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SURVEY AND SEASONAL EVALUATION OF THE SPIDERS OF COTTON IN NEW MEXICO

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Abstract

The relative abundance of spiders was evaluated among six large fields of cotton (conventional acala, Bt acala, conventional pima, and organic pima) over two years in New Mexico. Spiders were collected both from the foliage and from the ground. Forty-two genera of spiders in nineteen families were identified. The most abundant spiders collected were wolf spiders, sheetweb spiders, crab spiders, ghost spiders, and meshweb weavers. The most common spider collected overall during this study was *Pardosa sternalis.*

Introduction

Spiders have long been considered an important, yet poorly understood, component to arthropod management in agroecosystems (Mansour et al. 1983; Young and Edwards 1990; Young and Lockley 1985). Over three hundred species of spiders may be associated with cotton in the United States alone (Whitcomb and Bell 1964; Young and Edwards 1990). These arachnids have been shown to make up nearly 50% of the total predators associated with certain Bt cotton fields (Liu et al. 2003) and well over that in conventional cotton (Plagens 1983). In Texas spiders were found to be the key predator of the cotton fleahopper, *Pseudatomoscelis seriatus* (Breene et al. 1989; Sterling et al. 1992). Spiders have been shown to collectively impact the populations of other cotton pests as well (Breene et al. 1993; Nyffeler et al. 1994), including the cotton bollworm, *Helicoverpa zea,* and tobacco budworm, *Heliothis virescens* (Ruberson and Greenstone 1998) and the Egyptian cotton leafworm *Spodoptera littoralis* (Mansour 1987).

Species associated with cotton have been extensively surveyed for several states including Arkansas (Whitcomb and Bell 1964), California (Leigh and Hunter 1969), and Texas (Breene et al. 1993). However, little is known about spider diversity on cotton in New Mexico. This study was initiated to determine the relative abundance of spiders among the various types of cotton grown in the state.

Materials and Methods

Experimental design

The survey was conducted in 2003 and 2004 in the south central region of New Mexico. Cotton utilized for this study each season was conventional acala 1517-99 (2 sites), transgenic Bt acala 1517-99 (2 sites), organic pima S-6 (1 site), and conventional pima S-6 (1 site). Each field was broken into a large sampling area of 32 rows (40 in spacing) by approximately 600 ft. Sampling was initiated both years in mid-June (shortly after squaring) and continued weekly until plants were defoliated.

Plant samples

Spiders on the cotton plants were sampled using the beat bucket method described by Knutson and Wilson (1999). Eighty plants were randomly sampled per field site. Spiders were placed in vials containing 80% EtOH and taken to the laboratory for identification.

Ground samples

Spiders frequenting the ground and bases of plants were sampled using pitfall traps. Each trap consisted of two plastic cups (32 oz.); the bottom cup remained in the ground to prevent collapse, while the top cup rested inside the other with its rim flush with the soil surface and was partially filled with a 50% propylene glycol solution. A plastic pie plate, secured by two nails, covered the trap to prevent flooding by rain. Five pitfall traps were placed at each field site in a large "x" pattern. Samples were removed weekly, placed in vials containing 80% EtOH, and taken to the laboratory for identification.

Results

2003

The diversity of spiders in New Mexico cotton was quite high for the 2003 growing season. At least 45 species of spiders in 41 genera and nineteen families were present this year (Tables 1 and 2). A total of 4475 spiders were collected. The most common spider collected overall during this year was *Pardosa sternalis* (44%).

Plant samples

The most common spiders collected from cotton plants in 2003 included crab spiders (Thomisidae), meshweb weavers (Dictynidae), and ghost spiders (Anyphaenidae) (Table 1). Crab spiders made up 31% of the total collected from cotton plants, and were primarily in the genus *Misumenops*. Meshweb spiders, *Dictyna*, were the second most common group at 16%, followed closely by the ghost spiders at 15%. Spider populations appeared to be similar among the cotton varieties examined.

Ground samples

Ground dwelling spiders made up 71% of the total spiders collected this season. As would be expected the overwhelming majority of these (86%) were wolf spiders (Lycosidae). Approximately 62% of the total spiders collected from the ground were *P. sternalis*. The second most common group collected was the sheetweb spiders (Linyphiidae), primarily *Eperigone* and *Grammonota*, at approximately 10% (Table 2).

2004

The diversity of spiders appeared somewhat lower than the previous year. At least 34 species of spiders in 28 genera and fifteen families were collected this year (Tables 3 and 4). A total of 1490 spiders were collected. The most common spider collected overall during this year was *P. sternalis* (36%).

Plant samples

The most common spiders collected from cotton plants in 2004 were ghost spiders, crab spiders, and long-jawed orb weavers (Tetragnathidae) (Table 3). Ghost spiders, primarily *Hibana incursa*, made up 34% of the total collected from cotton plants. Crab spiders in the genus *Misumenops* were the second most common group at 20%. The tetragnathids, represented predominately by *Tetragnatha laboriosa*, composed 12% of spiders on cotton plants.

Ground samples

Ground dwelling spiders were again the most abundant group at 60% of the total spiders collected for 2004. Approximately 71% were wolf spiders, of which 60% were *P. sternalis*. The second most common group was the sheetweb spiders, primarily *Grammonota*, at approximately 23% (Table 4).

Conclusions

The most abundant spiders collected from New Mexico cotton during this study were wolf spiders (predominately *P. sternalis*), sheetweb spiders, crab spiders, ghost spiders, and meshweb weavers. Both wolf and ghost spiders are wandering spiders that actively hunt their prey; the former are typically active on the ground, although at least one species is often found on cotton plants at night, while the latter are usually active on foliage (Breene et al. 1993). The crab spiders are ambush predators most commonly found waiting for prey in flowers. As indicated by their common names the sheetweb and meshweb spiders are web builders that feed on trapped prey. The common sheetweb spiders collected in this study all build their webs on or near ground level (Young and Edwards 1990). The meshweb weavers build their webs on the cotton plant (Breene et al. 1993). The long-jawed orb weaver, *T. laboriosa*, which was among the more common spiders found on plants during 2004, builds horizontal webs between rows in the cotton canopy and primarily captures insects flying upward (Richman et al. 1990, CSB, personal observations). All genera above have been reported to be predators of important pests of cotton (Breene et al. 1993). The biology and feeding behavior of these spiders needs to be examined to determine their potential benefit to cotton IPM in New Mexico.

It is of interest to note that the domination of a few spider species in agricultural systems in New Mexico, as exemplified by alfalfa (Richman et al. 1990) and observed in this survey for cotton, seems typical for much of the Western United States. In the eastern half of the country more species and less dominance of a few species was common (Whitcomb et al. 1963; Whitcomb and Bell 1964).

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Table 1. Spiders of New Mexico cotton fields (beat bucket), 2003.

Family	Species	FIELD[1]

		CON1	CON2	BT1	BT2	PIMA1	OPIMA1	Total
Anyphaenidae	*Anyphaena* sp.	9	2	2	2	1	0	16
	Hibana incursa	29	43	49	34	24	14	193
Araneidae	*Larinia* sp.	1	1	0	0	0	2	4
	Metapeira arizonica	13	8	6	9	3	6	45
	Neoscona sp.	2	5	0	0	0	2	9
	unknown araneid	1	8	2	0	2	0	13
Clubionidae	*Clubiona* sp.	0	0	1	0	0	0	1
Corinnidae	*Trachelas* sp.	0	0	1	3	0	7	11
Dictynidae	*Dictyna reticulata*	10	20	9	5	8	32	84
	Dictyna sp.	15	16	15	13	12	49	120
Gnaphosidae	*Zelotes* sp.	0	0	0	1	0	2	3
	unknown immatures	0	1	0	2	0	3	6
Linyphiidae	*Eperigone* sp.	0	0	0	0	1	0	1
	Erigone sp.	0	1	2	0	0	1	4
	Grammonota sp.	2	0	3	4	0	4	13
	unknown erigonine	1	0	2	0	1	1	5
	unknown linyphiine	0	0	0	1	0	0	1
Lycosidae	unknown immature	4	1	1	2	1	1	10
Mimetidae	*Mimetus* sp.	1	0	0	0	0	0	1
Miturgidae	*Cheiracanthium inclusum*	1	7	3	18	5	25	59
Oxyopidae	*Hamataliwa grisea*	2	0	0	1	1	0	4
	Oxyopes salticus	0	0	0	0	2	0	2
Philodromidae	*Ebo* sp.	3	3	0	2	1	0	9
	Philodromus sp.	0	0	0	0	1	0	1
Salticidae	*Habronattus klauseri*	1	1	0	1	0	0	3
	Metaphidippus chera	27	19	35	33	18	3	135
	Pelegrina sp.	0	0	1	0	1	0	2
	Phidippus apacheanus	1	0	0	0	1	0	2
	Phidippus audax	0	0	0	1	0	0	1
	Phidippus sp.	1	4	1	1	0	0	7
	Sassacus vittis	1	2	1	0	0	4	8
Tetragnathidae	*Tetragnatha laboriosa*	3	9	4	6	17	18	57
Theridiidae	*Achaearanea caniones*	0	0	0	0	1	0	1
	Latrodectus hesperus	3	0	0	0	0	0	3
	Theridion sp.	14	14	16	12	7	0	63
	unknown theredíid	0	0	0	0	0	1	1
Thomisidae	*Misumenops coloradensis*	30	63	20	15	27	44	199
	Misumenops sp.	34	36	26	37	22	40	195

	Xysticus sp.	0	1	0	0	0	0	1
	unknown thomisid	0	0	2	0	0	1	3

[1]Cotton examined included conventional acala (CON1, CON2), transgenic Bt acala (BT1, BT2), conventional Pima (PIMA1), and organic Pima (OPIMA1).

Table 2. Spiders of New Mexico cotton fields (pitfall trap), 2003.

Family	Species	FIELD[1]						
		CON1	CON2	BT1	BT2	PIMA1	OPIMA1	Total
Anyphaenidae	*Hibana incursa*	0	0	0	0	1	0	1
Araneidae	*Larinia* sp.	0	0	0	0	0	3	3
	Metapeira sp.	0	0	1	1	0	0	2
	Neoscona sp.	0	0	1	0	0	0	1
Corinnidae	*Trachelas* sp.	1	0	0	0	0	3	4
	Castianera sp.	0	0	0	1	0	0	1
Dictynidae	*Dictyna* sp.	1	0	0	1	0	1	3
Gnaphosidae	*Herpyllus* sp.	4	0	0	2	2	0	8
	Micaria emertoni	5	4	0	0	4	5	18
	Trachyzelotes jaxartensis	0	0	0	0	2	0	2
	Urozelotes rusticus	0	1	0	0	0	0	1
	Zelotes sp.	0	0	0	2	0	0	2
	unknown gnaphosid	1	0	2	2	0	1	6
Linyphiidae	*Eperigone* sp.	28	24	25	10	6	11	104
	Erigone sp.	18	3	13	5	5	5	49
	Grammonota sp.	8	6	15	17	8	25	79
	Tennesseelum formicum	15	1	6	2	0	9	33
	unknown erigonine	7	1	3	4	8	14	37
	unknown linyphiine	3	3	4	1	1	1	13
Lycosidae	*Hogna* sp.	20	14	22	15	19	22	112
	Pardosa sternalis	155	53	1212	362	65	112	1959
	unknown lycosid	47	13	176	159	82	185	662
Mimetidae	*Mimetus* sp.	0	0	0	1	0	2	3
Miturgidae	*Cheiracanthium inclusum*	0	0	0	1	0	0	1
Nesticidae	*Eidmannella pallida*	0	5	0	16	0	0	21
Oecobiidae	*Oecobius* sp.	1	0	0	0	0	0	1
Oxyopidae	*Oxyopes salticus*	0	0	0	1	0	0	1
Pholcidae	*Psilochorus imatatus*	4	4	2	2	1	0	13
Salticidae	*Habronattus klauseri*	10	5	2	5	1	2	25

Tetragnathidae	*Tetragnatha laboriosa*	0	0	1	1	0	6	8
Theridiidae	*Latrodectus hesperus*	0	0	0	0	0	1	1
	Theridion sp.	1	1	0	1	2	0	5

[1]Cotton examined included conventional acala (CON1, CON2), transgenic Bt acala (BT1, BT2), conventional Pima (PIMA1), and organic Pima (OPIMA1).

Table 3. Spiders of New Mexico cotton fields (beat bucket), 2004.

Family	Species	FIELD[1]						
		CON1	CON2	BT1	BT2	PIMA1	OPIMA1	Total
Anyphaenidae	*Anyphaena* sp.	2	35	2	1	2	0	42
	Hibana incursa	11	118	9	5	6	8	157
Araneidae	*Larinia* sp.	0	0	2	0	0	1	3
	Metapeira arizonica	1	0	3	1	0	1	6
	unknown araneid	0	2	0	2	1	0	5
Corinnidae	*Trachelas* sp.	1	0	0	0	0	4	5
	unknown corinnid	0	1	0	1	0	0	2
Dictynidae	*Dictyna reticulata*	5	0	2	6	0	3	16
	Dictyna sp.	10	2	7	8	2	5	34
Gnaphosidae	*Micaria* sp.	0	0	0	1	0	0	1
	Zelotes sp.	0	0	1	0	0	0	1
	unknown gnaphosid	0	1	0	2	0	3	6
Linyphiidae	*Eperigone* sp.	3	0	1	0	0	0	4
	Erigone sp.	2	1	1	1	0	0	5
	Grammonota sp.	2	8	0	0	0	4	14
Lycosidae	*Hogna* sp.	0	1	0	0	0	0	1
	Pardosa sternalis	1	5	12	0	0	1	19
Miturgidae	*Cheiracanthium inclusum*	4	5	3	3	1	4	20
Philodromidae	*Ebo* sp.	2	3	3	1	2	1	12
Salticidae	*Habronattus klauseri*	0	0	0	1	0	0	1
	Habronattus sp.	0	0	0	0	0	1	1
	Metaphidippus chera	6	6	6	6	4	1	29
	Metaphidippus sp.	0	0	0	1	0	0	1
	Sassacus vittis	0	1	0	0	0	0	1
Tetragnathidae	*Tetragnatha laboriosa*	12	8	20	9	3	10	62
	Tetragnatha sp.	4	0	1	2	0	0	7
Theridiidae	*Theridion* sp.	4	4	4	1	0	0	13

Thomisidae	*Misumenops coloradensis*	14	14	27	18	11	25	109
	Misumenops sp.	5	0	2	4	0	1	12

[1]Cotton examined included conventional acala (CON1, CON2), transgenic Bt acala (BT1, BT2), conventional Pima (PIMA1), and organic Pima (OPIMA1).

Table 4. Spiders of New Mexico cotton fields (pitfall trap), 2004.

Family	Species	FIELD[1]						
		CON1	CON2	BT1	BT2	PIMA1	OPIMA1	Total
Anyphaenidae	*Hibana incursa*	0	0	1	1	0	1	3
	Anyphaena sp.	0	1	0	0	0	1	2
Araneidae	*Metapeira* sp.	0	0	0	0	0	1	1
	Neoscona sp.	0	1	0	0	0	0	1
Corinnidae	*Trachelas* sp.	1	1	2	0	0	0	4
	unknown corinnid	0	0	0	1	0	0	1
Dictynidae	*Dictyna* sp.	0	0	0	0	0	3	3
Gnaphosidae	*Drassyllus*	0	0	0	1	0	0	1
	Micaria emertoni	2	0	0	1	0	0	3
	Micaria sp.	0	0	0	0	0	5	5
	Trachyzelotes jaxartensis	0	0	1	0	0	0	1
	Zelotes sp.	0	0	0	0	0	1	1
	unknown gnaphosid	0	1	0	1	0	0	2
Linyphiidae	*Eperigone* sp.	2	2	1	4	0	2	11
	Erigone sp.	3	1	7	9	0	11	31
	Grammonota sp.	22	17	17	63	17	17	153
	Tennesseelum formicum	2	0	0	0	1	2	5
	unknown erigonine	0	0	0	2	0	1	3
	unknown linyphiine	0	0	1	0	0	3	4
Lycosidae	*Hogna* sp.	32	10	15	9	7	23	96
	Pardosa sternalis	55	27	135	163	96	69	545
Nesticidae	*Eidmannella pallida*	3	0	0	1	0	0	4
Philodromidae	*Ebo* sp.	0	1	0	0	0	0	1
Pholcidae	*Psilochorus imatatus*	0	0	0	0	0	1	1
Salticidae	*Habronattus klauseri*	2	3	1	5	0	1	12
Tetragnathidae	*Tetragnatha laboriosa*	0	2	0	0	0	0	2
Theridiidae	*Theridion* sp.	3	0	0	0	0	1	4
Thomisidae	*Misumenops coloradensis*	0	1	0	0	0	0	1

[1]Cotton examined included conventional acala (CON1, CON2), transgenic Bt acala (BT1, BT2), conventional Pima (PIMA1), and organic Pima (OPIMA1).