

# DIVERSITY OF WANDERING SPIDERS (ARANEAE) COLLECTED BY PITFALL TRAPS IN NORTHERN ILLINOIS PRAIRIES AND WOODLANDS

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**Abstract.** Spiders were collected by pitfall traps in various natural communities in northern Illinois: a young prairie restoration, a relatively high-quality prairie, a high-quality savanna, a degraded savanna woodland, and a degraded woodland forest. Diversity of the wandering or cursorial spiders was highest for the older, less-disturbed communities—the quality prairie and savanna and the woodland forest. The two woodland sites showed strong community similarity, as did the two prairies. The savanna showed weak similarity to all of the other four sites. Clubionidae were important in woodland areas; Lycosidae were dominant in the prairies and savanna.

## INTRODUCTION

Invertebrates, including spiders, play critical, though poorly understood, roles in natural communities. Spiders are a dominant group of predators in terrestrial habitats, achieving high populations in most communities. Distinct spider faunas are characteristic of specific plant associations (Muma 1973). Although some are specialists, spiders are often generalist feeders. In this role, their diversity influences community structure, and, probably, increased spider diversity leads to increased diversity of other taxa. In spite of this, spiders in prairies and savannas have been very little studied (Wolff 1990).

Pitfall trapping is an efficient method of sampling the active invertebrates, primarily arthropods, on the soil surface (Uetz and Unzicker 1976). This study examined the diversity of wandering or cursorial spiders in several communities representative of natural areas in northern Illinois. Specific goals were to determine the spider fauna present in these natural areas, to determine the diversity of these communities, and to examine the community similarity along a prairie-savanna-woodland gradient.

## METHODS

This study was conducted by pitfall trapping with 10 simple cup traps for each transect. A 1:1 mixture of ethylene glycol and water was used as an entrapping and killing fluid. Different time periods were used before emptying traps, but each transect was trapped through the summer months. Some traps were disturbed by animals, probably raccoons or skunks. Data from the traps were lumped, and overall numbers from each transect were sufficient for analysis.

The five study areas constitute a prairie-savanna-woodland gradient, including two prairies, a savanna, a savanna woodland and a woodland forest. The Morton Arboretum Prairie is slightly more than 2 acres of restored mesic tallgrass prairie with a high diversity of planted grasses and forbs. The Morton Arboretum Meadow, an area adjacent to the prairie restoration and containing some relatively undisturbed portions, was last plowed in 1961. It is a high-quality native prairie dominated by Indian grass and big bluestem, but it is low in forb diversity. It has been burned annually during the previous ten years.

Middlefork Savanna is a 10-ha tract of relatively high-quality, somewhat disturbed savanna. Large burr and white oaks provide an open canopy with a diverse grass and herbaceous ground flora characteristic of savannas. Reed-Turner Woodland Preserve is a

15-ha woodland that was historically a more open savanna. It is now a closed-canopy, dry-mesic to mesic woodland with burr, white, black, and red oaks, as well as hickory trees, but with an apparent loss of plant diversity. Morton Arboretum Woods is an extensive woodland that has grown into a closed-canopy forest. Dominated by maple and various oak trees, the forest is typical of many in the area, altered by grazing and fire suppression.

Diversity indices and community similarity analyses were conducted by standard methods as described in Magurran (1988) and Brower et al. (1990)

## RESULTS AND DISCUSSION

Distinct patterns are seen in the analysis of diversity in the five habitats. Table 1 lists the spider species identified and their numbers. In Table 2, the diversity indices are calculated. Morton Arboretum Meadow prairie had the highest species diversity or richness, with 21 species of wandering spiders. Middlefork Savanna and Morton Arboretum Woods each had relatively high species diversity, with 17 species each. The Morton Arboretum Prairie restoration has the lower diversity of 14, possibly because of its small size and youth. Reed-Turner Woodland, probably suffered the greatest community structure change, from savanna to closed woodland, and had the least diversity, only 11 species.

Sac spiders of the family Clubionidae showed a greater dominance in the two woodland areas; wolf spiders of the family Lycosidae were dominant in the prairie areas and in the savanna. Crab spiders of the family Thomisidae were relatively common, with one species of *Xysticus* abundant in the prairies and a different species common in the woodlands.

Diversity indices sensitive to richness (Table 2), such as Margalef, showed a clear pattern with Morton Arboretum Meadow being the most diverse followed by Middlefork Savanna and Morton Arboretum Woods. The Menhinick index (Table 2), which is affected by the number of specimens, had Middlefork Savanna highest, followed by Reed-Turner, Morton Arboretum woods, then the Meadow, with the restored prairie scoring rather low.

The evenness index of Pielou and the heterogeneity index of Simpson (Table 2) both showed the Morton and Reed-Turner woods to be most diverse, with the Meadow and Savanna following. Shannon, considered by Bultman et al. (1982) to be the best index for pitfall studies, showed the Morton Arboretum Woods to be the most diverse, followed by the Meadow, Reed-Turner, and the Middlefork Savanna close together, and the restored prairie with low diversity. Overall, the communities that were less disturbed, older, or with fairly large tracts had higher diversity as indicated by these indices. Demonstrating the importance of diversity measures for distinguishing native communities is difficult because of the different components used in evaluating data. Although the indices basically agreed with perceptions of the communities, more extensive sampling should allow for precise evaluation of communities using spider diversity.

Community similarity indices, such as the Jaccard Coefficient (Table 3) and Percent Similarity (Table 4), demonstrate that the

**Table 1. Number and species of spiders trapped in each of the five study areas.**

Species	Number trapped					Species	Number trapped				
	RTW	MFS	MAM	MAP	MAW		RTW	MFS	MAM	MAP	MAW
Anyphaenidae						<i>Arctosa rubicunda</i>			2	3	
<i>Anyphaena pectorosa</i>					5	<i>Hogna helluo</i>			2		
Clubionidae						<i>Pardosa milvina</i>		4			
<i>Agroeca ornata</i>	7					<i>Pardosa moesta</i>		10			
<i>Agroeca pratensis</i>	1					<i>Pardosa saxatilis</i>		10	126	204	
<i>Castianeira cingulata</i>	2				23	<i>Pirata insularis</i>		3			
<i>Castianeira descripta</i>			1			<i>Pirata minutus</i>	1	63	3		1
<i>Castianeira longipalpa</i>					1	<i>Pirata sedentarius</i>		1			
<i>Castianeira trilineata</i>		1			1	<i>Schizocosa avida</i>			6	3	
<i>Castianeira variata</i>			1	2		<i>Schizocosa bilineata</i>			17	9	1
<i>Clubiona kastoni</i>	1				2	<i>Schizocosa crassipalpita</i>		1			
<i>Phrurotimpus alarius</i>	8				37	<i>Schizocosa ocreata</i>	6	8			32
<i>Phrurotimpus dulcineus</i>			3			<i>Schizocosa retrorsa</i>			23	1	
<i>Scotinella fratella</i>					1	<i>Trabeops aurantiaca</i>	5	1			
<i>Scotinella madisonia</i>			6			<i>Trochosa pratensis</i>					1
Gnaphosidae						<i>Trochosa terricola</i>		4			
<i>Drassyllus depressus</i>			8	6		Philodromidae					
<i>Drassyllus sp.</i>			1			<i>Thanatus rubicellus</i>			4	1	
<i>Gnaphosa parvula</i>		1				Thomisidae					
<i>Haplodrassus signifer</i>				1		<i>Ozyptila conspurcata</i>				1	
<i>Herpyllus ecclesiasticus</i>	1				2	<i>Ozyptila georgiana</i>			2		
<i>Micaria pulicaria</i>		1				<i>Ozyptila sincera canadensis</i>					7
<i>Sergiolus decoratus</i>			2	1		<i>Xysticus ferox</i>					5
Hahniidae						<i>Xysticus fraternus</i>	29				27
<i>Neoantistea agilis</i>			1	2		<i>Xysticus triguttatus</i>			32	34	
<i>Neoantistea sp.</i>		1				Salticidae					
Pisauridae						<i>Evarcha hoyi</i>		1			
<i>Dolomedes sp.</i>					2	<i>Habrocestum pulex</i>	2		2		5
Lycosidae						<i>Phidippus pius</i>		1	1	1	
<i>Allocosa funerea</i>		4				<i>Sitticus cursor</i>			4		

RTW = Reed-Turner Woodland; MFS = Middlefork Savanna; MAM = Morton Arboretum Meadow; MAP = Morton Arboretum Prairie restoration; MAW = Morton Arboretum Woods.

**Table 2. Diversity indices for communities listed in Table 1.**

Index	Community				
	RTW	MFS	MAM	MAP	MAW
Individual Richness (n)	63	115	247	269	153
Richness					
Species (s)	11	17	21	14	17
Margalef	2.41	3.37	3.63	2.32	3.18
Menhinick	1.39	1.59	1.34	.85	1.37
Heterogeneity					
Simpson	.75	.68	.71	.41	.84
Shannon (H')	1.77	1.76	1.85	.97	2.11
Evenness					
Pielou	.74	.62	.61	.37	.74

**Table 3. A community similarity index, the Jaccard Coefficient of Community, comparing the communities in Table 1.**

	RTW	MFS	MAM	MAP
MFS	.120			
MAM	.067	.086		
MAP	.000	.069	.522	
MAW	.400	.097	.086	.033

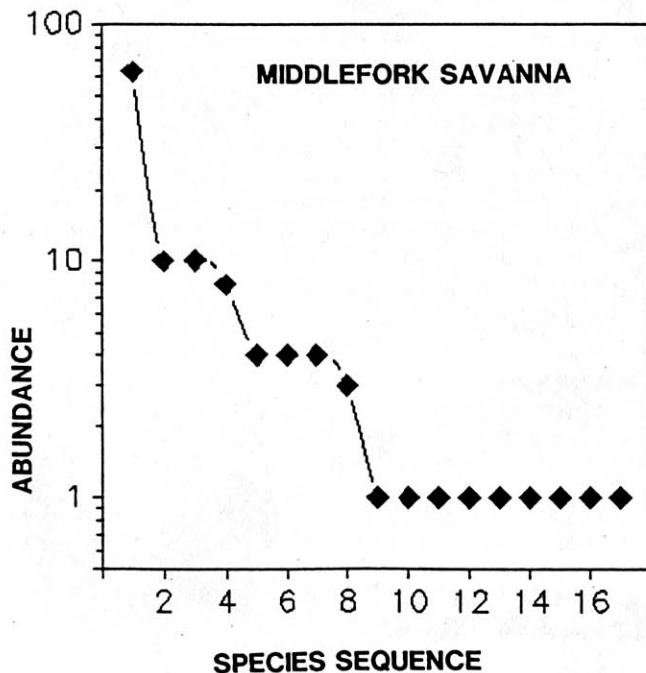
**Table 4. A community similarity index, Percent Similarity, comparing the communities in Table 1.**

	RTW	MFS	MAM	MAP
MFS	9.4			
MAM	2.0	10.3		
MAP	0.0	9.1	73.4	
MAW	49.5	8.3	2.1	.65

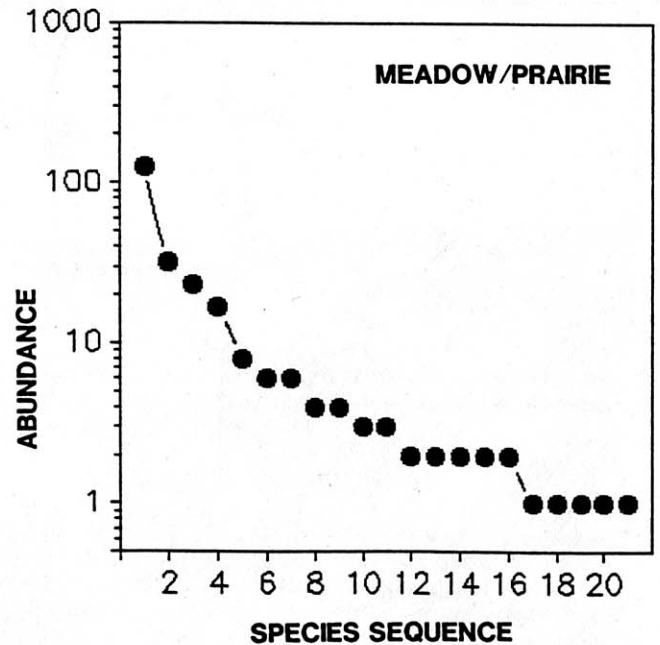
Morton Arboretum Meadow prairie and Prairie are rather similar, as are the Reed-Turner and Morton Woods. All other similarity figures were low, although Middlefork Savanna did show some weak similarity to each of the other communities. This suggests the possibility that the savanna is a community distinct from prairie or woodland, based on soil surface and cursorial spiders.

Dominance-diversity curves, which are also known as relative abundance curves or rank abundance plots (Magurran 1988), are presented for Middlefork Savanna (Figure 1) and for the Morton Arboretum Meadow (Figure 2). These curves demonstrate that the communities are approaching a log normal distribution, which is characteristic of natural communities.

The diversity and similarity analyses indicate that the spiders from prairie, savanna, and woodland are faunally separate communities, are rather diverse if the community is relatively undisturbed,



**Figure 1. A dominance-diversity curve for Middlefork Savanna.**



**Figure 2. A dominance-diversity curve for the Morton Arboretum Meadow prairie.**

and have characteristics of natural communities. More extensive studies need to be done to confirm and expand the findings reported here.

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