

A checklist of spiders from Sovenga Hill, an inselberg in the Savanna Biome, Limpopo Province, South Africa (Arachnida: Araneae)

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The South African National Survey of Arachnida (SANSA) was initiated to make an inventory of the arachnid fauna of South Africa. Various projects are underway to prepare inventories of the spider fauna of the different floral biomes and provinces of South Africa. During April and May 2004 five different collecting methods were used to sample spiders from four slopes on Sovenga Hill, an inselberg situated in the Savanna Biome, near Polokwane, in the Limpopo Province of South Africa. A total of 793 specimens represented by 29 families, 62 genera and 76 species were recorded over the two-month period. The Thomisidae was the most abundant ($n = 167$) representing 21.1 % of all spiders sampled, followed by the Gnaphosidae ($n = 101$) with 12.7 % and the Lycosidae ($n = 77$) with 9.7 %. The most abundant species was a thomisid *Tmarus comellini* Garcia-Neto ($n = 82$), representing 10.3 % of the total, followed by a clubionid *Clubiona godfreyi* Lessert ($n = 66$) with 8.3 %. The Thomisidae was the most species-rich family with 12 species, followed by the Gnaphosidae with 11 species and the Araneidae with 10 species. Of the species collected 83.9 % were wandering spiders and 16.1 % web builders. This is the first quantitative survey of the Savanna Biome in the Polokwane area.

Keywords: Araneae, checklist, diversity, Limpopo Province, Savanna Biome, South Africa, spiders.

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Introduction

Although spiders constitute an abundant and successful group of invertebrates in South Africa they are poorly sampled and little is known about their diversity within most eco-regions (Dippenaar-Schoeman 2002a). This lack of knowledge undermines meaningful conservation (De Wet & Schoonbee 1991). Additionally, the critical lack of professional taxonomic expertise within the country presents significant problems for the understanding of invertebrate biodiversity, which leads to an under-appreciation and estimation of the actual species pool (Gibbons 1999; Dippenaar-Schoeman 2002a). In South Africa, more than 2000 spider species have been recorded but only about 30 % of the

families have been revised (Dippenaar-Schoeman 2002a).

The South African National Survey of Arachnida (SANSA) was initiated in 1997 to address this lack of baseline information by conducting surveys and biodiversity assessments of the arachnid fauna of South Africa (Dippenaar-Schoeman & Craemer 2000). One such a project of SANSA is to determine spider diversity in the Savanna Biome of South Africa, with the primary aim to gather information on areas still poorly sampled (Dippenaar-Schoeman & Leroy 2003; Van den Berg *et al.* 2003).

Research on the spider fauna of the Savanna Biome in South Africa is presently restricted to surveys of the Roodeplaat Dam Nature Reserve (Dippenaar-Schoeman *et al.* 1989);

Makalali Game Reserve (Whitmore *et al.* 2001; Whitmore *et al.* 2002), the spiders of the Western Soutpansberg mountains (Foord *et al.* 2002), a survey of the spiders of the Kruger National Park (Dippenaar-Schoeman & Leroy 2003) and the spiders of the Springbok Flats (Van den Berg *et al.* 2003).

There are numerous collecting methods used for sampling arachnids (Eardley & Dippenaar-Schoeman 1996), but there are biases associated with some methods frequently resulting in under-sampling of sites when only one method is used or one habitat is sampled (New 1999). Scientists have for years recognised that standard methods are essential to be able to compare biodiversity assessments (Coddington *et al.* 1996). Spiders are able to occupy nearly every terrestrial habitat (Dippenaar-Schoeman & Jocqué 1997). It is therefore essential to sample the fauna separately at different layers during biodiversity surveys. Areas showing low diversity may simply be a reflection of inadequate sampling (Whitmore *et al.* 2002), therefore sampling protocols are very important. Unfortunately, many of the surveys undertaken in South Africa have used restricted sampling techniques, sampling only one habitat type.

In this study, a survey was undertaken to determine the spider diversity of Sovenga Hill, an inselberg, situated near Polokwane, Limpopo Province. During a two-month period this inselberg was extensively surveyed using five collecting methods. Twenty-four sites were sampled and samples were taken from both the ground, litter, grass and tree layers. The collecting methods were evaluated for surveys to be continued in the Polokwane area. This is the first of a series of papers on spider diversity of the Savanna Biome in the Polokwane area.

Material and methods

Sovenga Hill (23°53'S, 29°44'E), an inselberg, was sampled over a two-month period from 1 April to 31 May 2004. This unique landform consists of dome-shaped granite rocks and is situated on the campus of the University of Limpopo near Polokwane in the

Limpopo Province of South Africa. It covers an area of approximately 6.3 ha and is surrounded by indigenous flora consisting mostly of *Euphorbia cooperi* N.E.Br. ex A. Berger var. *cooperi*, *Heteropyxis natalensis* Harv. and *Croton gratissimus* Burch. var. *gratissimus*. This is a closed woodland plant community classified as Mamabolo Mountain Bushveld of which small, outlying, isolated communities are found on the Pietersburg Plateau (S.A. vegmap project, *in prep.* - P. Winter *pers. comm.*).

Six sampling sites of 4 m x 4 m were selected on each of the southern, eastern, northern and western slopes, resulting in a total of 24 sites sampled. The first two sites were at an altitude of between 1318 m–1335 m, the second two sites between 1333 m–1354 m and the third two sites between 1347 m–1374 m.

Sampling was conducted twice a week during April and May 2004. During April sampling was conducted on all the sites while no sampling was done on the sites of the northern slope during May due to vandalism of the sampling sites. The following methods were used during sampling:

Sweep netting (S) — a sweeping net was used to sweep through the grass and herb layer to dislodge specimens into the net. Walking in a straight line, 20 sweeps were taken to form one sample. The contents from the net were emptied into a marked plastic bag and spiders and other organisms were separated from the vegetation in the laboratory. A total of 101 sweepnet samples were taken. This method could only be used at sites where grass and herb layers were present.

Active searching (A) — active lifting of stones and searching for spiders was done at all sites for 10 minutes per sampling session (eight sessions during April and nine in May).

Tree beating (T) — a stick was used to knock spiders from trees while a tray was used to catch all the specimens and plant material knocked off. A total of 20 beats formed one sample. The contents from the tray were placed in a marked plastic bag and spiders and other organisms were separated from the vegetation in the laboratory. A total of 354 samples were collected during the sampling period using this method. Different types of trees present on a site were sampled.

Pitfall trapping (P) — small plastic containers (10.5 cm diameter) were planted into the ground, with the upper rim level with the ground surface. Wooden planks of about 30 cm long were placed in three directions towards the trap to increase its effective catch area. A funnel was placed over the opening of the trap to prevent

spiders from escaping and a small container with 70 % ethanol was placed inside to immobilise and preserve the captured specimens. There were 20 pitfall traps per slope, randomly distributed. The traps were kept open for the whole period and were emptied twice a week.

Leaf litter sifting (L) — a leaf litter sample was collected in a wooden box (53 cm x 20 cm x 18.5 cm) with a chicken wired base and specimens were sieved from the litter. One sample consisted of enough litter to fill the wooden box. Two samples of litter were collected from sites where leaf litter was found.

Captured specimens were preserved in 70 % ethanol and were sorted and counted in the laboratory. All spiders were identified to species level by the third author, where possible. Some specimens could not be identified to species owing to the unresolved taxonomy of certain families in Africa (for instance the Lycosidae) and the immature stages of some specimens collected. Voucher specimens were deposited in the National Collection of Arachnida (NCA) at the Plant Protection Research Institute in Pretoria, an institute of the Agricultural Research Council.

Results and discussion

During the two-month sampling period a total of 793 spiders, represented by 29 families, 62 genera and 76 species were collected (Table 1). The few published surveys of spiders from herbaceous and ground layers in Africa indicate that the relative abundance of species differs between different areas and different plant biomes (Dippenaar-Schoeman *et al.* 1989; Russell-Smith 1981). Three surveys of spiders are known from the Limpopo Province. A study at Makalali Private Game Reserve was conducted over 11 months and resulted in a total of 4832 spiders collected, representing 38 families (Whitmore *et al.* 2002). Another study, conducted over a two-year period on the Springbok Flats, resulted in a total of 3139 specimens caught, representing 35 families (Van den Berg *et al.* 2003). Sporadic collection over a five-year period at Lajuma in the western Soutpansberg resulted in 127 species belonging to 46 families (Foord *et al.* 2002). From the above it is clear that although the current study was only conducted for two months, on an iso-

Table 1
Spider families collected at Sovenga Hill indicating the number of species and percentage of the total number of specimens collected

Family	Genera	Species	Specimens	%
Agelenidae	1	1	6	0.8
Amaurobiidae	1	1	4	0.5
Araneidae	8	10	57	7.2
Corinnidae	3	3	42	5.3
Clubionidae	1	1	66	8.3
Caponiidae	1	1	9	1.1
Ctenidae	1	1	7	0.9
Deinopidae	1	1	2	0.3
Eresidae	1	1	8	1.0
Gnaphosidae	5	11	101	12.7
Hahniidae	1	1	6	0.8
Hersiliidae	1	1	3	0.4
Linyphiidae	1	1	7	0.9
Lycosidae	2	2	77	9.7
Miturgidae	1	1	7	0.9
Nemesiidae	1	1	11	1.4
Oxyopidae	1	1	18	2.3
Palpimanidae	1	1	4	0.5
Philodromidae	2	5	51	6.4
Pholcidae	1	1	2	0.3
Pisauridae	1	1	9	1.1
Salticidae	5	5	54	6.8
Scytodidae	1	1	16	2.0
Segestriidae	1	1	3	0.4
Selenopidae	1	1	12	1.5
Theridiidae	6	6	21	2.6
Thomisidae	9	12	167	21.1
Uloboridae	1	1	3	0.4
Zodariidae	2	2	20	2.5
TOTAL	62	76	793	100

lated hill, a good representation of families (29) were caught. However, because of the short duration of the present study, the results may not reflect the actual abundance and species richness of Sovenga Hill, but nevertheless provide an indication of the minimum abundance and richness.

The family composition of the spider fauna as a whole is shown in Tables 1 and 2. The Thomisidae was the most abundant family ($n = 167$) representing 21.1 % of all spiders sampled, followed by the Gnaphosidae ($n = 101$) representing 12.7 %, the Lycosidae ($n = 77$) representing 9.7 % and Clu-

Table 2

Checklist of the spiders of Sovenga Hill, Polokwane, South Africa. (A: active search; B: beating; L: litter sifting; P: pittrapping; S: sweepnetting; W: wanderer; WD: web dweller)

Family	Species	Nr	Method	Guild	Habitat
Agelenidae	<i>Agelena</i> sp. (immature)	6	A	WD	funnel-web
Amaurobiidae	<i>Chresiona</i> sp. (immature)	4	P;L	WD	retreat-web
Araneidae	<i>Argiope</i> sp. (immature)	1	B	WD	orb-web
	<i>Argiope australis</i> (Walckenaer, 1805)	3	B	WD	orb-web
	<i>Caerostris sexcupidata</i> (Fabricius, 1793)	5	B	WD	orb-web
	<i>Cyphalonotus larvatus</i> (Simon, 1881)	5	B;L	WD	orb-web
	<i>Cyrtophora citricola</i> (Forskål, 1775)	1	B	WD	orb-web
	<i>Nemoscolus</i> sp. (immature)	1	B	WD	orb-web
	<i>Neoscona blondeli</i> (Simon, 1885)	20	P;B;L	WD	orb-web
	<i>Neoscona subfusca</i> (C.L. Koch, 1837)	19	B;L;A	WD	orb-web
	<i>Prasonica</i> sp. (immature)	1	B	WD	orb-web
	<i>Singa</i> sp. (immature)	1	L	WD	orb-web
Caponiidae	<i>Caponia</i> sp. (immature)	9	P;A	W	soil
Clubionidae	<i>Clubiona godfreyi</i> Lessert, 1921	66	P;B;L	W	soil
Corinnidae	<i>Thysanina</i> sp.	12	P;L	W	soil
	<i>Cetonana</i> sp. (immature)	13	P;L	W	soil
	<i>Copa flavoplumosa</i> Simon, 1885	17	B;L	W	soil
Ctenidae	<i>Ctenus</i> sp. (immature)	7	L;B	W	soil
Deinopidae	<i>Menneus camelus</i> Pocock, 1902	2	B	WD	throw-web
Eresidae	<i>Gandanameno</i> sp. (immature)	8	P;B;L	WD	retreat-web
Gnaphosidae	<i>Asemesthes</i> sp. (immature)	2	L;B	W	soil
	<i>Camillina</i> sp. (immature)	6	L;P;B	W	soil
	Drassodinae (undetermined)	2	B	W	soil
	<i>Setaphis browni</i> (Tucker, 1923)	12	L;A;P	W	soil
	<i>Zelotes lightfooti</i> (Purcell, 1907)	21	L;P	W	soil
	<i>Zelotes oneili</i> (Purcell, 1907)	13	P;L	W	soil
	<i>Zelotes reduncus</i> (Purcell, 1907)	12	B;A;L;P	W	soil
	<i>Zelotes unguis</i> Tucker, 1923	17	L;P	W	soil
	<i>Zelotes</i> sp. A	3	P	W	soil
	<i>Zelotes</i> sp. B	3	B;P	W	soil
Hahniidae	<i>Hahnina tabulicola</i> Simon, 1898	6	L	WD	sheet-web
Hersiliidae	<i>Hersilia sericea</i> Pocock, 1898	3	B	W	tree trunk
Linyphiidae	sp. (undetermined)	7	P	WD	sheet-web
Lycosidae	sp. (undetermined)	69	P	W	soil
	<i>Pardosa</i> sp.	8	P	W	soil
Miturgidae	<i>Cheiracanthium</i> sp. (immature)	7	B	W	leaves
Nemesiidae	<i>Lepthercus</i> sp.	11	P;B	W	burrow soil
Oxyopidae	<i>Oxyopes schenkeli</i> Lessert, 1927	18	P;B	W	grass
Palpimanidae	<i>Palpimanus transvaalicus</i> Simon, 1893.	4	P	W	soil
Philodromidae	<i>Philodromus</i> sp. (immature)	10	B;A;S	W	grass
	<i>Philodromus brachycephalus</i> Lawrence, 1952	15	B;S	W	grass
	<i>Philodromus grosi</i> Lessert, 1943	1	B;S	W	grass
	<i>Philodromus partitus</i> Lessert, 1919	3	S	W	grass
	<i>Suemus punctatus</i> Lawrence, 1938	22	B	W	grass
Pholcidae	<i>Smeringopus</i> sp. (immature)	2	B	WD	space-web
Pisauridae	<i>Chiasmopes</i> sp. (immature)	9	S;A;B	WD	sheet-web
Salticidae	<i>Heliophanus</i> sp. (immature)	5	B	W	leaves
	<i>Natta</i> sp.	18	L	W	soil
	<i>Portia</i> sp.	4	L	W	litter
	<i>Thyene ogdeni</i> Peckham & Peckham, 1903	24	B	W	leaves

Table 2 (continued)

Scytodidae	<i>Scytodes</i> sp.	16	L;P	W	soil
Segestriidae	<i>Ariadna</i> sp. (immature)	3	P	WD	soil
Selenopidae	<i>Anyphops</i> sp.	12	B	W	tree
Theridiidae	<i>Chorizopella tragardhi</i> Lawrence, 1947	1	B	WD	gumfoot- web
	<i>Dipoena</i> sp.	4	B	WD	gumfoot- web
	<i>Enoplognatha</i> sp.	4	B	WD	gumfoot- web
	<i>Episinus bilineatus</i> Simon, 1894	1	B	WD	gumfoot- web
	<i>Euryopsis</i> sp.	1	B	WD	gumfoot- web
	<i>Theridion</i> sp.	10	B	WD	gumfoot- web
Thomisidae	<i>Heriaeus fimbriatus</i> Lawrence, 1942	10	S,P	W	grass
	<i>Misumenops rubrodecoratus</i> Millot, 1941	2	S	W	grass
	<i>Monaeses austrinus</i> Simon, 1910	3	B	W	tree
	<i>Oxytate argenteooculata</i> (Simon, 1886)	4	B	W	tree
	<i>Runcinia flavida</i> (Simon, 1881)	1	S	W	grass
	<i>Stiphropus bisigillatus</i> Lawrence, 1952	5	P	W	soil
	<i>Thomisus granulatus</i> Karsch, 1880	2	S	W	grass
	<i>Thomisus scrupeus</i> (Simon, 1886)	2	S	W	grass
	<i>Thomisus</i> sp. (immature)	2	S	W	grass
	<i>Tmarus africanus</i> Lessert, 1919	25	S,P	W	grass
	<i>Tmarus comellini</i> Garcia-Neto, 1989	82	S,P	W	grass
	<i>Xysticus lucifugus</i> Lawrence, 1937	29	B;P	W	soil
Uloboridae	<i>Miagrammopes brevicaudus</i> O.P.-Cambridge, 1882	3	B;P	WD	vegetation
Zodariidae	<i>Cydrela</i> sp. (immature)	3	P	W	soil
	<i>Diores</i> sp. (immature)	17	B;P	W	soil
TOTAL		793			

bionidae ($n = 66$) representing 8.3 %. The rest of the families were low in abundance and none exceeded 7 % of the total. These percentages differ from other studies done in the Savanna Biome, possibly because of the difference in vegetation types. During the study on the Makalali Game Reserve the two vegetation types sampled were mixed lowveld bush and mopane bushveld, and 32 % of the specimens caught belonged to the Araneidae, followed by the Salticidae (18 %) and Thomisidae (10 %) (Whitmore *et al.* 2002). The study of Roodeplaats Dam Nature Reserve was done in an open savanna and Tetragnathidae with 29.3 % was the most abundant family, followed by the

Araneidae with 22.7 % and Salticidae with 21.4 % (Dippenaar-Schoeman *et al.* 1989). On the Springbok Flats, an open savanna but more disturbed area, Lycosidae was the dominant family (30 %), followed by Gnaphosidae (21 %) (Van den Berg *et al.* 2003).

The Thomisidae was the most species-rich family with 12 species followed by the Gnaphosidae with 11 species and the Araneidae with 10 species. Twenty families were represented by a single species (Table 1). The three most abundant species was a thomisid *Tmarus comellini* Garcia-Neto ($n = 82$), representing 10.3 % of the total,

followed by the clubionid *Clubiona godfreyi* Lessert ($n = 66$), representing 8.3 % and an undetermined lycosid ($n = 69$), representing 8.7 %. Neither *T. comellini* nor *C. godfreyi* have before been collected in high numbers during surveys. *Tmarus comellini* is known from Zaire and South Africa and has previously been collected from the grass and tree layer. It has a fairly wide distribution throughout South Africa and is known from the Eastern Cape, KwaZulu-Natal, Gauteng and Limpopo Province. *Clubiona godfreyi* is a species first recorded in Uganda. The first record from South Africa is from Lajuma, Soutpansberg.

Species dominance also differs from area to area. A quantitative survey of the herbaceous layer of coastal dune forest at Richards Bay, South Africa showed the pisaurid *Charminus atomarius* (Lawrence) to be the most abundant species, representing 18 % of the total, followed by the salticid *Thyene ogdeni* (Peckham & Peckham) with 12 % and the araneid *Caerostris sexcuspidata* (Fabricius) with 11 % (Dippenaar-Schoeman & Wasseenaar *in prep.*).

Most spiders live in a defined environment with limitations set by both physical conditions and biological factors (Foelix 1982) and species can be grouped into guilds based on available information on their habitat preferences and predatory methods. A guild is a group of species that potentially compete for jointly exploited limited resources (Polis & McCormick 1986). For the present study two main guilds were recognised, namely wandering spiders (W) and web builders (WB), with further subdivisions based on microhabitat and web structure (Dippenaar-Schoeman *et al.* 2005). Twelve of the collected families (16.1 %) are web dwellers. Three families namely Araneidae, Deinopidae and Uloboridae, construct orb-webs or adapted orb-webs while the Amaurobiidae, Eresidae and Segestriidae build retreat-webs usually low in vegetation, the Hahniidae, Linyphiidae and Pisauridae construct sheet-webs, the Pholcidae space-webs, the Theridiidae gumfoot-webs and the Agelenidae funnel-webs.

Seventeen of the collected families (83.9 %) are wanderers. Of the wanderers 55.6 % (370) are soil dwellers while 44.4 % (295) were collected from plants. The lack of grass on parts of Sovenga Hill may have contributed to the lower number of plant dwellers collected. Only one mygalomorph species, a member of the Nemesiidae (wish-bone trapdoor spiders) was collected. This is the first record of a *Lepthercus* species from an area outside the Eastern Cape (Dippenaar-Schoeman 2002b). Studies indicated that the physical structure of the habitat could have a distinct effect on the composition of the spider community (Wise 1993). Vegetation not only provides the necessary support for anchoring webs but it also increases the availability of retreat space and modifies the microclimate, which could have an effect on the spiders as well as their prey. Therefore, the structure of the vegetation is expected to influence the diversity of spiders found in a habitat (Whitmore *et al.* 2002). From a survey conducted at Swartberg Nature Reserve in the Succulent Karoo Biome, 76.5 % of the spiders collected over a 10-year period were wanderers and 23.5 % were web dwellers. Of the wanderers 56.7 % were associated with the ground layer (Dippenaar-Schoeman *et al.* 2005).

Since the present study was conducted for only a short period of time (two months), numbers were too low to be able to make any meaningful comparisons amongst spiders collected from different slopes or different altitudes.

Conclusion

In South Africa there is a lack of baseline information on most invertebrate taxa. This causes a serious problem in conservation planning. With the ecology and diversity of the spider fauna of the Savanna Biome still poorly known, this study is a contribution to our knowledge of the geographical distribution of species. As such, it represents new distribution records for all the species recorded and specimens of some undescribed species are now available for sys-

tematic research. Since the present study was conducted over a relatively short period totaling only 17 sampling sessions over two months, the results may not reflect the actual abundance and species richness of Soven-ga Hill. However, it indicates the importance to sample more than one habitat type in order to obtain a clearer picture of species richness and abundance.

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