Phidippus cardinalis</i> (Hentz)	3	Early-late	Cotton field
<i>Phidippus clarus</i> Keyserling	3	Early	Weevil trap, ground, plant
<i>Sarinda hentzi</i> (Banks)	3	Late	Near base of plant
<i>Thiodina puerpera</i> (Hentz)	3	Early-late	Plant
<i>Thiodina sylvana</i> (Hentz)	3	Mid-late	Plant
<i>Zygoballus nervosus</i> (Peckhams)	3	Early	Weevil trap
<i>Zygoballus rufipes</i> Peckhams	3	Late	Cotton field

Web Spinners.—Spiders that spin webs feed mostly on arthropods that become caught in their webs, which are built in various places among cotton plants.

The theridiids and dictynids usually spin flat or irregular and tangled webs. Nine species of theridiids were found but only two were common, *L. mactans* and *Theridion australe* Banks. *Dictyna segregata* was common but *D. volucripes* Keyserling was rarely collected. Rogers and Horner (1977) reported *D. volucripes* to be a primary predator of adult midges in guar fields spinning small irregular webs in the terminal. *Dictyna segregata* was commonly captured in pitfall traps and also found throughout the plant strata, under or on top of leaves near the base of the plant and in the terminal (i.e. top 15 cm of the plant).

Sheet-like webs are spun by the hahniids, linyphiids and erigonids usually near the base of the plant. Two male specimens of *Neoantistea mulaiki* Gertsch (family Hahniidae) were collected in pitfall traps on 28 May. Two species of linyphiids were collected but both species were rare. Three species of the family Erigonidae were identified. Only one species, *Erigone autumnnalis* Emerton, was abundant. Several other species of this family remain unidentified.

Eighteen species of orb weavers (families Uloboridae and Araneidae) were found but only seven were abundant. Of these, *A. stellata* and *Tetragnatha laboriosa* Hentz were the most abundant. Three specimens of *A. stellata* and one specimen of *Gea heptagon* (Hentz) were captured in pitfall traps, however, orb weavers are generally residents of the mid or upper part of the plant.

Ambushers.—Ambushing spiders are so named because they do not make webs but wait, usually near the terminal, for an arthropod to move within its grasp. Only two species, *Misumenops celer* (Hentz) and *Xysticus funestus* Keyserling, were abundant. We observed *M. asperatus* (Hentz) feeding on a cotton fleahopper adult.

Hunters.—Hunting spiders actively pursue their prey on the ground or the plant. Forty-five species of hunting spiders represented by seven families were found but only 12 species were abundant. The family Pisauridae was represented by only a single specimen captured in a pitfall trap in June. Eight species of Lycosidae were found and two of these were common in cotton fields. The gnaphosids were represented by seven species but only one was abundant. The clubionids and anyphaenids are generally nighttime hunters that live in tubular retreats during the day. Four species of each family were found with

Table 2.—Total numbers collected and percent of total spiders for the more common species or groups.

Species or Group	Total Number Collected	Percent
<i>Oxyopes salticus</i> Hentz	887	22.9
Erigonidae	461	11.9
<i>Pardosa</i> spp.	307	7.9
<i>Misumenops celer</i> (Hentz)	204	5.3
<i>Tetragnatha laboriosa</i> Hentz	192	5.0
<i>Dictyna segregata</i> Gertsch & Mulaik	176	4.6
<i>Chiracanthium inclusum</i> (Hentz)	159	4.1
<i>Phidippus audax</i> (Hentz)	142	3.7
<i>Acanthepeira stellata</i> (Walckenaer)	139	3.6
<i>Peucetia viridans</i> (Hentz)	94	2.4
<i>Schizocosa avida</i> (Walckenaer)	84	2.2
<i>Cyclosa turbinata</i> (Walckenaer)	64	1.7
<i>Pellenes coecatus</i> (Hentz)	57	1.5
<i>Aysha gracilis</i> (Hentz)	50	1.3
<i>Metaphidippus galathea</i> (Walckenaer)	32	0.8
<i>Drassyllus notonus</i> Chamberlin	31	0.8
<i>Neoscona arabesca</i> (Walckenaer)	29	0.7
<i>Latrodectus mactans</i> (Fabricius)	20	0.5
<i>Hentzia palmarum</i> (Hentz)	19	0.5
<i>Xysticus</i> spp.	19	0.5
All other spiders	701	18.1

one commonly collected species in each family. Eighteen species of salticids were found but only three species were numerous.

Lycosids are normally active at night and were commonly captured in pitfall traps. They were usually observed on the ground but were occasionally seen on the cotton plant. *Oxyopes salticus* was found throughout the plant strata and also captured in pitfall traps. In September, females of *Peucetia viridans* clutching their egg sacs were seen hanging from threads in the plant terminal. *Drassyllus notonus* Chamberlin was found mostly in the pitfall traps. *Chiracanthium inclusum* and *Aysha gracilis* were observed in tube webs under the tips of rolled leaves or around the bracts of fruit near the top of the plant. *Phidippus audax* and *Metaphidippus galathea* (Walck.) were both found throughout the plant strata and occasionally in pitfall traps. *Pellenes coecatus* (Hentz) was captured mostly in pitfall traps, but was observed jumping on the ground and seen occasionally on cotton plants.

Miscellaneous.—The families Filistatidae and Mimetidae are listed here since they do not fit any of the other guilds. Each of these families was represented by one species, and each was rare.

RELATIVE ABUNDANCE OF SPIDER GROUPS

Only about 20 species or species complexes in eastern Texas were common. *Oxyopes salticus* was by far the most common species. Whitcomb et al. (1963) reported that 6% of the spiders collected in Arkansas were *O. salticus*. We found that *O. salticus* plus *Pardosa milvina* (Hentz), *P. pauxilla* Montgomery, *M. celer*, *Tetragnatha laboriosa*, *Dictyna segregata* and *C. inclusum* numerically constituted half of the total. These seven species were

Table 3.—Population densities of spiders sampled by D-vac[®].

Year	Web Spinners		Hunters		Total	
	\bar{x}/m^2	Peak	\bar{x}/m^2	Peak	\bar{x}/m^2	Peak
1978	0.42	1.24 (June 9)	1.36	3.96 (June 21)	1.78	4.16 (June 21)
1979	0.89	1.40 (Aug. 13)	0.77	1.60 (Aug. 27)	1.77	2.52 (Aug. 6)
1980	0.53	0.96 (June 30)	1.93	3.48 (July 21)	2.47	4.28 (July 21)

found throughout the season and, as a group, represented all locations on the plant and ground.

Table 2 presents the more common species and species complexes found in cotton fields in eastern Texas. Included are the total numbers of spiders from the three years sampled and the three sampling techniques used. Specimens from pitfall traps are difficult to quantify on an absolute basis, but they provide relative estimates of the ground fauna, whereas D-vac[®] and whole plant sampling do not accurately reflect numbers of spiders found on the ground or at night. The Erigonidae are grouped by family due to the difficulty in their identification. *Pardosa* spp. are listed to genus in this table because we were unable to identify them to species under field conditions. A total of 821 spiders were found in the pitfall traps over the three years sampled and 318 of these were adult lycosids. The least common species of the genus *Pardosa* was *P. delicatula* Gertsch and Wallace. Only 14 individuals were captured in pitfall traps. *Pardosa milvina* was the most common species of this genus in the pitfall traps totaling 120 specimens. Almost as abundant was *P. pauxilla* with 106 specimens. *Misumenops celer* was the dominant species of crab spider but one specimen of *M. asperatus* and a few specimens of *M. oblongus* (Keyserling) were found. The dominant species of *Xysticus* was probably *funestus* since more specimens were found than of either of the other two species.

Of the spiders included in Table 2 under all other spiders, (18.1%), the following families represent those species found in small numbers or identified only to family: 5.6% Lycosidae, 4.6% Salticidae, 3.3% Araneidae, 0.8% Theridiidae, 0.5% Thomisidae, 0.4% Gnaphosidae, 0.3% Clubionidae, 0.2% Linyphiidae, 0.1% Mimetidae, 0.1% Uloboridae, 0.08% Oxyopidae, 0.05% Hahniidae, 0.03% Anyphaenidae, 0.03% Pisauridae, and 2.0% as unidentified. Species listed elsewhere in this table are not included in these percentages.

A total of 33 species of spiders were found only in the first half of the season and 30 were found only in the latter half. Thirty different species were found throughout the season. Certain groups or species of spiders were only found at certain times of the season, but sufficient overlap of other species occurred to maintain stable densities throughout the season.

Table 4.—Population densities of spiders sampled by whole plant examination.

Year	Web Spinners		Hunters		Total	
	\bar{x}/m^2	Peak	\bar{x}/m^2	Peak	\bar{x}/m^2	Peak
1978	0.33	1.10 (June 20)	1.79	4.60 (July 5)	2.24	5.80 (July 5)
1979	1.53	3.05 (Aug. 6)	0.88	1.70 (Aug. 27)	2.48	4.65 (Aug. 6)
1980	0.51	1.00 (July 9)	1.12	2.35 (July 9)	1.63	3.35 (July 9)

POPULATION DENSITIES OF SPIDERS

Densities of spiders during 1978-1980 by D-vac[®] and whole plant sampling are shown in Tables 3 and 4. The total of web spinners and hunters may be less than the total due to unidentified spiders. Rainfall during the hot and dry year of 1978 was 12.8 cm in the sampling period. The average rainfall during the growing season (May-Aug.) is usually 34.5 cm. A total of 53.1 cm of rainfall fell during the sampling period in 1979, a wet and mild (temperature) year. Only 12.7 cm of rain was recorded in 1980, a hot, dry year.

In 1978 and 1980 (hot and dry years), hunting spiders were more abundant than web spinners (Tables 3 and 4). The reverse was found in 1979 during a wet year with mild temperatures. These data suggest that hunting spiders were more prevalent during a hot and dry year while web spinners apparently were more abundant during a cooler and wetter year.

ACKNOWLEDGMENTS

We thank Mrs. Pebble Lewis for assistance in the rearing of the spiders. We also appreciate the cooperation of the staff of the Texas Department of Corrections. The authors also acknowledge the following individuals for assistance in the identification of spiders: Mr. J. C. Cokendolpher (Texas Tech Univ., Lubbock, TX); Dr. G. B. Edwards (Bur. of Entomol., Div. Plant Industry, Gainesville, FL); Dr. J. Kaspar (Univ. of Wisconsin at Oshkosh, WI); Dr. H. W. Levi (Mus. Comp. Zool., Harvard Univ., Cambridge, MA); Dr. W. P. Peck (Central Missouri State Univ., Warrensburg, MO); and Dr. N. I. Platnick (Am. Mus. Nat. Hist., NY).

LITERATURE CITED

- Aguilar, P. G. 1976. Arañas del campo cultivado – III: Araneidos en algodones del valle de Lurín. *Revista Peruana de Entomología*, 19:71-2.
- Dietrick, E. J. 1961. An improved backpack motor fan for suction sampling of insect populations. *J. Econ. Entomol.*, 54:394-5.
- Kagan, M. 1943. The Araneida found on cotton in central Texas. *Ann. Entomol. Soc. America*, 36:257-8.
- Leigh, T. F., and R. C. Hunter. 1969. Predaceous spiders in California cotton. *California Agric.*, 23:4-5.
- LeSar, C. D., and J. D. Unzicker. 1978. Soybean spiders: species composition, population densities, and vertical distribution. *Illinois Nat. Hist. Surv. Biol. Notes No. 107*, 14 pp.
- Luczak, J. 1960. Rozmieszczenie pająków w lesie. *Ekol. Polska B*, 6:39-50.
- McDaniel, S. G., and W. L. Sterling. 1979. Predator determination and efficiency on *Heliothis virescens* eggs in cotton using ³²P. *Environ. Entomol.*, 8:1083-7.
- McDaniel, S. G., and W. L. Sterling. 1982. Predation of *Heliothis virescens* (F.) eggs on cotton in east Texas. *Environ. Entomol.*, 11:60-6.
- McDaniel, S. G., W. L. Sterling, and D. A. Dean. 1981. Predators of tobacco budworm larvae in Texas cotton. *Southwest. Entomol.*, 6:102-8.
- Mitchell, E. B., and D. D. Hardee. 1974. In-field traps: a new concept in survey and suppression of low populations of boll weevils. *J. Econ. Entomol.*, 67:506-8.
- Pamanes-Guerrero, A. 1975. Spider populations in cotton. Ph.D. Dissert. Texas A & M University. 95 pp.
- Rogers, C. E., and N. V. Horner. 1977. Spiders of guar in Texas and Oklahoma. *Environ. Entomol.*, 6:523-4.
- Skinner, R. B. 1974. The relative and seasonal abundance of spiders from the herb-shrub stratum of cotton fields and the influence of peripheral habitat on spider populations. M.S. Thesis, Auburn Univ., 107 pp.

- Sterling, W. L., D. Jones, and D. A. Dean. 1979. Failure of the red imported fire ant to reduce entomophagous insect and spider abundance in a cotton agroecosystem. *Environ. Entomol.*, 8:976-81.
- Whitcomb, W. H., and K. Bell. 1964. Predaceous insects, spiders, and mites of Arkansas cotton fields. *Arkansas Agric. Exp. Stn. Bull.* 690, 84 pp.
- Whitcomb, W. H., H. Exline, and R. C. Hunter. 1963. Spiders of the Arkansas cotton field. *Ann. Entomol. Soc. America*, 56:653-60.

Manuscript received June 1981, revised December 1981.