

A checklist of the non-acarine arachnids (Chelicerata: Arachnida) of the Ndumo Game Reserve, Maputaland, South Africa

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Haddad, C.R., A.S. Dippenaar-Schoeman and W. Wesółowska. 2006. A checklist of the non-acarine arachnids (Chelicerata: Arachnida) of the Ndumo Game Reserve, Maputaland, South Africa. *Koedoe* 49(2): 1–22. Pretoria. ISSN 0075-6458.

Arachnids (Chelicerata: Arachnida) were collected in the Ndumo Game Reserve (Maputaland, South Africa) during 11 collecting trips in the period 2000–2006. Sampling was undertaken by various methods in eight broad habitat types: *Acacia tortilis* savanna; *Acacia xanthophloea* (fever tree) forests; deciduous broadleaf woodland; *Ficus* (wild fig tree) forests; floodplain vegetation; riparian forest; sand forest; and subtropical bush. In total, 457 species of arachnids were collected, representing six orders, 59 families and 240 determined genera. The most diverse order was the Araneae (46 families, 431 spp.), followed by the Pseudoscorpiones (6 families, 12 spp.), Scorpiones (3 families, 8 spp.), Opiliones (2 families, 3 spp.), Solifugae (1 family, 2 spp.) and Amblypygi (a single species). The most diverse families all belonged to the Araneae: Salticidae (82 spp.), Thomisidae (56 spp.) and Araneidae (38 spp.). The spider diversity is the highest recorded from any protected area in South Africa so far, and represents approximately 22% of the country's spider fauna. The habitat and guild associations of each species are provided.

Key words: Arachnida, Araneae, conservation, diversity, habitats, Ndumo Game Reserve, South African National Survey of Arachnida (SANSA).

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Introduction

The Ndumo Game Reserve (NGR) is situated in the western parts of the Maputaland bioregion in northern KwaZulu-Natal, South Africa (Van Wyk & Smith 2001). Despite its relatively small size it is one of South Africa's most attractive reserves, forming a RAMSAR site protecting several wetland and riparian ecosystems (Ramsar 2001). At NGR, a combination of subtropical climate and rich habitat diversity provide conditions conducive for impressive species diversity. Although several vertebrate and plant taxa have been well studied (e.g. Pooley 1965; Dixon 1966; De Moor *et al.* 1977), the diversity of invertebrates is poorly known (Haddad 2003), and consequently, there is great

potential for invertebrate research in this part of southern Africa.

Relative to other parts of South Africa, few surveys have been conducted on the arachnid fauna of the KwaZulu-Natal Province, and many distribution records are limited to species descriptions (Lawrence 1937a, 1937b, 1938, 1942a, 1942b, 1952). Lawrence *et al.* (1980) studied the arachnid fauna of Maputaland, with the emphasis on the fauna of the eastern shore of Lake Sibaya. Van der Merwe *et al.* (1996) investigated spiders in indigenous forests and pine plantations at the Ngome State Forest, while Dippenaar-Schoeman & Wassenaar (2002, *in press*) studied the fauna of rehabilitated coastal dune forests near Richards Bay. Most recently, Honiball *et al.* (*in prep.*) examined diversity patterns

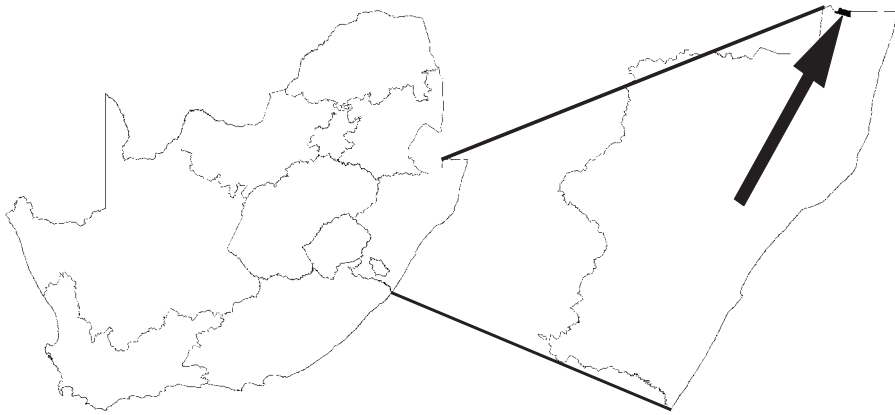


Fig. 1. Location of the Ndumo Game Reserve in northern KwaZulu-Natal, South Africa, as indicated by the arrow

of spiders in the Tembe Elephant Park and surrounding areas. Consequently, large gaps exist in the knowledge of spider diversity of Maputaland. The question raised is whether, for this group of invertebrates, Maputaland represents a centre of endemism, as is the case for other biological taxa such as plants (Matthews *et al.* 2001; Van Wyk & Smith 2001).

Although there are a limited number of published papers dealing specifically with spider diversity in the undisturbed conservation areas of South Africa, surveys have steadily increased during the last decade, largely due to the initiation of the South African National Survey of Arachnida (SANSA). This initiative aims, in part, to provide biodiversity information on arachnids in South Africa's conservancies, identify biodiversity hotspots, and aid conservation planning. As a consequence, several papers have now been published (Dippenaar-Schoeman 1988, 2006; Dippenaar-Schoeman & Gonzalez-Reyes 2006; Dippenaar-Schoeman & Leroy 2003; Dippenaar-Schoeman *et al.* 1989, 1999, 2005; Foord *et al.* 2002; Whitmore *et al.* 2001).

The relatively poor knowledge of the arachnids of Maputaland provided the impetus to set up a checklist for Ndumo Game Reserve. Although specimens of all of the arachnid

orders (excluding Acari) were collected, the primary focus of this study was on the spiders (Araneae), which was done with the aim of providing a baseline for future ecological research. This study forms part of the SANSA projects in conservancies and the Savanna Biome.

Study area

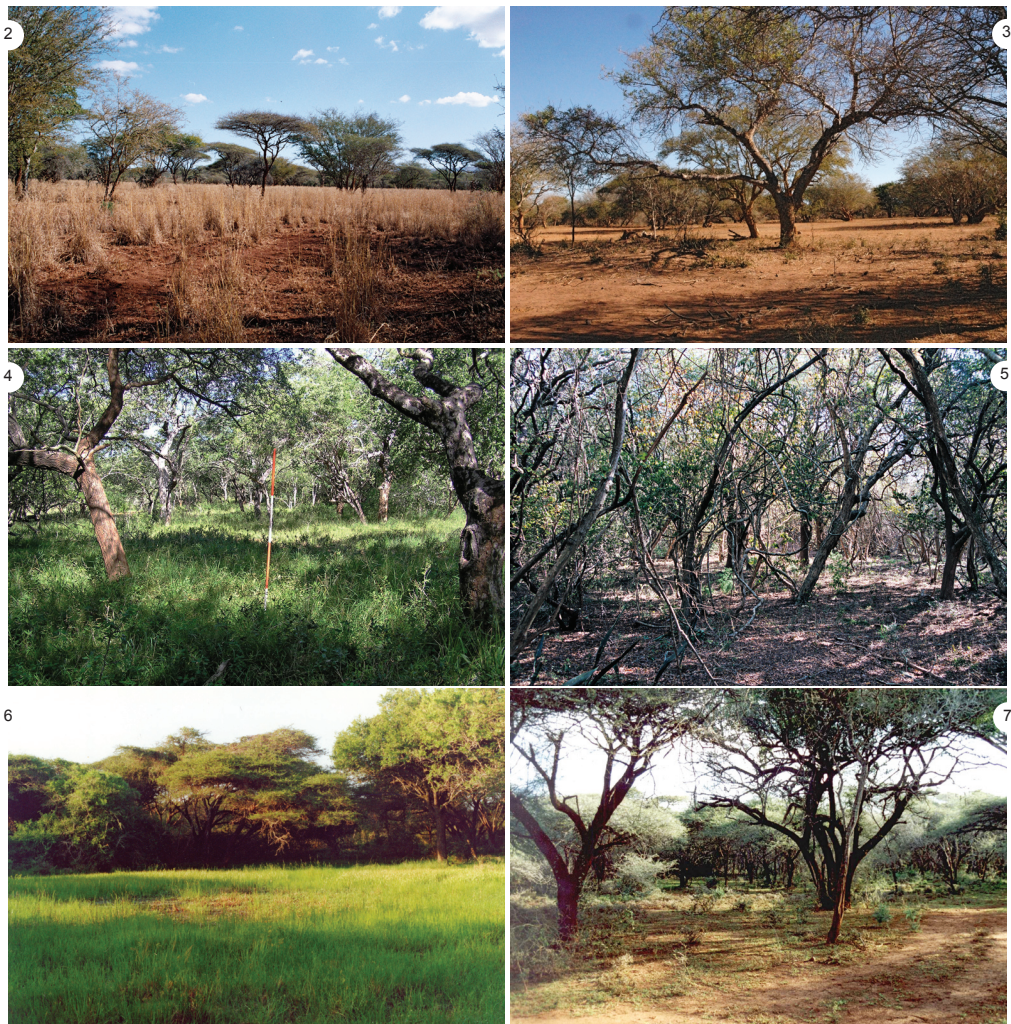
The Ndumo Game Reserve (NGR) is situated in Maputaland, a geographical bioregion covering the northern-most parts of the KwaZulu-Natal Province, South Africa, and the southern parts of Mozambique (Fig. 1). The game reserve borders on Mozambique to the north (Usutu [Usuthu] River), and lies close to South Africa's border with Swaziland to the west. The NGR covers an area of 10 117 ha, and falls within the Bushveld-Savanna ecozone of southern Africa (Grant & Thomas 1998).

A rich habitat variety can be found at NGR (De Moor *et al.* 1977), but for the purposes of this study they are grouped into eight broad habitat types, which are briefly described here. Classification of plants follows Germishuizen *et al.* (2006):

1. *Acacia tortilis* (Forssk.) Hayne (umbrella thorn) savanna (AS)—situated in the south-western parts of the reserve. This

habitat type is dominated by *A. tortilis*, *Albizia anthelmintica* (A.Rich.) Brongn. and *A. petersiana* (Bolle) Oliv. trees, and has a well-developed grass layer (Figs 2–3), including *Aristida adscensionis* L., *Chloris pycnothrix* Trin., *C. virgata* Sw., *Enteropogon macrostachyus* (Vahl) K.Schum., *Hyperthelia dissoluta* (Nees ex Steud.) Clayton, *Setaria* sp., *Sporobolus fimbriatus* (Trin.) Nees and *Themeda triandra* Forssk.

2. Deciduous broadleaf woodland (BW)—situated in the southern, higher lying parts of the reserve. This is a highly diversified savanna habitat, with extreme variations in plant composition and vegetative density (Fig. 4). Common trees include *Acacia burkei* Benth., *Albizia adianthifolia* (Schumach.) W.Wight, *A. petersiana*, *Combretum molle* R.Br. ex G.Don, *Dichrostachys cinerea* (L.) Wight & Arn., *Grewia occidentalis* L., *Sclerocarya birrea* (A.Rich.) Hochst., *Strychnos madagascariensis* Poir., *Terminalia sericea* Burch. ex DC., *Trichilia emetica* Vahl and *Ziziphus mucronata* Willd. Various short shrubs, including *Chionanthus peglerae* (C.H.Wright) Stearn, *Maytenus* sp., *Olinia* sp. and *Teclea natalensis* (Sond.) Engl., dominate the lower strata of the habitat. Common grasses include *Aristida adscensionis*, *Cymbopogon nardus* (L.) Rendle, *Cynodon dactylon*, *Dactyloctenium* spp., *Digitaria eriantha* Steud., various *Eragrostis* spp. (*E. lehmanniana* Nees, *E. rigidior* Pilg. and *E. superba* Peyr.), *Heteropogon contortus* (L.) Roem. & Schult., *Hyperthelia dissoluta* (Nees ex Steud.) Clayton, *Panicum maximum* Jacq., *P. repens* L. and *Setaria* species.
3. Sand forest (SF)—situated in the south east of the reserve. Sand forest is more typical of the Tembe Elephant Park (Matthews *et al.* 2001) and is a habitat unique to Maputaland. Only a small patch is found in Ndumo at the bottom of Ndumo hill along the southern boundary fence. Common trees and shrubs include *Artabotrys monteiroae* Oliv., *Carissa bispinosa* (L.) Desf. ex Brenan, *Commiphora neglecta* I.Verd., *Haplocoelum foliosum* (Hiern) Bullock, *Hymenocardia ulmoides* Oliv., *Phyllanthus* sp. and *Spirostachys africana* Sond. The ground is generally devoid of any grass, and short plants (*Asparagus africanus* Lam., *A. falcatus* L. and *Sansevieria hyacinthoides* (L.) Druce, amongst others) occur sporadically in the habitat (Fig. 5).
4. Subtropical bush (ST), which covers the largest area of the reserve, is a heterogeneous habitat composed largely of Mahemene thicket and *Acacia nigrescens* Oliv. woodland (De Moor *et al.* 1977). Although other habitat types can be included under subtropical bush, sampling was primarily carried out in these two habitats. Dominant trees include various *Acacia* spp. (including *A. burkei*, *A. karroo* Hayne and *A. nigrescens*), *Albizia* species (including *A. anthelmintica*, *A. petersiana* and *A. versicolor* Welw. ex Oliv.), *Apodytes dimidiata* E.Mey. ex Arn., *Balanites maughamii* Sprague, *Euclea* species (*E. crispa* (Thunb.) Gürke, *E. daphnoides* Hiern and *E. divinorum* Hiern), *Euphorbia ingens* E.Mey. ex Boiss., *Ptaeroxylon obliquum* (Thunb.) Radlk., *Trema orientalis* (L.) Blume and *Vepris lanceolata* (Lam.) G.Don. Shrubs and shorter plants include *Carissa bispinosa*, *Croton menyharthii* Pax, *Euphorbia grandicornis* Goebel ex N.E.Br., *Hypericum* sp., *Gardenia* spp., *Grewia bicolor* Juss., *Sansevieria hyacinthoides* and *Tarchonanthus camphoratus* L. The grass and herb layer is highly variable, in some areas consisting primarily of the creepers *Cissus rotundifolia* (Forssk.) Vahl and *Crassula* sp. (*Acacia nigrescens* woodland), while other areas, including Mahemane thicket, consist primarily of short grasses such as *Chloris* spp., *Dactyloctenium* spp., *Eragrostis* spp. and *Setaria verticillata* (L.) P.Beauv., with *Cissus rotundifolia* creepers found near the base of trees (Figs 6–7).
5. *Acacia xanthophloea* Benth. (fever tree) forests (AX)—situated around the margins of the freshwater pans Banzi, Hotwe, Nyamiti [Nyamithi] and Shokwe, in rela-



Figs. 2–7. Savanna and associated habitats in Ndumo Game Reserve: 2–3) *Acacia tortilis* savanna (AS) dominated by *Acacia tortilis* (2) and *Albizia* spp. (3) trees; 4) Deciduous broadleaf woodland (BW); 5) Sand forest (SF); 6–7) Subtropical bush (SB) consisting of Mahemane thicket (6) and *Acacia nigrescens* woodland (7).

tively localised areas. This habitat type is strongly dominated by *Acacia xanthophloea* trees, with shorter shrubs (e.g. *Carissa* and *Grewia* spp.). Weeds such as *Solanum* spp. occur sporadically (Figs 8–9). *Cynodon dactylon* (L.) Pers. is the dominant grass species, although the taller *Cyperus* sp. and *Leptochloa fusca* (L.) Kunth are also present in places. In some areas (e.g. some sites at Banzi Pan) grasses were entirely absent.

6. Floodplain (FP)—situated inland from riparian forests along the Pongola [Phongolo] and Usutu Rivers. This habitat is dominated by the reed species *Phragmites australis* (Cav.) Steud. and *P. mauritanicus* Kunth, and various shorter grasses and sedges, including *Cynodon dactylon*, *Cyperus fastigiatus* Rottb. and *Echinochloa pyramidalis* (Lam.) Hitchc. & Chase (Figs 10–11). Trees and shrubs occur sporadically along the floodplain,



Figs. 8–13. Floodplain and associated habitats in Ndumo Game Reserve: 8–9) Fever tree or *Acacia xanthophloea* forests at Shokwe pan (8) and Banzi pan (9). Note the differences in understory plant growth; 10–11) Floodplain vegetation (FP); 12) Wild fig or *Ficus* forest (FF) at Shokwe pan; 13) Riparian forest (RF) at the Pongola River.

and include *Acacia xanthophloea*, *Ficus sycomorus* L., *Grewia caffra* Meisn., *Gymnosporia senegalensis* (Lam.) Loes. and *Kigelia africana* (Lam.) Benth., and are often covered near their trunks by *Monanthonotaxis caffra* (Sond.) Verdc. creepers.

7. *Ficus* (wild fig tree) forests (FF)—situated around the margins of the freshwater pans Shokwe and Banzi, and along rivers. This habitat is dominated by wild

fig trees (particularly *F. sycomorus* and *F. sur* Forssk.), and is characterised by a near absence of shrubs and grasses, and presence of a very well developed leaf litter layer (Fig. 12). Other trees that occur sporadically in the habitat include *A. xanthophloea*, *Breonadia salicina* (Vahl) Hepper & J.R.I.Wood, *K. africana* and *Trichilia emetica*.

8. Riparian forest (RF)—situated along the banks of the Usutu and Pongola rivers

(Fig. 13). This habitat is dominated by tall trees including *B. salicina*, *F. sur*, *F. sycomotorus*, *Harpephyllum caffrum* Bernh., *Olea capensis* L. and *Rauvolfia caffra* Sond., with *M. caffra* creepers frequently growing between trees. Shrubs present include *Antidesma venosum* E.Mey. ex Tul., *Grewia caffra*, *Tarenna pavettoides* (Harv.) Sim. and *Tricalysia* species. A dense leaf litter layer is present, and grasses (e.g. *Cynodon dactylon*, *Hemarthria altissima* (Poir.) Stapf & C.E.Hubb. and *Ischaemum* spp.) only occur very sporadically.

Sampling was generally limited to winter, when game counts (wildlife censuses) were conducted, and mid-summer. Arachnids were collected during the following periods: July 2000 (2 weeks); November–December 2000 (4 weeks); January (1 week) and July 2002 (2 weeks); June–July 2003 (2 weeks); July 2004 (2 weeks); February (1 week) and June 2005 (2 weeks), and January 2006 (2 weeks), April (1 week) and June 2006 (2 weeks).

Methods

Sampling was conducted primarily on an *ad hoc* basis, and was not quantitative. Consequently, sampling intensity in each habitat varied considerably. For example, sand forest was relatively poorly sampled, while deciduous broadleaf woodland and subtropical bush were very well sampled.

The sampling methods for each arachnid guild can be summarised as follows: ground wanderers were sampled using pitfall traps, rock and log turning, and leaf litter sifting; plant wanderers were collected using beating sheets and by hand (trees), and sweep-nets

and by hand (grass); web-builders were collected by hand and sweep-nets; spiders were collected on or under bark with a pooter, using a modified net, or by hand. Night collecting was done by hand with the aid of a flashlight. Spiders attracted to light traps at night were also collected. Specimens were preserved in 70% ethanol for each site sampled.

The second author identified most of the material to species level, while the third author identified the Salticidae. Various taxa were identified by the specialists listed in the Acknowledgments. Voucher specimens have been deposited in the following institutions: Royal Museum of Central Africa, Tervuren, Belgium (Linyphiidae, Salticidae and Zodariidae); National Museum, Bloemfontein, South Africa (Miturgidae, Sicariidae and Opiliones); Western Australian Museum, Perth, Australia (Pseudoscorpiones); Zoological Institute and Museum Alexander Koenig, Bonn, Germany (Pholcidae); American Museum of Natural History, New York, U.S.A. (Scorpiones); and the National Collection of Arachnida, ARC—Plant Protection Research Institute, Pretoria, South Africa (all other arachnids).

Guilds observed

Two main guilds can be distinguished among arachnids, namely wanderers and web-builders. The wanderers can be further divided into plant wanderers (PW) and ground wanderers (GW). Plant wanderers were separated and placed in a guild based on the vegetation type that they were most commonly found on, namely plant wanderer on foliage (PWF), plant wanderer on grass (PWG) and plant wanderer on bark (PWB).

The web-building spiders can also be subdivided into different guilds based on the structure of the webs that they build: sheet-web builders (SWB), space-web builders (SPWB), orb-web builders (OWB), modified orb-web builders (MOWB), funnel-web builders (FWB), retreat-web builders (RWB) and gum-foot-web builders (GWB).

Table 1
Order composition of the non-acarine arachnids in the
Ndamo Game Reserve, Maputaland

Order	Common Name	Families	Genera	Species
Amblypygi	Tailless whip-scorpions	1	1	1
Araneae	Spiders	46	222	431
Opiliones	Harvestmen	2	2	3
Pseudoscorpiones	False scorpions	6	8	12
Scorpiones	Scorpions	3	5	8
Solifugae	Sun spiders	1	2	2
Total		59	240	457

Table 2

Proportional diversity of the non-acarine arachnid orders in Ndumo Game Reserve relative to total South African (Dippenaar-Schoeman & Haddad, unpubl.) and global (Harvey 2002) diversity of each order

Order	NGR		South Africa		Global	
	Species	%	Species	%	Species	%
Araneae	431	94.52	2000	78.03	36000	74.70
Pseudoscorpiones	12	2.63	135	5.27	3239	6.72
Scorpiones	8	1.75	93	3.63	1279	2.65
Opiliones	3	0.66	179	6.98	6000	12.45
Solifugae	2	0.44	150	5.85	1087	2.26
Amblypygi	1	0.22	3	0.12	136	0.28
Others	0	0.00	3	0.12	451	0.94
	457	~100.00	2563	~100.00	48 192	~100.00

Specimens were identified in the laboratory and placed within a particular guild. Additional notes were made of the habitats in which each species was collected, and information on the habits of some species was gathered to provide a fuller picture of the ecology of the spiders within the reserve.

Results and Discussion

Diversity

In total, 457 species representing six orders, 59 families and 240 determined genera of arachnids were collected (Appendix 1, Table 1). The greatest diversity was found in the Araneae (46 families, 431 spp.), followed by the Pseudoscorpiones (6 families, 12 spp.), Scorpiones (3 families, 8 spp.), Opiliones (2 families, 3 spp.) and Solifugae (1 family, 2 spp.). The Amblypygi was only represented by a single species. Compared to the high diversity of spiders collected,

the other arachnid orders (excluding Acari) are under-represented relative to the global arachnid diversity of each order (Table 2; Harvey 2002; Dippenaar-Schoeman & Haddad unpubl.). The under-representation of some of these orders (Solifugae and Scorpiones) could be attributed to their generally higher diversity in more arid environments, and lower diversity in subtropical environments, in southern Africa (Lawrence 1955, 1963; Prendini 2005).

The most diverse families collected were the Salticidae (82 spp.), followed by the Thomisidae (51 spp.) and Araneidae (38 spp.). Eighteen families were represented by a single species only. The total spider diversity (431 spp.) represents the highest number of species recorded from a single conservancy surveyed in South Africa thus far. Previous surveys have yielded between 75 and 268 species (Table 3). It must be noted that the current study took place over

Table 3

Currently known total species diversity of spiders (Araneae) recorded from South African conservancies

Conservancy	Families	Species	Reference
Karoo National Park	38	116	Dippenaar-Schoeman <i>et al.</i> (1999)
Kruger National Park	40	152	Dippenaar-Schoeman & Leroy (2003)
Makalali Game Reserve	38	268	Whitmore <i>et al.</i> (2001)
Mountain Zebra National Park	34	75	Dippenaar-Schoeman (1988, 2006)
Ndumo Game Reserve	46	431	Present study
Roodeplaat Dam Nature Reserve	27	110	Dippenaar-Schoeman <i>et al.</i> (1989)
Soutpansberg West Conservancy	46	127	Foord <i>et al.</i> (2002)
Swartberg Nature Reserve	45	186	Dippenaar-Schoeman <i>et al.</i> (2005)

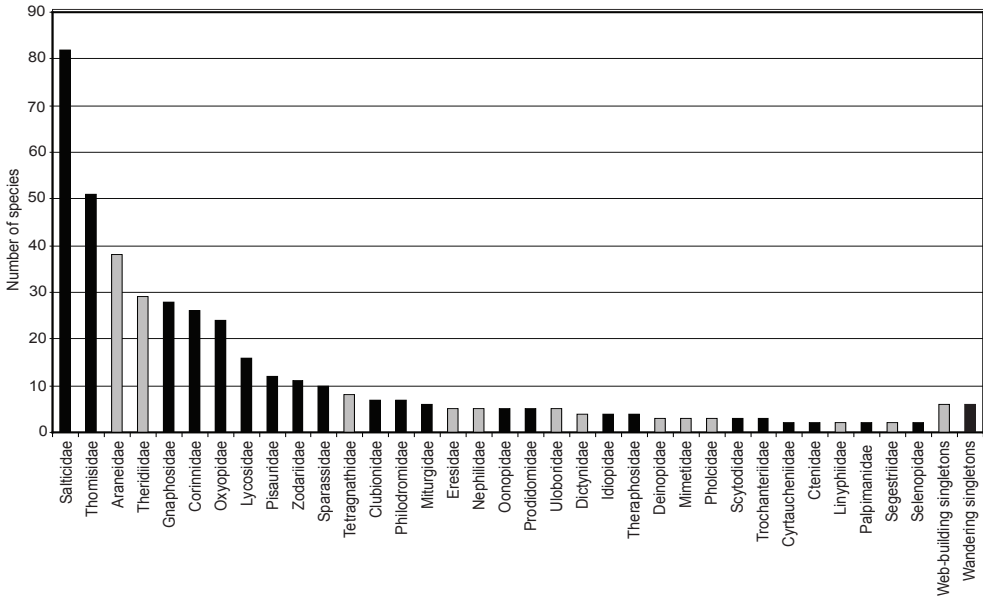


Fig. 14. Species diversity of spider families collected in Ndumo Game Reserve ranked from highest to lowest. Black bars indicate wandering spiders and grey bars indicate web-builders.

a period of seven years (11 intensive sampling trips). Furthermore, a wide variety of sampling methods were used in most strata of the habitats present, while many of the other surveys were restrictive in terms of sampling intensity (often *ad hoc* sampling) or methods. The survey in Roodeplaat Dam Nature Reserve only involved the field and tree layer and did not include ground-dwelling arachnids (Dippenaar-Schoeman *et al.* 1989).

Guilds

The vast majority of the arachnids collected were wanderers (75.9%), with web-builders comprising 24.1% of the species. Amongst spiders only, wanderers contributed a much higher proportion of the species (Fig. 14), with two families (Salticidae and Thomisidae) contributing more than 32% of the total spider species. Two of the diverse web-building families, Araneidae and Theridiidae, contributed 15.5% of the spider species, combined.

Common taxa by stratum

Since this study was not conducted quantitatively there is no specific data available on the abundance of particular species in each habitat. However, based on observations and collecting frequency during this study the following patterns emerged for each stratum and guild:

Ground wanderers: A large number of species (Appendix 1) are wandering arachnids on the ground surface. The community composition varied greatly between different habitats. Open savanna habitats (AS, BW) were dominated by various gnaphosid genera (*Asemesthes*, *Zelotes*, *Setaphis* and *Camillina*), lycosids (*Geolycosa* sp. and *Evippomma squamulatum* (Simon)), corinnids (*Merenius alberti* Lessert, *Copa flavoplumosa* Simon and *Castianeira* sp.), salticids (*Mexcala elegans* Peckham & Peckham, *Stenaelurillus* and *Phlegra* spp.) and zodariids (*Caesetius bevisi* (Hewitt), *Capheris* sp., *Palfuria* sp. and *Psammorygma* sp.), while *Uroplectes olivaceus* Pocock (Buthidae), *Opistacan-*

thus spp. (Liochelidae), *Brachionopus* sp. (Theraphosidae), *Scytodes caffra* Lawrence (Scytodidae), *Loxoscelis spinulosa* Purcell (Scyriidae) and *Caponia chelifera* Lessert (Caponiidae) were most common under logs and rocks.

The fauna of floodplain habitats (AX, FF, FP) was strongly dominated by wolf spiders (Lycosidae), gnaphosids (particularly *Zelotes* spp.), corinnids (particularly *M. alberti*) and salticids (*Thyenula* spp. and *Evarcha* spp.). *Metabiantes maximus* Lawrence (Biantidae) and *Scytodes* spp. (Scytodidae) were common under logs in these habitats.

The remaining two forest types studied differed considerably in their faunas. Riparian forest was dominated by *Zelotes* spp., *Merenius alberti*, *Copa flavoplumosa*, *Thyenula* spp., and various lycosids and oonopids. Spider densities also appear to be much higher than in sand forest. The latter habitat was dominated by lycosid spiders, with oonopids and corinnids in lower densities.

Subtropical bush had relatively similar faunas. Mahemane thicket areas were dominated by salticids (*Stenaelurillus* spp. and *Phlegra* spp., and *Mexcala elegans*), lycosids, oonopids and gnaphosids of the genera *Asemesthes*, *Camillina*, *Setaphis* and *Zelotes*, while *Acacia nigrescens* woodland areas were dominated by lycosids, salticids and liochelid scorpions.

Ground web-builders: Web-builders near the ground surface were generally uncommon, and were largely limited to amaurobiids, *Euprosthena vuattouxi* Blandin (Pisauridae), *Xeviosa amica* Griswold (Phyxelididae), *Ariadna* spp. (Segestriidae) and *Hippasa australis* Lawrence (Lycosidae), which were found in contrasting habitats (Appendix 1). The latter species was the only species that was widespread in NGR, occurring in all of the habitats sampled. Linyphiid and hahniid sheet-web builders were most common in ST leaf litter.

Wanderers associated with bark: Due to the variable plant composition of the different habitats, arachnids associated with bark varied considerably. The habitat best

sampled was AX, with a survey having been conducted specifically on the arachnids associated with *Acacia xanthophloea* bark at five pan and floodplain sites in the reserve (Haddad unpubl.). The most common associations with this tree species are *Cetonana* spp. (Corinnidae), *Pseudicius* spp. and *Heliophanus* spp. (Salticidae), various gnaphosids, miturgids (*Cheiracanthium* spp. and *Cheiramiona* spp.), *Hersilia sericea* Pocock (Hersiliidae), *Platyoides* spp. (Trochanteridae) and *Clubiona* spp. (Clubionidae). In the *Ficus* forest (FF) and floodplain (FP) a similar fauna was found, but densities were generally lower, probably due to the more variable bark structure. Pseudoscorpions, particularly atemnids (e.g. *Titanatemnus natalensis* Beier), and buthid scorpions (particularly *Uroplectes* spp. and *Pseudolycus pegleri* (Purcell)) were also very common under the bark of trees in these habitats.

The arachnids associated with tree bark in RF and SF differed considerably. In RF, the fauna contained elements of *Ficus* forest, which can be explained by the presence of *Ficus* spp. in this habitat. In SF, jumping spiders (particularly *Holcolaetis zuluensis* Lawrence and *Pseudicius* spp.) were most common, with lesser numbers of *Hersilia sericea* and *Clubiona* spp. present.

Trees in AS, BW and ST generally had a coarser bark structure compared to the aforementioned habitats. Wandering spiders were largely limited to *H. sericea*, *Clubiona* spp., *Philodromus* spp. (Philodromidae) and various salticids.

Web-builders associated with bark: As for wanderers, AX also had a high diversity and abundance of web-builders compared to other habitats. The most widespread and common species associated with bark in the eight habitats include various theridiids (*Theridion* spp., *Euryopsis* sp. and *Argyrodes* spp.), araneids (particularly *Neoscona* spp.), and on occasion *Nephilengys cruentata* (Fabricius) (Nephilidae).

Wanderers on grass: Grasses were particularly widespread in AS and BW, where a large proportion of sampling was undertak-

en. Common wanderers in these two habitats include various salticids (particularly *Thyene*, *Viciria* and *Heliophanus* spp.), *Philodromus* and *Tibellus* spp. (Philodromidae), *Oxyopes* spp. (Oxyopidae) and *Thomisus*, *Runcinia* and *Synema* spp. (Thomisidae).

In the two floodplain habitats (AX and FP) the grass fauna was dominated by immature lycosids, *Heliophanus* spp., *Oxyopes* spp., *Charminus* spp. and *Afropisaura rothiformis* (Simon) (Pisauridae), and *Thomisus* species. The grass fauna of ST was dominated by *Charminus* and *Oxyopes* spp., with other common taxa including *Synema*, *Thomisus*, *Thyene* and *Hyllus* species. Grasses were largely or entirely absent from FS, RF and SF, and consequently little data could be generated for these habitats.

Web-builders in grass: The AS and BW grasslands were a rich source of web-building spiders, particularly for the families Araneidae (*Neoscona*, *Hypsosinga*, *Isoxya* and *Singa* spp.), Dictynidae (*Archaeodictyna* and *Dictyna* spp.) and Theridiidae (*Latrodectus geometricus* C. L. Koch and *Theridion* spp.). Most of these species construct a retreat or web in the florescences of various grasses.

In the floodplain habitats AX and FP, web-builders primarily included various *Tetragnatha* spp. (Tetragnathidae), *Neoscona*, *Argiope* and *Araniella* spp. (Araneidae) and small theridiids. Web-builders in ST grasses were generally uncommon due to the short grasses present, and consisted mainly of immature araneids and theridiids.

Wanderers on foliage: All of the habitats have a well-developed tree layer and there was generally a large degree of overlap in the faunas between habitats. Generally, the most common wandering spiders throughout NGR include many of the Thomisidae (particularly *Thomisus*, *Monaeses*, *Thomisops* and *Synema* spp., and *Misumenops rubrodecoratus* Millot), Salticidae (especially *Hyllus*, *Evarcha*, *Heliophanus*, *Thyene* and *Pseudicius* spp.), Oxyopidae (*Oxyopes* and *Hamataliwa* spp.), Clubiona spp. and Miturgidae (especially *Cheiramiona* spp.). In particular, Philodromidae were very common on thorn trees in AS,

while being less frequently encountered in the other habitats.

Web-builders on foliage: The web-building arachnids showed greater habitat variation than the wanderers, which could be related to spacing between trees and shrubs in which webs can be constructed. The savanna and woodland habitats (AS, BW and ST) had higher densities of large and colourful araneids (*Gasteracantha milvoides* Butler, *Cyrtophora citricola* (Forskål), *Caerostris* and *Isoxya* spp.) and the nephilid *Nephila senegalensis* (Walckenaer) than the other habitats in the reserve. In contrast, riverine and floodplain habitats had high densities of *G. milvoides*, *N. fenestrata* Thorell and *N. inaurata* (Walckenaer). The SF fauna comprised largely of small araneid spiders, particularly *Araniella* and *Neoscona*. Theridiid, dictynid and araneid spiders were common on small shrubs and trees at AX, FF, FP and RF, while araneid, theridiid and uloborid spiders were common in AS, BW and ST.

Conservation implications

The high species diversity of arachnids, and spiders in particular, as a single taxon group suggests that other invertebrate taxa may similarly display high levels of diversity in Ndumo Game Reserve. Approximately 18% and 22% of the total South African non-acarine arachnid, and spider diversity, respectively (Table 2), is currently conserved in this reserve. Thus, further study on the invertebrates is needed to discover the extent of the richness of the Maputaland fauna. The high diversity of a single taxon should serve as strong supportive evidence of the need to create awareness of the plight of invertebrate conservation, and increase the area under conservation in this part of South Africa.

Species of notable conservation importance include the four baboon spiders (Theraphosidae) collected. *Ceratogyrus bechuanicus* Purcell is already considered to be a threatened species due to the pet trade (De Wet & Dippenaar-Schoeman 1991). The *Brachionopus* sp. is unlikely to be seriously threatened, and was encountered very frequently under logs

and rocks throughout the reserve. The new species of *Idiothele* is of particular conservation importance. This species has unique blue setae on the metatarsi and tarsi, a trait that could make them especially susceptible to collectors for the pet trade. This species is presently only known from Ndumo, and thus any restrictions possible to limit collection of this species should be imposed.

Numerous new species were discovered in this study, emphasising the need to continue work on all invertebrate taxa so that the knowledge base of South Africa's fauna can be increased. The study also provided new information on the distribution of all species concerned, including several species recorded from South Africa for the first time, and provided material that can be used for taxonomic studies. This highlights the important contribution that the SANSA initiative makes to a better knowledge of the diversity of arachnids in South Africa.

Acknowledgments

KZN Wildlife is thanked for their interest in and support for this project, particularly Catharine Hanekom, Wayne Matthews, Adrian Armstrong, Peter Ruinard and Jabulani Ngunane, and for providing collecting permits for this study (Sharron Hughes). The following taxonomists are thanked for providing identifications of specimens: Leon Lotz (National Museum, Bloemfontein—Miturgidae, Sicariidae and Opiliones), Rudy Jocqué (Royal Museum for Central Africa, Tervuren—Linyphiidae and Zodariidae), Mark Harvey (Western Australian Museum, Perth—Pseudoscorpiones), Bernhard Huber (Zoological Institute and Museum Alexander Koenig, Bonn—Pholcidae) and Mark Alderweireldt and Tony Russell-Smith (Lycosidae). Johan Venter, Andor Venter and Samantha Oliver (University of the Free State, Bloemfontein) and Wayne Matthews provided assistance with the identification of plant specimens. Catharine Hanekom, Wayne Matthews and Adrian Armstrong are thanked for their comments on the manuscript. John Clarke and Catharine Hanekom provided the photos of the *Acacia tortilis* savanna and deciduous broadleaf woodland, respectively. The Faculty of Natural and Agricultural Sciences and Department of Zoology and Entomology of the University of the Free State gave financial and logistical support during the early parts of the survey. Many students from the University of the Free State provided assistance with fieldwork during the course

of the study. Particular mention should be given to Vaughn Swart, Johann van As, Jonathan Venter, Ilse Els, Stefan van As, John Clarke and Frikkie Spangenberg, who assisted with the initial surveys.

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Appendix 1

A checklist of the arachnids of the Ndumo Game Reserve.

Guild abbreviations are provided in the text. Habitat abbreviations: AS – Acacia tortilis savanna; AX – Acacia xanthophloea forests around pans; BW – Broadleaf woodland; FF – Ficus forest; FP – Floodplain vegetation near the Pongola and Usutu rivers; RF – riparian forests along Pongola and Usutu rivers; SF – Sand forest; ST – Subtropical bush. Symbols: □ indicates a new genus and species, † indicates a new species, ‡ a possible new species, and ? an uncertain determination

Family/Genus/Species	Guilds	Habitats
ORDER: AMBLYPYGI (tailless whip-scorpions)		
FAMILY: PHYRNICHIDAE		
<i>Damon variegatus</i> (Perty, 1834)	GW	BW, FP, RF, SF, ST
ORDER: ARANEAE (spiders)		
FAMILY: AGELENIDAE		
<i>Agelena</i> sp.	FWB	FP, ST
FAMILY: AMAUROBIIDAE		
Macrobuninae sp.	RWB	FF, FP
FAMILY: AMMOXENIDAE		
<i>Rastellus florissbad</i> Platnick & Griffin, 1990	GW	ST
FAMILY: ARANEIDAE		
<i>Afroxya camerunensis</i> (Thorell, 1899)	OWB	BW, ST
<i>Arachnura scorpionoides</i> Vinson, 1863	OWB	BW, FP, RF, ST
Araneidae sp. indet.	OWB	BW
<i>Araneus apricus</i> (Karsch, 1884)	OWB	AS, AX, FP, SF, ST
<i>Araneus</i> sp. 2	OWB	AS, FP, ST
<i>Araniella</i> sp. ?	OWB	AS, AX, FP, RF, SF, ST
<i>Argiope aurocincta</i> Pocock, 1898	OWB	BW, FP, ST
<i>A. australis</i> (Walckenaer, 1805)	OWB	BW
<i>A. levii</i> Björn, 1997	OWB	AX, BW, FF, FP, RF, ST
<i>A. trifasciata</i> (Forskål, 1775)	OWB	FF, RF
<i>Caerostris sexcuspidata</i> (Fabricius, 1793)	OWB	FP, RF, ST
<i>C. vicina</i> (Blackwall, 1866)	OWB	BW, FF, RF, ST
<i>Chorizopes</i> sp. 1	HWB	AX, RF, ST
<i>Chorizopes</i> sp. 2	HWB	RF
<i>Cyclosa insulana</i> (Costa, 1834)	OWB	AS, BW, FP, RF, SF, ST
<i>Cyphalonotus larvatus</i> (Simon, 1881)	OWB	AS, ST
<i>Cyrtophora citricola</i> (Forskål, 1775)	OWB	AS, AX, BW, RF, ST
<i>Gasteracantha milvodes</i> Butler, 1873	OWB	All habitats sampled
<i>Gea infuscata</i> Tullgren, 1910	OWB	FP, RF
<i>Hypsosinga lithyphantoides</i> Caporiacco, 1947	OWB	AS, AX, BW, ST
<i>Isoxya stuhlmanni</i> (Bösenberg & Lenz, 1894)	OWB	AS, BW, RF, ST
<i>I. tabulata</i> (Thorell, 1859)	OWB	All habitats sampled
<i>Isoxya</i> sp. 3	OWB	ST
<i>Kilima</i> sp. imm.?	OWB	AS
<i>Lipocrea longissima</i> (Simon, 1881)	OWB	BW
<i>Nemoscolus elongatus</i> Lawrence, 1947	OWB	AS
<i>Neoscona blondeli</i> (Simon, 1885)	OWB	AS, FF, FP, SF, ST
<i>N. hirta</i> (C. L. Koch, 1845)	OWB	RF, ST
<i>N. penicillipes</i> (Karsch, 1879)	OWB	RF, ST
<i>N. rufipalpis</i> (Lucas, 1858)	OWB	BW, RF, ST
<i>N. subfusca</i> (C. L. Koch, 1837)	OWB	RF, SF
<i>N. theisi theisiella</i> (Tullgren, 1910)	OWB	AS, RF, ST
<i>N. triangula</i> (Keyserling, 1864)	OWB	AX, BW, RF, ST
<i>Neoscona</i> sp. 8	OWB	BW
<i>Pararaneus cyrtoscapus</i> (Pocock, 1898)	OWB	RF
<i>Prasonica</i> sp.	OWB	FP
<i>Singa</i> sp. 1	OWB	AS, RF, ST
<i>Singa</i> sp. 2	OWB	AS

FAMILY: CAPONIIDAE		
<i>Caponia chelifera</i> Lessert, 1936	GW	AS, AX, BW, FF, RF, ST
FAMILY: CLUBIONIDAE		
<i>Clubiona abbajensis</i> Strand, 1906	PWB	AX
<i>C. annuligera</i> Lessert, 1929	PWG	BW
<i>C. bevisi</i> Lessert, 1923	PWF	ST
<i>C. durbana</i> Roewer, 1951	PWF	RF, ST
<i>C. helva</i> Simon, 1897	PWB	AX, FF
<i>C. pupillaris</i> Lawrence, 1938	PWF	RF
<i>C. pongolensis</i> Lawrence, 1952	PWB	AX, FF
FAMILY: CORINNIDAE		
<i>Apochinomma formicaeforme</i> Pavese, 1881	PWF/GW	AX, BW, ST
<i>Cambalida coriacea</i> Simon, 1909	PWF	AX, FF, FP, RF, SF, ST
<i>Castianeira</i> sp.	GW	AS, BW, FP, ST
<i>Cetonana simoni</i> (Lawrence, 1942)	PWB	AX, FF, ST
<i>C. tridentata</i> Lessert, 1923	PWB	All habitats sampled
<i>Cetonana</i> sp. 3	PWF	AX, FF, ST
<i>Corinna natalis</i> Pocock, 1898	PWB	AX, FF, ST
Corinninae sp.	GW	AX, FF
<i>Corinnomma semiglabrum</i> (Simon, 1896)	GW	AS, BW, FP, RF, ST
<i>C. lawrencei</i> Haddad, in press†	GW	BW, FP, RF
<i>Copa flavoplumosa</i> Simon, 1885	GW	AX, BW, FF, FP, RF, SF, ST
<i>Copa</i> sp.†	PWF	RF
<i>Graptartia tropicalis</i> Haddad, 2004	GW	AX, BW, FF, RF, ST
<i>Hortipes aelurisiopae</i> Bosselaers & Jocqué, 2000	GW	AX, BW, FP, RF, SF, ST
<i>H. griswoldi</i> Bosselaers & Jocqué, 2000	GW	AX, FP, RF
<i>Merenius alberti</i> Lessert, 1923	GW	All habitats sampled
<i>Messapus martini</i> Simon, 1898	GW/PWB	BW, SF
<i>Messapus</i> sp.†	GW	AX, RF, SF
<i>Orthobula radiata</i> Simon, 1897	GW	AX, BW, FF, RF, ST
<i>Pronophaea natalica</i> Simon, 1897	GW	RF
<i>Thysanina transversa</i> Lyle & Haddad, in press†	PWF	RF
<i>Trachelas schenkeli</i> Lessert, 1923	PWF	AX, FP, ST
<i>Trachelas</i> sp. 2	PWB	AX, FF, ST
<i>Trachelas</i> sp. 3	PWB	AX, BW, SF
<i>Trachelas</i> sp. 4	PWB	BW
Trachelinae sp.□	GW	BW, ST
FAMILY: CTENIDAE		
<i>Anahita</i> sp.	GW	BW, FP
<i>Ctenus gulosus</i> Des Arts, 1912?	GW	FF
FAMILY: CYATHOLIPIDAE		
Cyatholipidae sp. indet.	SWB	RF
FAMILY: CYRTAUCHENIIDAE		
<i>Ancylotrypa zebra</i> Simon, 1892	GW	BW, RF
<i>Ancylotrypa</i> sp. 2‡	GW	BW, RF, ST
FAMILY: DEINOPIDAE		
<i>Deinopis cylindrica</i> Pocock, 1898	MOWB	BW, FP, RF, SF, ST
<i>Deinopis</i> sp. 2 imm.	MOWB	ST
<i>Menneus camelus</i> Pocock, 1902	MOWB	BW, FP, ST
FAMILY: DICTYNIDAE		
<i>Archaeodictyna</i> sp. 1	RWB	AS, AX, BW, FP, ST
<i>Dictyna</i> sp. 1	RWB	AX, BW, RF, ST
<i>Dictyna</i> sp. 2	RWB	AS, ST
<i>Mashimo leleupi</i> Lehtinen, 1967	RWB	AX, FP
FAMILY: ERESIDAE		
<i>Adonea</i> sp.?	RWB	AS

Appendix 1 (continued)

<i>Dresserus</i> sp.	RWB	BW, ST
<i>Gandanomeno</i> sp.	RWB	AS
<i>Stegodyphus africanus</i> Blackwall, 1866	RWB	BW
<i>S. mimosarum</i> Pavesi, 1893	RWB	AS, AX, BW
FAMILY: GNAPHOSIDAE		
<i>Asemesthes ceresicola</i> Tucker, 1923?	GW	AS, BW, ST
<i>Camillina cordifera</i> (Tullgren, 1910)	GW	AS, AX, BW, FF, FP, RF, ST
<i>C. corrugata</i> (Purcell, 1907)	GW	AX, BW, RF
<i>C. maun</i> Platnick, 1987	GW	ST
<i>Drassodes</i> sp.	GW	AS, RF
<i>Echemus</i> sp.	PWB	AX
<i>Echeminae</i> sp. 1	GW	BW
<i>Gnaphosinae</i> sp. 1	GW	AX
<i>Latonigena africanus</i> Tucker, 1923	PWF	AS, AX
<i>Megamyrmaekion</i> sp. imm.	PWF	AS
<i>Micaria</i> sp. 1	GW	AS, AX, BW, ST
<i>Micaria</i> sp. 2	GW	AX, FF
<i>Poecilochroa capensis</i> Strand, 1909?	GW	AX, ST
<i>Scotophaeus</i> sp.?	GW	BW, FP
<i>Setaphis browni</i> (Tucker, 1923)	GW	FP, ST
<i>Trachyzelotes jaxartensis</i> (Kronenberg, 1875)	GW	AX
<i>Xerophaeus bicarvus</i> Tucker, 1923	GW	BW, ST
<i>X. zuluensis</i> Lawrence, 1938	GW	AX, BW
<i>Xerophaeus</i> sp. 3	PWB	AX
<i>Xerophaeus</i> sp. 4	GW	RF, ST
<i>Zelotes bimamillatus</i> (Caporiacco, 1941)	GW	BW, FF, RF, ST
<i>Z. lavus</i> Tucker, 1923	GW	AX, RF
<i>Z. natalensis</i> Tucker, 1923	GW	RF
<i>Z. scrutatus</i> (O. P.-Cambridge, 1872)	GW	BW
<i>Z. tuckeri</i> Roewer, 1951	GW	AX, BW, RF, ST
<i>Z. unguis</i> Tucker, 1923	GW	BW, RF
<i>Z. uquathus</i> FitzPatrick, <i>in litt.</i> †	GW	AX
<i>Zelotes</i> sp. 8	GW	AX
FAMILY: HAHNIIDAE		
<i>Hahnia lobata</i> Bosmans, 1981?	SWB	ST
FAMILY: HERSILIIDAE		
<i>Hersilia sericea</i> Pocock, 1898	PWB	All habitats sampled
FAMILY: IDIOPIDAE		
<i>Idiops grandis</i> (Hewitt, 1915)	GW	AS
<i>Segregara mossambicus</i> (Hewitt, 1919)	GW	BW, FP, ST
<i>S. pectinipalpis</i> (Purcell, 1903)	GW	BW, FP
<i>S. transvaalensis</i> (Hewitt, 1913)	GW	BW
FAMILY: LINYPHIIDAE		
<i>Meioneta natalensis</i> Jocqué, 1984	SWB	AS, RF, ST
<i>Microtenonyx</i> sp.	SWB	AX, BW, ST
FAMILY: LIOCRANIDAE		
<i>Rhaeboctesis</i> sp.?	PWF	ST
FAMILY: LYCOSIDAE		
<i>Allocosa lawrencei</i> (Roewer, 1951)	GW	AX, BW, RF, ST
<i>Alopecosa</i> sp.	GW	AX, FP
<i>Amblyothele</i> sp.	GW	AX, FF, ST
<i>Arctosa</i> sp.	GW	FF
<i>Evippomma squamulatum</i> (Simon, 1898)	GW	AS, BW, FF, RF
<i>Hippasa australis</i> Lawrence, 1927	FWB	All habitats sampled
<i>Hogna</i> sp.	GW	FF, FP
<i>Lycosa</i> sp.	GW	AX, BW
Lycosidae sp. □	GW	BW, ST

Appendix 1 (continued)

Lycosinae sp. 1	GW	FF
<i>Ocyale atalanta</i> (Audouin, 1825)	GW	FP
<i>Pardosa crassipalpis</i> Purcell, 1903	GW	AX, FF, FP, ST
<i>P. schreineri</i> Purcell, 1903	GW	FP, FF
<i>Trochosa</i> sp. 1	GW	AX, FF
<i>Trochosa</i> sp. 2	GW	FF
Wadicolinae sp. indet.	GW	AX
FAMILY: MIMETIDAE		
<i>Ero</i> sp.	PWB	FF
<i>Mimetus cornutus</i> Lawrence, 1947	PWF	AS, AX, FP, ST
<i>Mimetus</i> sp. ‡	PWG/F	AX, BW, FP, SF, ST
FAMILY: MITURGIDAE		
<i>Cheiracanthium furculatum</i> Karsch, 1879	PWF	AS, AX, FF, FP, RF, ST
<i>C. inclusum</i> (Hentz, 1847)	PWF	BW, ST
<i>C. vansoni</i> Lawrence, 1936	PWF	AX, BW, ST
<i>Cheiramiona paradisis</i> Lotz, 2002	PWF	AS, AX, FP, RF, ST
<i>C. mlawula</i> Lotz, 2002	PWF	AX, BW, ST
<i>Cheiramiona</i> sp. 3 ‡	PWF	AX, ST
FAMILY: NEPHILIDAE		
<i>Clitaetra irenae</i> Kuntner, 2006	OWB	AX, BW, FF, FP, RF, SF, ST
<i>Nephila fenestrata</i> Thorell, 1859	OWB	AX, BW, FP, RF, ST
<i>N. inaurata</i> (Walckenaer, 1842)	OWB	All habitats sampled
<i>N. senegalensis</i> (Walckenaer, 1842)	OWB	BW, FP, RF, ST
<i>Nephilengys cruentata</i> (Fabricius, 1775)	OWB	All habitats sampled
FAMILY: OECOBIIDAE		
<i>Oecobius navus</i> Blackwall, 1859	PWB	BW, ST
FAMILY: OONOPIDAE		
<i>Dysderina speculifera</i> Simon, 1907	GW	AS, RF, ST
<i>Gamasomorpha humicola</i> Lawrence, 1946	GW	BW, RF
<i>G. longisetosa</i> Lawrence, 1952	GW	RF, ST
<i>Oonops</i> sp.	GW	BW
<i>Opopaea speciosa</i> (Lawrence, 1952)	GW/PWB	AX, BW, FF, FP, RF, ST
FAMILY: OXYOPIDAE		
<i>Hamataliwa kulczynskii</i> (Lessert, 1915)	PWF	AX, FP, RF
<i>H. rostrifrons</i> (Lawrence, 1928)	PWF	AS, FP, RF
<i>Hamataliwa</i> sp. 3	PWF	FF
<i>Hamataliwa</i> sp. 4	PWF	ST
<i>Oxyopes bothai</i> Lessert, 1915	PWF	RF
<i>O. castaneus</i> Lawrence, 1927	PWF	FP, RF
<i>O. flavipalpis</i> (Lucas, 1858)	PWF	AS, FF, FP, ST
<i>O. hoggi</i> Lessert, 1915	PWF	RF, ST
<i>O. jacksoni</i> Lessert, 1915	PWF	AS, RF
<i>O. longispinosus</i> Lawrence, 1938	PWF	RF, ST
<i>O. pallidecoloratus</i> Strand, 1906	PWF	AX, FP, RF
<i>O. rostrifrons</i> (Lawrence, 1928)	PWF	FP, ST
<i>O. russoi</i> Caporiacco, 1940	PWF	AX, RF, ST
<i>O. sjostedti</i> Lessert, 1915	PWF	AS, FP, RF
<i>Oxyopes</i> sp. 11	PWF	AS, RF, ST
<i>Oxyopes</i> sp. 12	PWF	FF, FP
<i>Oxyopes</i> sp. 13	PWF	ST
<i>Oxyopes</i> sp. 14	PWF/G	AS, RF, ST
<i>Oxyopes</i> sp. 15	PWF/G	ST
<i>Oxyopes</i> sp. 16	PWF	FF
<i>Oxyopes</i> sp. 17	PWF	ST
<i>Oxyopes</i> sp. 18	PWF	ST
<i>Oxyopes</i> sp. 19	PWF	ST
<i>Peuceitia madalanae</i> Van Niekerk & Dippenaar-Schoeman, 1994	PWF	AX, BW, FP, RF, ST

Appendix 1 (continued)

FAMILY: PALPIMANIDAE		
<i>Palpimanus potteri</i> Lawrence, 1937	GW	AS, AX, BW, RF, ST
<i>P. transvaalicus</i> Simon, 1893	GW	AX, BW, FF, FP, ST
FAMILY: PHILODROMIDAE		
<i>Ebo</i> sp.	PWF	AS, BW, ST
<i>Gephyrota</i> sp. ‡	PWF	AX, FP, RF, ST
<i>Philodromus browningi</i> Lawrence, 1952	PWB	AX, FF, FP, RF
<i>P. partitus</i> Lessert, 1919	PWF	AS, BW, RF, ST
<i>Suemus punctatus</i> Lawrence, 1938	PWF	AS, BW, ST
<i>Tibellus hollidayi</i> Lawrence, 1952	PWF/G	AS
<i>T. sunetae</i> Van den Berg & Dippenaar-Schoeman, 1994	PWF/G	AS, FP, ST
FAMILY: PHOLCIDAE		
<i>Leptopholcus</i> sp. ‡	SPWB	RF, SF, ST
<i>Smeringopus</i> sp. ‡	SPWB	AS, AX, BW, FF, FP, RF, ST
<i>Pebrforsskalia</i> sp.?	SPWB	AS, BW
FAMILY: PHYXELIDIDAE		
<i>Xeviosa amica</i> Griswold, 1990	RWB	BW, FP, ST
FAMILY: PISAURIDAE		
<i>Afropisaura rothiformis</i> (Strand, 1908)	PWF	AS, AX, BW, FP, RF, ST
<i>Charminus atomarius</i> (Lawrence, 1942)	PWF	BW, FP, ST
<i>C. natalensis</i> (Lawrence, 1947)	PWF	AX, FP, RF, ST
<i>Cispus kimbicus</i> Blandin, 1978	PWF	AS, AX, BW, FF, FP, ST
<i>Cispus</i> sp. 2 ‡	PWF	BW, ST
<i>Euprostenopsis vuattouxi</i> Blandin, 1977	PWF	BW, ST
<i>Maypacijs bilineatus</i> (Pavesi, 1895)	GW	BW, RF
<i>Perenethis simoni</i> (Lessert, 1916)	PWF	FP
Pisauridae sp. indet.	PWF	BW, RF
<i>Rothus purpurissatus</i> Simon, 1898	PWF	AS, ST
<i>Thalassius margaritatus</i> Pocock, 1898	GW/PWF	FP, RF
<i>T. spinosissimus</i> (Karsch, 1879)	GW	AX, FP, RF
FAMILY: PRODIDOMIDAE		
Prodidominae sp. indet.	GW	BW
<i>Prodidomus flavipes</i> Lawrence, 1952	GW	AS, BW, ST
<i>Theuma fusca</i> Purcell, 1907	GW	AS
<i>T. maculata</i> Purcell, 1907	GW	BW, ST
<i>T. tragardhi</i> Lawrence, 1947	GW	BW, ST
FAMILY: SALTICIDAE		
<i>Afromarengo coriacea</i> (Simon, 1900)	PWF	BW, SF
<i>Asemonea stella</i> Wanless, 1980	PWF	FP, RF, SF, ST
<i>Baryphas ahenus</i> Simon, 1902	PWF/G	AX, FP, ST
<i>Bianor</i> sp.	PWF	ST
<i>Cyrba boveyi</i> Lessert, 1933	GW	BW
<i>C. lineata</i> Wanless, 1984	GW	AS, BW, RF
<i>Dendryphantes</i> sp.	PWF	AX, BW, ST
<i>Encymachus</i> sp.?	GW	AX
<i>Evarcha dotata</i> (Peckham & Peckham, 1903)	PWF/G	AS, BW, ST
<i>Evarcha</i> sp. 2	PWF/G	AS, FP, ST
<i>Evarcha</i> sp. 3	PWG	AS, FF
<i>Evarcha</i> sp. 4	PWF	ST
<i>Festucula festuculaeformis</i> (Lessert, 1926)	PWF	BW
<i>Goleba puella</i> (Simon, 1885)	PWF	FF, ST
<i>Habrocestum</i> sp.	GW	ST
<i>Harmochirus luculentis</i> (Simon, 1885)	PWG	AS
<i>Harmochirus</i> sp. 2	PWG	AS
<i>Heliophanus claviger</i> Simon, 1901	PWF	BW
<i>H. debilis</i> Simon, 1901	PWG	AS, AX, RF
<i>H. orchestra</i> Simon, 1885	PWG	FP, RF

Appendix 1 (continued)

<i>H. pauper</i> Wesolowska, 1986	PWG	AS, FP, RF
<i>Heliophanus</i> sp. 5	PWB	AX
<i>Hispo inermis</i> (Caporiacco, 1947)	PWB	BW, SF, ST
<i>Holcolaetis zuluensis</i> Lawrence, 1937	PWF	AS, AX, BW, FF, SF, ST
<i>Hyllus argyrotoxus</i> Simon, 1902	PWF	ST
<i>H. brevitarsis</i> Simon, 1902	PWF	AS, BW, FP, RF, ST
<i>H. treleaveni</i> Peckham & Peckham, 1902	PWF	BW, FP
<i>Hyllus</i> sp. 4	PWF	FE, ST
<i>Kima variabilis</i> Peckham & Peckham, 1903	PWF	BW, ST
<i>Menemerus manicus</i> Wesolowska, 1999	PWF	BW, RF
<i>Mexcala elegans</i> Peckham & Peckham, 1903	GW/PWF	All habitats sampled
<i>Myrmarachne ichneumon</i> (Simon, 1885)	PWF	BW, ST
<i>M. laurentina</i> Bacelar, 1953	PWF	BW
<i>M. uvira</i> Wanless, 1982	GW	AS, AX
<i>Myrmarachne</i> sp. 4	PWF	RF, ST
<i>Myrmarachne</i> sp. 5	PWF	ST
<i>Natta horizontalis</i> Karsch, 1879	PWG	All habitats sampled
<i>Pachyballus castaneus</i> Simon, 1900	PWF	AX
<i>Pachypoessa</i> sp. †	GW	AS
<i>Pellenes bulawayoensis</i> Wesolowska, 2000	GW	AS
<i>Pellenes</i> sp. 2	GW	RF
<i>Phlegra bresnieri</i> (Lucas, 1846)	GW	AS, BW
<i>P. nuda</i> Próchniewicz & Heciak, 1994	GW	AS, AX
<i>Phintella aequipes</i> (Peckham & Peckham, 1903)	PWF	FP
<i>Phintella</i> sp. 2	PWF	ST
<i>Portia schultzi</i> Karsch, 1878	PWF	AS, AX, BW, FF, FP, ST
<i>Pseudicius</i> sp. 1 †	PWB/F	AX, FF, RF, SF, ST
<i>Pseudicius</i> sp. 2	PWB/F	AX, FF, FP
<i>Pseudicius</i> sp. 3	PWF	AS
<i>Schenkella modesta</i> Lessert, 1927	PWF	FF
<i>Siler</i> sp.	GW	AX, FP
<i>Sonoita lightfooti</i> Peckham & Peckham, 1903	PWF	FP, RF, ST
<i>Stenaelurillus</i> sp. 1 †	GW	AS, BW, ST
<i>Stenaelurillus</i> sp. 2	GW	ST
<i>Thyene bucculenta</i> (Gerstäcker, 1873)	PWF	ST
<i>T. coccineovittata</i> (Simon, 1885)	PWG	RF, ST
<i>T. crudelis</i> Peckham & Peckham 1903	PWF	AS, AX, BW, FF
<i>T. inflata</i> (Gerstaecker, 1873)	PWF	AX, BW, FP, ST
<i>T. natali</i> Peckham & Peckham, 1903	PWF	AX, BW, FF, RF, ST
<i>T. ogdeni</i> Peckham & Peckham, 1903?	PWF	RF
<i>T. semiargentea</i> (Simon, 1884)	PWF/G	AS, ST
<i>Thyene</i> sp. 8?	PWG	ST
<i>Thyenula aurantiaca</i> (Simon, 1902)	PWG	AS, RF
<i>T. ogdeni</i> Peckham & Peckham, 1903	PWG	RF, ST
<i>Tomocyrba</i> sp. †	PWF	FF
<i>Tusitala barbata</i> Peckham & Peckham, 1902	PWF	AS, BW, ST
<i>Tusitala</i> sp. 2	PWF	FF
<i>Veissela durbani</i> (Peckham & Peckham, 1903)	PWF	ST
<i>Viciria morigera</i> Peckham & Peckham, 1903	PWF	BW, FF
<i>V. mustela</i> Simon, 1902	PWF/G	AS, ST
<i>Viciria</i> sp. 3	PWF	RF, ST
Salticidae sp. 1	PWG	AS
Salticidae sp. 2	PWB	AX
Salticidae sp. 3	PWF	ST
Salticidae sp. 4	PWF	FP
Salticidae sp. 5	PWB	BW
Salticidae sp. 6	PWF	ST
Salticidae sp. 7	PWF	ST
Salticidae sp. 8	PWF	ST
Salticidae sp. 9	GW	AS
Salticidae sp. 10	PWF	BW, ST
Salticidae sp. 11	GW	FP
FAMILY: SCYTODIDAE		
<i>Scytodes caffra</i> Purcell, 1904	GW	All habitats sampled

Appendix 1 (continued)

<i>S. maritima</i> Lawrence, 1938	GW	AX, FP, RF
<i>S. rubra</i> Lawrence, 1937	GW	AX, FF
FAMILY: SEGESTRIIDAE		
<i>Ariadna corticola</i> Lawrence, 1952	RWB	AS, AX, RF
<i>Ariadna</i> sp. 2	RWB	AS
FAMILY: SELENOPIIDAE		
<i>Anyphops barbertonensis</i> (Lawrence, 1940)	PWB/GW	AS, AX, BW, FF, RF, ST
<i>Selenops zuluanus</i> Lawrence, 1940	GW	AS, ST
FAMILY: SICARIIDAE		
<i>Loxoscelis spinulosa</i> Purcell, 1904	GW	AS, BW, RF, SF, ST
FAMILY: SPARASSIDAE		
<i>Olios auricornis</i> (Simon, 1880)	PWB	AX, FP
<i>O. chelifera</i> Lawrence, 1937?	PWF	RF
<i>O. chubbi</i> Lessert, 1925	PWF	RF, ST
<i>O. correboni</i> Lessert, 1921	PWB	AS, AX, BW
<i>O. machadoi</i> Lawrence, 1938	PWF	AX, BW, FP
<i>Olios</i> sp. 6	PWB	AX, FF
<i>Palystes superciliosus</i> L. Koch, 1875	PWF	BW, RF, ST
<i>Panaretella immaculata</i> Lawrence, 1952	PWB	RF, ST
<i>P. zuluana</i> Lawrence, 1937	PWF	AX, BW
<i>Pseudomicrommata longipes</i> (Bösenberg & Lenz, 1895)	PWG	BW, FP
FAMILY: SYMPHYTOGNATHIDAE		
<i>Patu</i> sp.	OWB	AS, AX, BW
FAMILY: TETRAGNATHIDAE		
<i>Leucauge decorata</i> (Blackwall, 1864)	OWB	FP, ST
<i>L. medjensis</i> Lessert, 1930	OWB	All habitats sampled
<i>Tetragnatha ceylonica</i> Cambridge, 1869	OWB	ST
<i>T. demissa</i> L. Koch, 1872	OWB	ST
<i>T. maxillosa</i> Thorell, 1895	OWB	AX, BW, FP
<i>T. subsquamata</i> Okuma, 1985	OWB	FP, RF, ST
<i>T. unicornis</i> Tullgren, 1910	OWB	AX
<i>Tetragnatha</i> sp. 6‡	OWB	FP
FAMILY: THERAPHOSIDAE		
<i>Brachionopus</i> sp.	GW	All habitats sampled
<i>Ceratogyrus bechuanicus</i> Purcell, 1902	GW	BW, SF
<i>Harpactira</i> sp.	GW	AS, BW
<i>Idiothele</i> sp.‡	GW	BW, RF
FAMILY: THERIDIIDAE		
<i>Achaearanea</i> sp.	GWB	FP, RF
<i>Anelosimus</i> sp.	GWB	FP, RF
<i>Argyrodes affinis</i> (Lessert, 1936)	GWB	AX, FP, RF, ST
<i>A. convivans</i> Lawrence, 1937	GWB	All habitats sampled
<i>Argyrodes</i> sp. 3	GWB	AS
<i>Argyrodes</i> sp. 4	GWB	AS
<i>Argyrodes</i> sp. 5	GWB	FF, FP, RF
<i>Choriozopella tragardi</i> Lawrence, 1947	GWB	AX
<i>Dipoena</i> sp.	GWB	AS, AX, FF, ST
<i>Episinus bilineatus</i> Simon, 1894	GWB	AS, ST
<i>Euryopis</i> sp. 1	GWB	AS, AX, FF, FP, ST
<i>Euryopis</i> sp. 2	GWB	AX, FP
<i>Latrodectus cinctus</i> Blackwall, 1865	GWB	BW, ST
<i>L. geometricus</i> C. L. Koch, 1841	GWB	AS, BW, FP
<i>L. renivulvatus</i> Dahl, 1902	GWB	BW, FF, FP
<i>Phoroncidia eburnea</i> (Simon, 1895)	GWB	AX, RF, ST
<i>Steatoda lawrencei</i> Brignoli, 1983	GWB	AS, AX, FP, RF, ST

Appendix I (continued)

Theridiidae sp.	GWB	BW
<i>Theridion</i> sp. 1	GWB	FF
<i>Theridion</i> sp. 2	GWB	BW, ST
<i>Theridion</i> sp. 3	GWB	FF
<i>Theridion</i> sp. 4	GWB	FF
<i>Theridion</i> sp. 5	GWB	AX, FF, FP
<i>Theridion</i> sp. 6	GWB	AS
<i>Theridion</i> sp. 7	GWB	AX
<i>Theridion</i> sp. 8	GWB	RF
<i>Theridion</i> sp. 9	GWB	RF
<i>Theridion</i> sp. 10	GWB	AX
<i>Tidarren cuneolatum</i> (Tullgren, 1910)?	GWB	AS
FAMILY: THOMISIDAE		
<i>Ansieae tuckeri</i> (Lessert, 1919)	PWF	AS, AX, RF, ST
<i>Camaricus nigrotessellatus</i> Lessert, 1923	PWF	FP, RF
<i>Cynathea bicolor</i> Simon, 1895	PWF	AS
<i>Diaea puncta</i> Karsch, 1884	PWF	AX, BW, FP, RF, ST
<i>Diaea</i> sp. 2	PWF/G	AS, FP, RF, ST
<i>Firmicus bragantinus</i> (Brito Capello, 1866)	PWF	AS, AX, BW, ST
<i>Heriaeus crassispinus</i> Lawrence, 1942	GW	BW
<i>Heterogriffus berlandi</i> (Lessert, 1938)	PWF	AX
<i>Hewittia gracilis</i> Lessert, 1928	PWF	AS, FP
<i>Misumenops rubrodecoratus</i> Millot, 1942	PWF	AS
<i>Monaeses austrinus</i> Simon, 1910	PWF	ST
<i>M. griseus</i> Pavesi, 1897	PWF	ST
<i>Oxytate argenteooculata</i> (Simon, 1886)	PWF	AS, AX, RF, SF, ST
<i>Pactates trimaculatus</i> Simon, 1895	PWF	AX
<i>Pherecydes zebra</i> Lawrence, 1927	PWF	AS
<i>Platythomisus jubbi</i> Lawrence, 1968?	PWF	AS, RF
<i>Runcinia affinis</i> Simon, 1897	PWG	AX
<i>R. flavida</i> (Simon, 1881)	PWF/G	AS, ST
<i>Simorcus zuluanus</i> Lawrence, 1942	PWF	AS, AX, FP, RF, SF, ST
<i>Smodicinus coroniger</i> Simon, 1895	PWF	AS, AX, RF, ST
<i>Stephanopsis</i> sp.	PWF	FP, RF
<i>Stiphropus bisigillatus</i> Lawrence, 1952	GW/PWB	AS, AX, BW, FF, FP, ST
<i>S. intermedius</i> Millot, 1942	GW/PWB	BW
<i>Sylligma hirsuta</i> Simon, 1895	PWF	AX, BW, FP, RF, ST
<i>Synema buettneri</i> Dahl, 1907	PWF	RF
<i>S. imitator</i> (Pavesi, 1883)	PWF	AX, FP, RF, ST
<i>S. mandibulare</i> Dahl, 1907	PWF	FP
<i>S. marlothi</i> Dahl, 1907	PWF/G	AS, FP, ST
<i>S. nigrotibiale</i> Lessert, 1919	PWF/G	AS, FP
<i>S. simoneae</i> Lessert, 1919	PWF	BW
<i>Thomisops bullatus</i> Simon, 1895	PWF	AS, BW
<i>T. pupa</i> Karsch, 1879	PWF	AS, BW, FP, ST
<i>T. sulcatus</i> Simon, 1895	PWF	RF
<i>Thomisus australis</i> Comellini, 1957	PWF/G	AS, BW, FF, FP, ST
<i>T. blandus</i> Karsch, 1880	PWF	BW, FP
<i>T. citrinellus</i> Simon, 1875	PWG	AS, FP
<i>T. daradioides</i> Simon, 1890	PWF	AS, FP
<i>T. granulatus</i> Karsch, 1880	PWF	AS, FP, RF, ST
<i>T. scrupeus</i> (Simon, 1886)	PWB	AS, AX, BW, FP, RF, ST
<i>T. spiculosus</i> Pocock, 1901	PWF/G	FP, RF, ST
Thomisidae sp. 1 imm	GW	AX
Thomisidae sp. 2 imm	PWF/G	AS, AX, FF, RF, ST
Thomisidae sp. 3□	GW	AX
Thomisidae sp. 4□	PWF/G	BW
<i>Tmarus cameliformis</i> Millot, 1942	PWF	AS, FP, ST
<i>T. comellini</i> (Comellini, 1955)	PWB	AX, RF
<i>Tmarus</i> sp. 3†	PWF	AS, AX, BW
<i>Xysticus lucifugus</i> Lawrence, 1937	GW	AS
<i>X. natalensis</i> Lawrence, 1952	GW	AX, FP, ST
<i>X. urbensis</i> Lawrence, 1952	GW	AX
<i>Xysticus</i> sp. 4	PWB	AX, RF

Appendix 1 (continued)

FAMILY: TROCHANTERIIDAE		
<i>Platyoides leppanae</i> Pocock, 1902	PWB	AX, RF
<i>P. pusillus</i> Pocock, 1898	PWB	AX, FF
<i>P. walteri</i> (Karsch, 1886)	PWB	AX, FF, FP, SF, ST
FAMILY: ULOBORIDAE		
<i>Miagrammopes longicaudus</i> O. P.-Cambridge, 1882	MOWB	AS, AX, BW, RF, SF, ST
<i>Miagrammopes</i> sp. 2	MOWB	SF
<i>Uloborus planipediis</i> Simon, 1896	OWB	AS, RF, ST
<i>U. plumipes</i> Lucas, 1846	OWB	AX, FP, RF, ST
<i>Uloborus</i> sp. 3	OWB	AS, BW, ST
FAMILY: ZODARIIDAE		
<i>Caesetius bevisi</i> (Hewitt, 1916)	GW	AS, BW, RF, ST
<i>Capheris</i> sp.	GW	AS, AX, SF, ST
<i>Chariobas cylindraceus</i> Simon, 1893	PWG	BW, ST
<i>Cicynethus florumfontis</i> Jocqué, 1991	PWF	BW
<i>Cydrela</i> sp.	GW	AX, BW, FF
<i>Diores lesserti</i> Lawrence, 1952	GW	AS, BW
<i>Diores</i> sp. ‡	GW	AS
<i>Palfuria</i> sp. ‡	GW	BW
<i>Psammorygma</i> sp. ‡	GW	BW, RF, SF, ST
<i>Ranops</i> sp. ‡	GW	BW
<i>Systemoplacis</i> sp. ‡	GW	BW, SF
ORDER: OPILIONES (harvestmen)		
FAMILY: BIANIIDAE		
<i>Metabiantes maximus</i> Lawrence, 1931	GW	All habitats sampled
FAMILY: PHALANGIIDAE		
<i>Rhamsinitus leighi</i> (Pocock, 1902)	GW	AX, FF, FP, RF, SF
<i>Rhamsinitus</i> sp. 2	GW	FF, FP, SF
ORDER: PSEUDOSCORPIONES (false scorpions)		
FAMILY: ATEMNIDAE		
Atemnidae sp.	PWB	AX
<i>Cyclatemnus dolosus</i> Beier, 1958	PWB	AX, FF
<i>C. globosus parvus</i> Beier, 1964	PWB	AX
<i>Titanatemnus natalensis</i> Beier, 1932	PWB	AX, BW, FF, FP, SF
FAMILY: CHEIRIDIIDAE		
<i>Cheiridium</i> sp.	PWB/GW	AX, FF
<i>Cryptocheiridium subtropicum</i> Tullgren, 1907	GW	FF, SF, ST
FAMILY: CHELIFERIDAE		
<i>Lophochernes mucronatus</i> (Tullgren, 1907)	PWB	BW
FAMILY: GEOGARYPIDAE		
<i>Geogarypus</i> sp.	GW	AX, ST
FAMILY: OLPIIDAE		
<i>Nanolpium milanganum</i> Beier, 1964	PWB/G	BW
Olpiidae sp.	GW	BW, ST
FAMILY: WITHIIDAE		
<i>Withius</i> sp.	GW/PWB	AX, ST
ORDER: SCORPIONES (scorpions)		
FAMILY: BUTHIDAE		
<i>Pseudolychas pegleri</i> (Purcell, 1901)	PWB/GW	AX, BW, RF
<i>Uroplectes formosus formosus</i> Pocock, 1890	PWB/GW	AX, FF, FP, RF

Appendix 1 (continued)

<i>U. f. maculipes</i> Hewitt, 1918	GW	AX, BW
<i>U. olivaceus</i> Pocock, 1896	GW	AS, AX, BW, FE, SE, ST

FAMILY: LIOCHELIDAE

<i>Cheloctonus jonesii</i> Pocock, 1892	GW/PWB	AS, BW, FP, RB, SF, ST
<i>Opisthacanthus asper</i> (Peters, 1861)	GW/PWB	AS, AX, BW, SE, ST
<i>O. validus</i> (Thorell, 1976)	GW	AS, BW

FAMILY: SCORPIONIDAE

<i>Opisthophthalmus glabrifrons</i> Peters, 1861	PWB	BW
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ORDER: SOLIFUGAE (sun-spiders)

FAMILY: SOLPUGIDAE

<i>Solpuga zuluana</i> Lawrence, 1937?	GW	AX, AS, BW, ST
<i>Solpugema krugeri</i> Lawrence, 1964?	GW	BW
