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GROUND SURFACE SPIDERS IN THREE CENTRAL FLORIDA PLANT COMMUNITIES

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ABSTRACT

Ground surface spiders were pitfall-trapped every two months in pond pine, sand pine scrub, and flatwoods plant communities on the University of Central Florida campus near Orlando from May, 1983 to March, 1984. Eight-two species and 2,326 individuals were collected: 57 species and 1,094 individuals in pond pine, 42 species and 851 individuals in sand pine scrub, and 48 species and 381 individuals in flatwoods community.

Spider diversity was greatest in pond pine, followed by sand pine scrub, and then flatwoods community. Similarity in spider species was greatest between pond pine and flatwoods, followed by sand pine scrub and flatwoods, and then pond pine and sand pine scrub.

A new species of *Drassyllus* (Gnaphosidae) was collected in the flatwoods and a range extension for *Zora pumila* (Zoridae) was recorded in pond pine.

INTRODUCTION

Spider populations in different plant communities have been studied by Lowrie (1942, 1968, 1985), Duffey (1962), Berry (1970, 1971), Barnes (1953), Uetz (1975, 1977, 1979), Bultman et al. (1982), and many other investigators. The spider faunas associated with plant communities in Florida are poorly defined, although important studies have been done by Muma (1973), Rey and McCoy (1983), and Lowrie (1963, 1971). Muma (1973) compared ground surface spider population in four central Florida ecosystems. Rey and McCoy (1983) sampled arthropods including spiders of northwest Florida salt marshes. Lowrie, working in the Pensacola area of northwest Florida, studied effects of grazing and intense collecting on a population of green lynx spiders (1963) and the effects of time of day and weather on spider catches with sweep nets (1971).

Our primary purposes were to determine and compare the ground surface spider fauna in pond pine, sand pine scrub, and flatwoods communities. In addition, we wanted to determine if seasonal differences exist in the spider populations among the three plant communities.

STUDY AREA

The three plant communities were in the eastern part of the University of Central Florida campus, located approximately 17 km east of Orlando in Orange County. Plant names mentioned herein are according to Wunderlin (1982).

Plant cover in the pond pine community consisted of shrubs, trees, tree seedlings, grasses, and vines. A large accumulation of leaf litter was present. Pond pine (*Pinus serotina* Michx.) was the dominant tree followed by two bays (*Gordonia lasianthus* (L.) Ellis and *Magnolia virginica* L., dahoon holly (*Ilex cassine* L.), and swamp black gum (*Nyssa sylvatica* Marsh.). Saw palmetto (*Serenoa repens* (Bartr.) Small) was common. Soil in pond pine was rutledge fine sand, a highly acidic type with low organic matter.

Ground surface in the sand pine scrub community was covered with a sparse leaf litter. The soil type was St. Lucie fine sand, which is low in organic matter, very acidic, nutrient deficient, and with low water-holding capacity. Dominant shrubs were myrtle oak (*Quercus myrtifolia* Willd.) and rusty lyonia (*Lyonia ferruginea* (Walt.) Nutt.). Sand pine (*Pinus clausa* (Chapm. ex Engelm.) Vasey ex Sarg.) was the dominant tree, but scrub live oak (*Q. geminata* Small), Chapman's oak (*Q. chapmanii* Sarg.), and saw palmetto were common.

The flatwoods site contained Leon fine sand, which is very acidic, low in organic matter, and poorly drained. Plants were mainly saw palmetto, longleaf pine (*P. palustris* Mill.), and two wiregrasses, *Aristida spiciformis* Ell. and *A. stricta* Michx. Ground cover consisted mainly of saw palmettos and grasses. See Corey (1987) for a more detailed description of the plants in each community.

MATERIALS AND METHODS

The three communities were sampled every two months starting in May, 1983 and ending in March, 1984. Ninety pitfall traps were deployed. (See Corey (1987) and Corey and Taylor (1987) for pitfall trap design). Ten traps each were placed in three sites in each plant community (pond pine: sites A, B, and C; sand pine scrub: sites D, E, and F; and flatwoods: sites G, H, and I). Pitfall traps were placed in a line transect with each trap at least 10 m apart. Trap lines were 20-50m apart. Each trap contained a 0.47-liter mixture of ethylene glycol, 95% ethanol, and water in a ratio of 2:1:2.

Thirty collections per plant community were made each collection month for a total of 540 pitfall collections. During each collection month, the pitfall traps remained open for 14 days. After that time, the contents of each trap was separated from the fluid using a fine-mesh wire screen and emptied into a baby food jar containing 70% ethanol. After each trap collection, the fluid was filtered, reconstituted back to its original volume, and reused.

Spiders were identified using a dissecting microscope. Difficult specimens were verified or identified by Jonathan Reiskind, University of Florida; Jonathan Coddington, Smithsonian Institution; Norman I. Platnick, American Museum of Natural History; J. H. Redner, Biosystematics Research Institute; and G. B. Edwards, Florida Department of Agriculture and Consumer Services.

Many immature spiders were identified to family. Some spiders were collected in poor condition and could not be identified to family; these specimens are reported as undetermined (See Table 3).

RESULTS AND DISCUSSION

A total of 2,326 spiders representing 82 species in 22 families, was captured in 540 pitfall trap collections. An overall average of 4.31 spiders was observed per

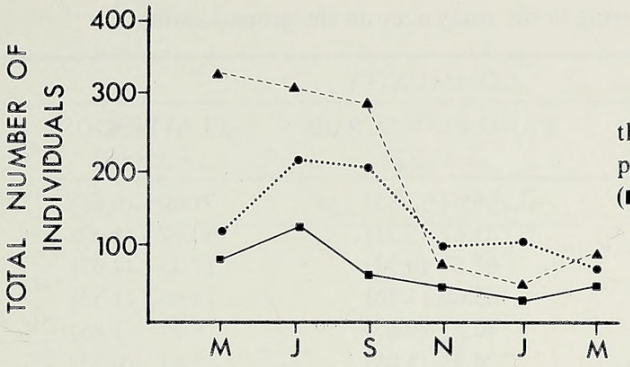

Fig. 1.—Total number of spiders caught on the ground surface using pitfall traps in pond pine (▲), sand pine scrub (●), and flatwoods (■).

pitfall trap. Forty-seven percent of the combined spider assemblage for the three communities was captured in pond pine, 36.6% in sand pine scrub, and 16.4% in flatwoods. More spiders were trapped in July than in any other month, except for pond pine where the greatest number occurred in May (Fig. 1). Few spiders were collected in November and January.

Pond pine yielded 1,094 individuals, 57 species, and 21 families; sand pine scrub, 851 individuals, 42 species, and 13 families; flatwoods, 381 individuals, 48 species, and 17 families. Sixty-five percent more spiders were found in pond pine than in flatwoods, 22% more in pond pine than in sand pine scrub, and 55% more in sand pine scrub than in flatwoods. A species list of all spiders collected appears separately (Corey 1987).

Most spiders were captured during summer months; similar results have been reported by Turnbull (1960), Berry (1971), and Uetz (1975).

The greater spider abundance and species richness found in pond pine, compared to scrub and flatwoods communities, may be correlated with its dense litter and generally moist ground surface. Litter and soil moisture have been shown to be correlated with spider species richness, abundance, and diversity by Uetz (1975, 1977, 1979), Bultman and Uetz (1982), Cady (1984), and Lowrie (1948, 1968). In contrast, flatwoods periodically had standing water after hard rains, but lacked a dense leaf litter to retain moisture; sand pine scrub was dry throughout the study.

Analysis of guild composition shows differences between communities (Fig. 2). Guilds were patterned after Bultman et al. (1982). Several families not represented

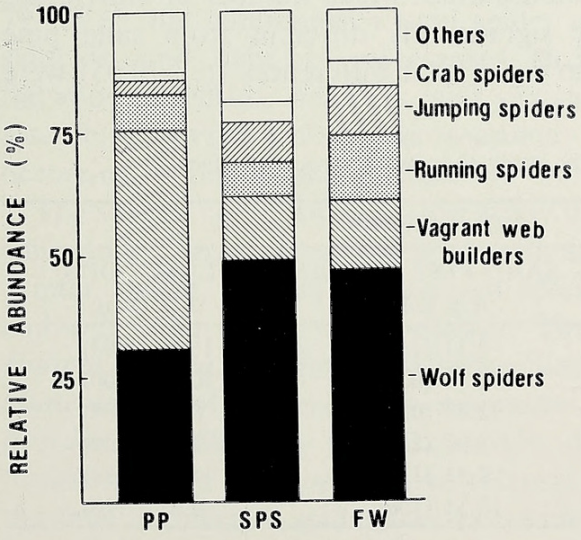

Fig. 2.—Guild composition of spider communities from the three study sites. PP = pond pine, SPS = sand pine scrub, and FW = flatwoods.

Table 1.—Mean number of individuals occurring in the study sites on the ground surface.

Collection Month	COMMUNITY		
	POND PINE $\bar{x} \pm$ (SE)	SAND PINE SCRUB $\bar{x} \pm$ (SE)	FLATWOODS $\bar{x} \pm$ (SE)
May	104.67 (9.22)	40.67 (3.85)	31.00 (6.66)
July	102.00 (16.52)	75.67 (5.21)	40.67 (14.42)
September	81.33 (3.18)	67.67 (0.34)	17.33 (4.67)
November	22.00 (2.09)	35.00 (7.10)	14.00 (1.53)
January	17.33 (3.94)	40.33 (4.67)	8.67 (1.86)
March	34.00 (6.66)	24.33 (5.05)	15.67 (0.33)

in the Bultman et al. study were placed in a guild based on Gertsch (1979). Guilds are (1) wolf spiders, Lycosidae; (2) vagrant web builders, Agelenidae and Hahniidae; (3) running spiders, Ctenidae, Gnaphosidae, and Clubionidae; (4) jumping spiders, Salticidae; (5) crab spiders, Thomisidae and Sparassidae; and (6) others; remainder of the spider families. Relative abundance of wolf spiders declined in pond pine from sand pine scrub and flatwoods. This may be due to the large amount of leaf litter in pond pine. Similar results were reported by Bultman et al. (1982) and Lowrie (1948). Vagrant web builders increased substantively in pond pine. These spiders live within the litter and have been found to increase in abundance with greater amount of litter (Bultman et al. 1982; Uetz 1979). The changes in the vagrant web builders are due to a single species, *Hahnia cinerea* Emerton. Bultman et al. also found a single species, *Neoantistea magna* (Keys.), to be responsible for an increase in vagrant web builders in a beech-maple community.

Sorensen's Index of Similarity (Krebs 1978) was used to determine the similarities of spider species composition among communities. Species composition was more similar between pond pine and flatwoods (0.65), followed by sand pine scrub and flatwoods (0.56). Pond pine and sand pine scrub (0.51) were least similar.

Table 1 shows the mean number of individuals occurring in the three communities. For each monthly mean 95% confidence intervals were calculated as $\bar{x} \pm t_2$ (SE) (Simpson et al. 1960). Pond pine in May was significantly different from the other communities in mean number of individuals; in September flatwoods was different from the other communities. Mean number of individuals captured in flatwoods in January were significantly different from sand pine scrub, but not pond pine. In contrast, no significant differences ($p > 0.05$) were

Table 2.—Mean number of species occurring in the study sites on the ground surface.

Collection Month	COMMUNITY		
	POND PINE $\bar{x} \pm$ (SE)	SAND PINE SCRUB $\bar{x} \pm$ (SE)	FLATWOODS $\bar{x} \pm$ (SE)
May	15.00 (1.16)	9.33 (1.34)	15.67 (2.03)
July	13.67 (0.88)	14.33 (0.66)	10.00 (1.00)
September	10.67 (1.20)	12.67 (0.34)	8.00 (2.09)
November	8.00 (0.00)	8.00 (2.00)	7.00 (2.00)
January	4.33 (0.66)	7.33 (1.34)	4.33 (0.88)
March	10.33 (0.34)	10.33 (1.46)	9.67 (1.20)

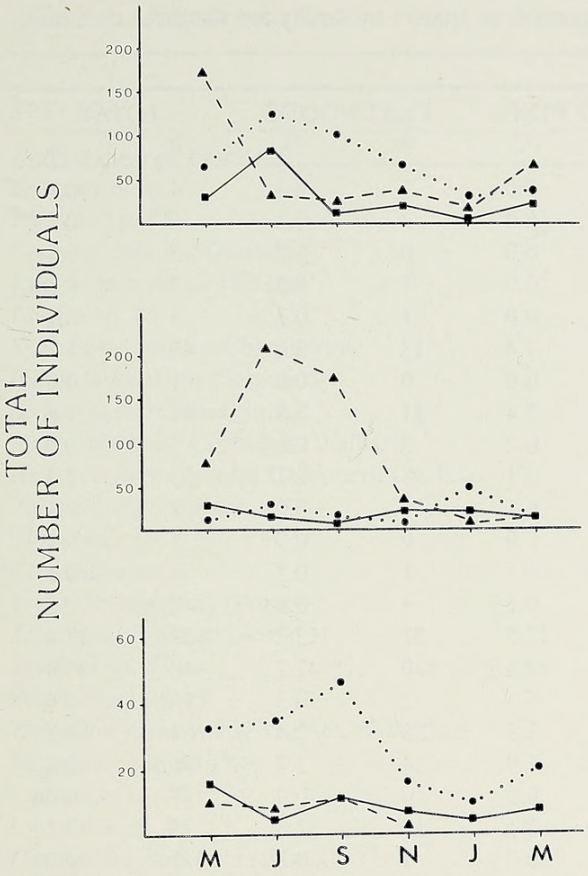

Fig. 3.—Seasonal distribution of the most common families of ground surface spiders caught in pitfall traps in pond pine (▲), sand pine scrub (●), and flatwoods (■). Lycosidae (upper), Hahniidae (middle), and Salticidae (lower).

found between the mean number of species occurring in the three communities during the collecting months (Table 2). This result may be due to the large variance in number of species found among the communities.

Species diversity, based on Simpson's Index of Diversity (Simpson 1949), was low for all communities. Pond pine had a value of 0.71, sand pine scrub of 0.90, and flatwoods of 0.94. This might be due to the high species richness and small number of dominant species found.

Spider families, represented by individuals collected on the ground surface, are listed in Table 3. Over all communities, the three most common families were lycosids, hahniids, salticids; collectively, they represent 72.5% of all spiders captured in pitfall traps. In pond pine, hahniids, lycosids, and ctenids represented 79.5% of that community's total spider assemblage. In sand pine scrub, lycosids, salticids, and hahniids represented 80.3% of the total spider assemblage. In flatwoods, lycosids, hahniids, and salticids represented 70.6% of the total spider assemblage. Figure 3 shows seasonal abundance of three common families occurring on the ground surface.

The species composition in our study differed from that found by Muma (1973) who studied ground surface spiders in sand pine dune and pine flatwoods near Winter Haven, Florida. Only seven species were common to his sand pine dune and our sand pine scrub habitats. These were *Pholcomma hirsuta* Emerton, *Hahnia cinerea, Trochosa parthenus* Simon, *Sosippus floridanus* Simon, *Cesonia bilineata* (Hentz), *Drassyllus seminolus* (Chamb. & Gertsch), and *Castianeira floridana* (Banks). In pine flatwoods, only *Neoantista agilis* (Keys.), *Sosippus floridanus*, and *Oxyopes salticus* (Hentz) were found in both studies. Reasons for the small number of spider species common to both studies are unknown.

Table 3.—Number of individuals collected and percent of spiders by family for the three communities.

	POND PINE		SAND PINE		FLATWOODS		TOTAL	
FAMILY	#	%	#	%	#	%	#	%
Oecobiidae	3	0.3	0	0.0	1	0.3	4	0.2
Uloboridae	3	0.3	0	0.0	3	0.8	6	0.3
Dictynidae	2	0.2	0	0.0	0	0.0	2	0.1
Oonopidae	6	0.6	0	0.0	1	0.3	7	0.3
Pholcidae	2	0.2	0	0.0	1	0.3	3	0.1
Theridiidae	18	1.6	12	1.4	13	3.4	43	1.8
Mymenidae	1	0.1	0	0.0	0	0.0	1	0.04
Linyphiidae	21	1.9	29	3.4	11	2.8	61	2.6
Linyphiinae	2	0.2	2	0.2	3	0.8	7	0.3
Erigoninae	19	1.7	26	3.1	8	2.1	53	2.3
Araneidae	1	0.1	1	0.1	0	0.0	2	0.1
Theridiosomatidae	5	0.5	0	0.0	0	0.0	5	0.1
Tetragnathidae	1	0.1	1	0.1	1	0.3	3	0.1
Agelenidae	2	0.2	4	0.5	1	0.3	7	0.3
Hahniidae	481	44.0	106	12.5	52	13.7	639	27.4
Lycosidae	344	31.4	424	49.8	180	47.2	948	40.8
Oxyopidae	7	0.6	4	0.5	2	0.5	13	0.6
Gnaphosidae	12	1.1	24	2.8	28	7.4	64	2.8
Clubionidae	26	2.4	16	1.9	14	3.7	56	2.4
Zoridae	1	0.1	0	0.0	0	0.0	1	0.04
Ctenidae	45	4.1	18	2.1	10	2.6	73	3.1
Sparassidae	0	0.0	0	0.0	1	0.3	1	0.04
Thomisidae	16	1.5	34	4.0	18	4.7	68	2.9
Salticidae	27	2.5	153	18.0	35	9.7	215	9.3
Undetermined	70	6.4	25	2.9	9	2.4	104	4.5

Our study and that of Muma's (1973) show important differences in species compositions of spiders between communities. In our sand pine sites, lycosids, salticids, and hahniids comprised 80.3% of the spider population. In contrast, lycosids (53%), gnaphosids (19%), and salticids (18%) totaled 90% of the spider population in the sand pine dune studied by Muma (1973). In our flatwoods community lycosids, hahniids, and salticids comprised 70.6% of the total spider population, whereas 90% of the total population in Muma's pine flatwoods consisted of lycosids (64%), salticids (21%), and linyphiids (5%). Differences in the two studies may be due to temporal changes in Florida habitats.

Table 4 shows the 15 commonest species collected by frequency of occurrence. The three most common species for all communities were *Hahnia cineria, Habrocestum bufoides* Chamberlin & Ivie, and *Pardosa* sp. #1.

Nineteen species occurred in all communities (Table 5). *Hahnia cinerea* was common in all communities and *Sosippus floridanus* and *H. bufoides* were common in sand pine scrub and flatwoods.

Changes in the seasonal cycle were due to variation in the population of each individual species and also to the appearance and disappearance of species at different times of the year. The largest number of adult spiders in all three communities occurred during the summer. Three species had two different months with large population peaks; *Centus captiosus* Gertsch in July and January, *Oxyptila modesta* (Scheffer) in November and March, and *Zelotes pullus* Bryant in September and March. *Hahnia cinerea* was present in large

Table 4.—Fifteen spider species ranked by frequency of occurrence within each plant community.

SPECIES	POND PINE	SAND PINE SCRUB	FLATWOODS
Hahnia cinerea Emerton	1	2	1
Schizocosa sp.	2	—	—
Pardosa sp. #2	3	14	9
Ctenus captiosus Gertsch	4	9	8
Lycosa punctulata (Hentz)	5	—	10
Lycosa sp. #1	6	5	10
Schizocosa duplex Chamberlin	7	6	—
Ozyptila modesta (Scheffer)	8	7	5
Sosippus floridanus Simon	9	4	2
Pirata alachuus Gertsch & Wallace	10	—	—
Habrocestum bufoides Chamberlin & Ivie	11	1	3
Zelotes pullus Bryant	11	11	6
Thymoites sp.	11	—	12
Corythalia sp.	11	—	—
Trachelas deceptus (Banks)	15	—	—
Trochosa partenus Simon	—	8	7
Pardosa sp. #1	—	3	—
Erigioninae sp. #3	—	10	—
Theridion alabamense Gertsch & Wallace	—	13	—
Neoantistea agilis (Key.)	—	—	4
Lycosidae sp. #2	—	11	—
Lycosidae sp. #3	—	14	—
Castianeira floridana (Banks)	—	14	—
Drassyllus sp.	—	—	12
Lycosidae sp. #1	—	—	12
Litophyllus temporarius Chamberlin	—	—	15

Table 5.—Spiders found in all three plant communities and their relative abundance (R = rare, less than 1% of the total population for that community; P = present, 1-4.9%; and C = common, 5% or more).

SPECIES	POND PINE	SAND PINE SCRUB	FLATWOODS
Pholcomma hirsutum Emerton	R	R	R
Theridion alabamense Gertsch & Wallace	R	R	P
Thymoites sp.	R	R	R
Erigoninae sp. #3	R	P	R
Hahnia cinerea Emerton	C	C	C
Schizocosa duplex Chamberlin	R	P	P
Schizocosa sp.	C	R	R
Sosippus floridanus Simon	P	C	C
Pardosa sp. #1	R	C	P
Pardosa sp. #2	C	R	P
Lycosa sp. #1	P	P	P
Zelotes pullus Bryant	R	P	P
Litopyllus temporarius Chamberlin	R	R	P
Castianeira floridana (Banks)	R	R	R
C. longipalpus (Hentz)	R	R	R
Ctenus captiosus Gertsch	P	P	P
Oxyptila modesta (Scheffer)	P	P	P
Habrocestum bufoides Chamberlin & Ivie	R	C	C
Metacyrba sp.	R	R	R

numbers from July through September in pond pine and flatwoods, but in January in sand pine scrub. *Ctenus captiosus* appeared in large numbers in summer in pond pine and sand pine scrub, but in the fall in flatwoods.

Berry (1971) found that adults and juveniles of some species appeared in large numbers after a period of time when no or very few adults or juveniles were found. *Sosippus floridanus, Trochosa parthenus, Zelotes pullus*, and *Habrocestum bufoides* exhibited this behavior in our study. These species were found in small numbers in November through March and in large numbers beginning in May. These species may overwinter as juveniles or eggs.

A new species of *Drassyllus* was found in flatwoods (Platnick, pres. comm.). Four males and one female were caught in May at sites G (three individuals) and I (two individuals). One female *Zora pumila* (Hentz) was found in May at site B of the pond pine community; the previous southernmost limit of its range was Alabama (Kaston 1978).

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