


# South African National Survey of Arachnida: A checklist of the spiders (Arachnida, Araneae) of the Lekgalameetse Nature Reserve, Limpopo province, South Africa

**Authors:**

Stefan H. Foord<sup>1</sup>   
 Anna S. Dippenaar-Schoeman<sup>2,3</sup>  
 Rudy Jocqué<sup>4</sup>  
 Charles R. Haddad<sup>5</sup>  
 Robin Lyle<sup>2</sup>  
 Peter Webb<sup>6</sup>

**Affiliations:**

<sup>1</sup>Centre for Invasion Biology, Department of Zoology, University of Venda, South Africa

<sup>2</sup>ARC – Plant Protection Research Institute, Queenswood, South Africa

<sup>3</sup>Department of Zoology & Entomology, University of Pretoria, South Africa

<sup>4</sup>Royal Museum for Central Africa, Tervuren, Belgium

<sup>5</sup>Department of Zoology and Entomology, University of the Free State, South Africa

<sup>6</sup>South African National Survey of Arachnida, Irene, South Africa

**Corresponding author:**

Stefan Foord,  
[stefan.foord@univen.ac.za](mailto:stefan.foord@univen.ac.za)

**Dates:**

Received: 02 May 2016  
 Accepted: 09 Sept. 2016  
 Published: 16 Nov. 2016

The aim of the South African National Survey of Arachnida (SANSA) is to document the Arachnida fauna of South Africa. One of the focus areas of SANSA is to survey protected areas to obtain species-specific information, and species distribution patterns for Red Data assessments. Here, we provide the first checklist of the spider species of Lekgalameetse Nature Reserve (LNR) in the Limpopo province of South Africa collected during five surveys between 2009 and 2016 using methods targeting both the ground and field layers. Forty-five families, represented by 168 genera and 268 species, have been collected so far. The most species-rich families were the Salticidae (41 spp.) and Araneidae (38 spp.), followed by the Thomisidae (33 spp.), while 11 families were represented by one species. Information on spider guilds, endemism value and conservation status are provided. The LNR protects approximately 12.2% of the total South African spider fauna. Two species, *Hasarinella distincta* Haddad & Wesolowska, 2013 (Salticidae) and *Ballomma legala* Jocqué & Henrard, 2015 (Zodariidae), are presently known to be endemic to the reserve.

**Conservation implications:** The LNR falls within the Savanna Biome in the Limpopo province. Only five spider species were previously known from the reserve and 263 spp. are reported from the reserve for the first time. Thirteen species are possibly new to science and 2 species represent new distribution records for South Africa.

## Introduction

Species distribution data are essential for conservation assessments and for compiling a Red Data List of the Araneae of South Africa. The South African National Survey of Arachnida (hereafter referred to as SANSA for brevity) was initiated in 1997 to mainly inventory the arachnid fauna of South Africa (Dippenaar-Schoeman *et al.* 2015). SANSA has several focus areas, such as arachnid diversity in floral biomes, agroecosystems and protected areas (hereafter referred to as PA for brevity). Extensive surveys were undertaken as part of SANSA to obtain species-specific information, and to identify new, rare and/or endemic species (Dippenaar-Schoeman *et al.* 2015; Foord, Dippenaar-Schoeman & Haddad 2011a; McGeoch *et al.* 2011). Inventories in PA provide information on species that are already conserved in existing protected areas. These species distribution records played an important role in compiling the first Spider Atlas of South Africa (Dippenaar-Schoeman *et al.* 2010) and national species list (Dippenaar-Schoeman 2013). The data are also used by provincial agencies for biodiversity assessments and management plans.

In South Africa, the Limpopo province is one of the best-sampled provinces, with 928 known species (Dippenaar-Schoeman, Foord & Haddad 2013; Dippenaar-Schoeman *et al.* 2015; Foord, Dippenaar-Schoeman & Haddad 2011b). Since the start of SANSA, more than 45 new species and 2 new genera have been described from Limpopo province alone (e.g. Azarkina & Foord 2014; Haddad 2009; Haddad & Wesolowska 2013; Jocqué & Henrard 2015; Wesolowska, Azarkina & Russell-Smith 2014; Wesolowska & Haddad 2013). Presently, 40 PA have been sampled in the province, with 14 PA represented by more than 50 species (Dippenaar-Schoeman *et al.* 2015), but several areas in the province are still undersampled (Foord *et al.* 2011a, 2011b). Checklists have been published for

**Read online:**

Scan this QR code with your smart phone or mobile device to read online.

**How to cite this article:** Foord, S.H., Dippenaar-Schoeman, A.S., Jocqué, R., Haddad, C.R., Lyle, R. & Webb, P., 2016, 'South African National Survey of Arachnida: A checklist of the spiders (Arachnida, Araneae) of the Lekgalameetse Nature Reserve, Limpopo province, South Africa', *Koedoe* 58(1), a1405. <http://dx.doi.org/10.4102/koedoe.v58i1.1405>

**Note:** Additional supporting information may be found in the online version of this article as Online Appendix 1: <http://dx.doi.org/10.4102/koedoe.v58i1.1405-1>

**Copyright:** © 2016. The Authors. Licensee: AOSIS. This work is licensed under the Creative Commons Attribution License.

7 of these 40 PA: Makalali Game Reserve (Whitmore *et al.* 2001), Kruger National Park (Dippenaar-Schoeman & Leroy 2003), Sovenga Hill (Modiba, Dippenaar & Dippenaar-Schoeman 2005), Polokwane Nature Reserve (Dippenaar *et al.* 2008), Western Soutpansberg (Foord *et al.* 2008), Nylsvley Nature Reserve (Dippenaar-Schoeman, Van den Berg & Prendini 2009) and Blouberg Nature Reserve and the Western Soutpansberg Conservancy (Muelelwa *et al.* 2010).

The current study presents the results of SANSA sampling in the Lekgalameetse Nature Reserve (LNR) in Limpopo province. This is the eighth survey of the spider fauna of PA in this province to be published and the first spider checklist for the LNR. Information is provided for each species regarding their guilds, endemism index and conservation status.

## Research method and design

### Study area and period

The LNR (-24.14, 30.28) is an 18 000 ha provincial nature reserve in the Limpopo province of South Africa (Figure 1). The reserve lies just south of the Wolkberg Wilderness Area near Haenertsburg, Hoedspruit and Tzaneen in the Wolkberg Mountain range, and it forms part of the Limpopo Drakensberg. It is characterised by kloofs filled with indigenous forests, interspersed with grassland hilltops (Figure 2). Lekgalameetse means 'Place of Water', and the reserve is the catchment area for the Letaba River that flows east and supports several Limpopo PA near the Kruger National Park. Two perennial east-west flowing rivers, the Selati and Makutsi, and a number of smaller streams dissect the reserve.

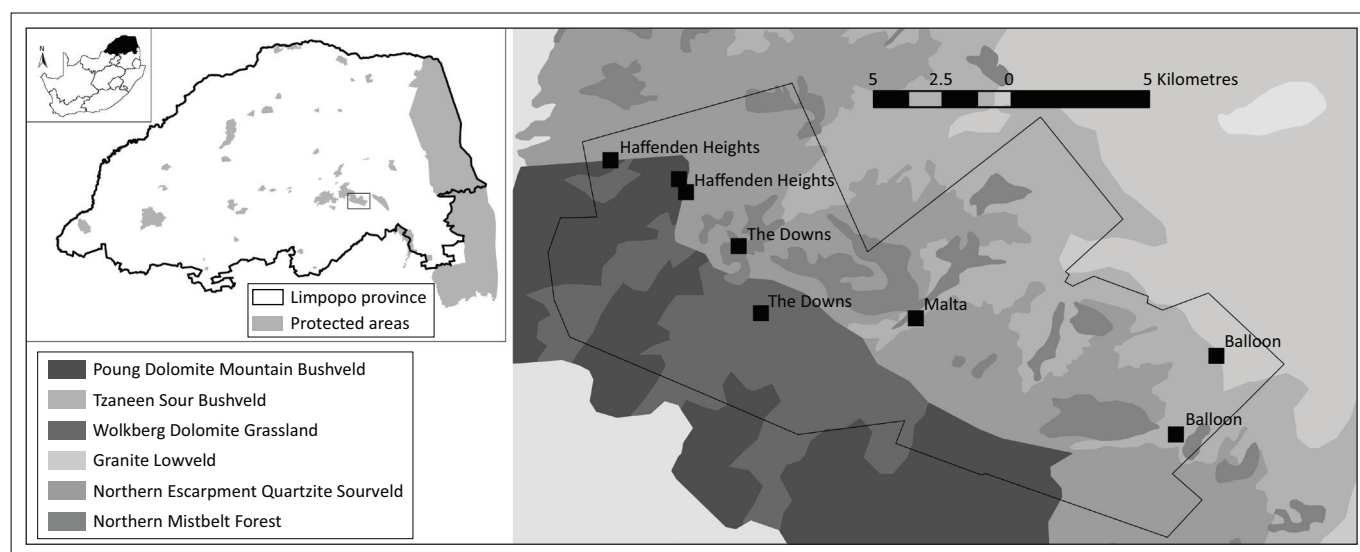
The LNR consists of a relatively low-lying (750 m – 900 m) eastern side that contains Tzaneen Sour Bushveld; a central mountain ridge (reaching 1800 m at the highest point)

encompasses the Northern Escarpment Quartzite Sourveld, interspersed with patches of Northern Mistbelt Forest at altitudes from 900 m – 1650 m; and the western plateau of the Park ('The Downs'), which consists of Wolkberg Dolomite Grassland (Mucina & Rutherford 2006; Williams & Altenroxel 2014).

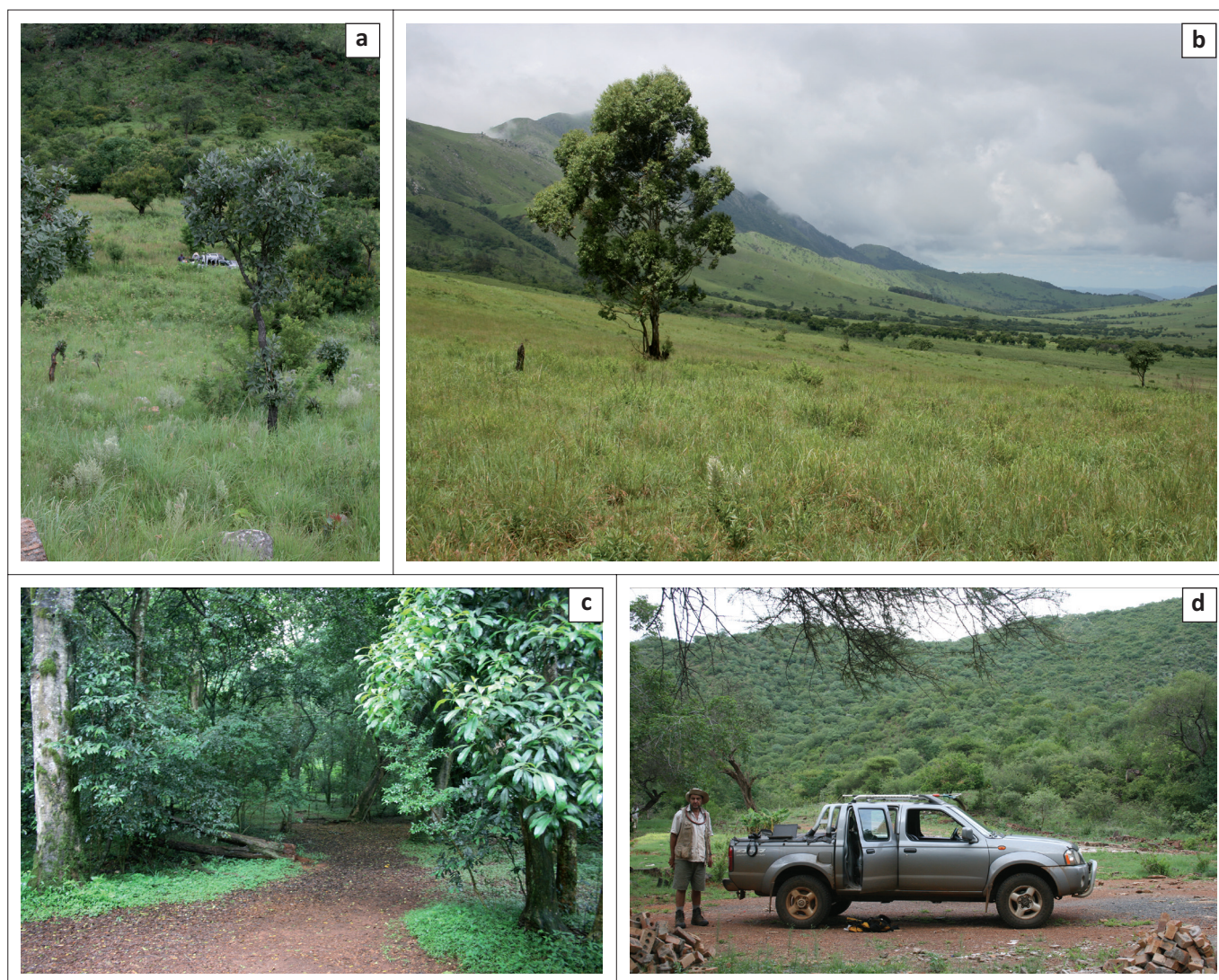
### Sampling methods and identification

As a team effort, SANSA has overcome some of the problems associated with invertebrate monitoring, such as sorting, identifying large samples and using a standardised sampling protocol (Haddad & Dippenaar-Schoeman 2015). The SANSA sampling protocol requires that four habitat types representative of the area be selected in the degree-square grid being sampled. All the habitat layers are sampled, including pitfall traps, litter sifting, Winkler traps (all targeting ground dwellers), sweeping and beating (plant dwellers) and hand and night collecting (ground- and plant dwellers). Five surveys were undertaken at the LNR to sample arachnids (Table 1) and the following areas were sampled: The Downs (-24.14, 30.31), Farm Balloon (-24.20, 30.34), Farm Malta (-24.17, 30.25), Farm Haffenden Heights (-23.82, 30.16) (Figure 1) and Church Forest (-24.16, 30.25) (Figure 2c).

Species determinations were performed by three of the authors. Voucher specimens are deposited in the National Collection of Arachnida housed at the Agricultural Research Council – Plant Protection Research Institute, Pretoria (NCA). The taxonomy of some families, for example, Agelenidae, Amaurobiidae, Dictynidae, Liocranidae and Theridiidae, is still unresolved and some specimens could not be identified to species level. Generic names were included in the checklist when immature specimens were sampled and could not be identified to species level, and when these genera were not represented by other identified species.



**FIGURE 1:** Map of South Africa, showing the locality of the Lekgalameetse Nature Reserve in the Limpopo Province as well as sites surveyed during the South African National Survey of Arachnida survey.



Source: Photos taken by Stefan Foord

**FIGURE 2:** Habitat types in the Lekgalameetse Nature Reserve: (a) Woodland (Haffenden Heights), (b) Grassland (The Downs), (c) Northern Mistbelt Forest & Church Forest (The Downs) and Riparian Gallery Forests (Balloon & Malta) and (d) Shrubland/Thicket (Balloon).

**TABLE 1:** Surveys undertaken at the Lekgalameetse Nature Reserve.

Survey team	Number collectors	Date	Sampling protocol
S. Foord SANSA Univen team	4	i.2009 (5 days)	SANSA survey protocol
P. Webb	2	vii.2012 (3 days)	Sweeps, hand
P. Webb	2	v.2015 (3 days)	Sweeps, beats, hand
P. Webb	2	ix.2015 (3 days)	Sweeps, beats, hand
R. Jocqué	2	ii.2016 (5 days)	Sweeps, beats, hand, pitfalls, litter sifting

SANSA, South African National Survey of Arachnida.

## Functional groups

Because most spiders live in a defined environment with limitations set by both physical conditions and biological factors, species can be grouped into guilds or functional groups based on available information on their habitat preferences and predatory methods. Functional groups provide additional insight on habitat functioning and utilisation by spiders, and contribute to our knowledge of ecosystem functioning. This is because spiders have diverse lifestyles and have developed diverse methods of capturing prey.

Spiders are broadly grouped as web builders (WB) and free-living wanderers (W) (Foord *et al.* 2011a). The wanderers can be further divided into plant wanderers (PW) and ground wanderers (GW), and the GW into the free-living ground dwellers (FGW) and burrow dwellers (BGW). The web-building spiders are subdivided into different guilds based on the web types they construct: funnel-web builders (FWB), gumfoot-web builders (GWB), orb-web builders (OWB), modified orb-web builders (MOWB), retreat-web builders (RWB), sheet-web builders (SWB) and space-web builders (SPWB).

## Endemicity value and conservation status

The conservation status of the species is important for conservation agencies and in preparing the first Red Data List of spiders. As part of the first Spider Atlas, an endemicity index was provided for each species (Dippenaar-Schoeman *et al.* 2010). It was calculated based on currently known distribution, which included six endemicity categories: 6 = endemic, known only from the type locality, 5 = known from one province only, wider than the type locality, 4 = known from two adjoining provinces only, 3 = South Africa, known from more than two provinces or two provinces that are not adjoining, 2 = southern Africa (south of Zambezi and Kunene Rivers), 1 = Afrotropical region and 0 = Africa and wider. In this paper, the following categories are recognised: LC = least concern, species with a wide distribution falling in categories 0–4, LE = Limpopo endemics (5), RE = reserve endemics (6) and DDT = data deficient for taxonomic reasons. This could be because of the unresolved taxonomy of the group or the species being undescribed.

## Photography

As part of SANSA, a photographic Virtual Museum was developed to access photographs of arachnid species (Dippenaar-Schoeman *et al.* 2015). Spiders sampled during three of the surveys at LNR were photographed by the last author. A photo gallery of the spiders of LNR will be made available on the SANSA website. Images can also be viewed at <http://www.arc.agric.za:8080/>.

## Results and discussion

### Spider biodiversity and endemicity

Forty-five families represented by 168 genera and 268 species have been collected from LNR from 2009 to 2016 over a total of only 19 sampling days (Table 2 and Online Appendix 1). The number of species collected compares well with spider diversity recorded from other Limpopo reserves sampled over periods of 1–12 months: Blouberg Nature Reserve (186 spp., Muelelwa *et al.* 2010); Nylsvley Nature Reserve (175 spp., Dippenaar-Schoeman *et al.* 2009); Western Soutpansberg Conservancy (222 spp., Muelelwa *et al.* 2010); Makelali Private Game Reserve (286 spp., Whitmore *et al.* 2001) and Polokwane Nature Reserve (275 spp., Dippenaar *et al.* 2008). This averages 228 species per reserve, ranging from 175 to 286 species.

Of the 268 species sampled, 33 spp. (12.3%) were data deficient and could not be identified to species level, 13 of them possibly being new to science (Table 3). However, these putative new species are representatives of species-rich families, and only after revisionary studies would it be possible to tell whether they are indeed new to science. Only the endemic species falling into categories 3–6 (75 spp., 29.0%) need to be evaluated using the International Union for Conservation of Nature (IUCN) criteria. The majority of the species sampled have a wide distribution in southern Africa or the Afrotropical Region and can be listed as LC (160 spp., 59.7%), while only 75 spp. (28.0%) are South African endemics.

**TABLE 2:** Spider diversity of Lekgalameetse Nature Reserve, with total number of families, genera and species sampled.

Family	Genera	Species
Agelenidae	1	1
Amaurobiidae	1	2
Araneidae	22	38
Caponiidae	1	1
Clubionidae	1	2
Corinnidae	6	6
Ctenidae	1	3
Cyrtacheniidae	1	1
Deinopidae	2	2
Dictynidae	1	2
Dipluridae	1	1
Eresidae	1	2
Eutichuridae	2	3
Gallieniellidae	1	1
Gnaphosidae	7	9
Hahniidae	1	1
Hersiliidae	1	2
Idiopidae	1	1
Linyphiidae	2	2
Liocranidae	2	2
Lycosidae	10	18
Mimetidae	2	2
Miturgidae	1	1
Nemesiidae	1	1
Nephilidae	2	3
Oonopidae	2	2
Oxyopidae	3	10
Palpimanidae	1	1
Philodromidae	4	6
Pholcidae	2	3
Phrurolithidae	1	1
Phyxelididae	2	4
Pisauridae	3	4
Salticidae	26	41
Scytodidae	1	3
Segestriidae	1	1
Selenopidae	1	4
Sparassidae	3	3
Tetragnathidae	4	9
Theraphosidae	1	1
Theridiidae	13	20
Thomisidae	17	33
Trachelidae	1	1
Uloboridae	4	5
Zodariidae	6	9
<b>Total</b>	<b>168</b>	<b>268</b>

Two species are so far unknown outside the reserve, *Hasarinella distincta* Haddad & Wesolowska, 2013 (Salticidae) and *Ballomma legala* Jocqué & Henrard, 2015 (Zodariidae), while five Limpopo endemic species are protected in the reserve: *Hortipes coccinatus* Bosselaers & Jocqué, 2000 (Corinnidae), *Xevioso lichmadina* Griswold, 1990 (Phyxelididae), *Euophrys limpopo* Wesolowska, Azarkina & Russell-Smith, 2014 (Salticidae), *Rumburak tuberatus* Wesolowska, Azarkina & Russell-Smith, 2014 (Salticidae) and *Palfuria spirembolis* Szuts & Jocqué, 2001 (Zodariidae).

During this study, new distribution and life history data on several species have been collected. Two species have been recorded from South Africa for the first time: *Ctenus caliginus*

**TABLE 3:** Level of endemicity of the spider species sampled at the Lekgalameetse Nature Reserve.

Distribution	Number spp.	Conservation status	%
DDT – Data deficient for taxonomic reasons	33	DDT	12.3
0 – Africa and wider	4	LC	1.5
1 – Africa	128	LC	47.8
2 – Southern Africa	28	LC	10.4
3 – Widespread in South Africa, > 3 provinces	64	SAE	23.9
4 – Two adjacent provinces	4	SAE/rare	1.5
5 – One province	5	LE/rare	1.9
6 – Only type locality	2	RE/rare	0.7

DDT, data deficient for taxonomic reasons; LC, least concern; LE, Limpopo endemic; RE, reserve endemic; SAE, South Africa endemic.

des Arts, 1912 (Ctenidae), a species previously only known from D.R. Congo and Burundi, and *Belippo calcarata* (Roewer, 1942) (Salticidae), a species previously known only from Angola and D.R. Congo. Many described species are known only from one sex, and during this survey the unknown sex of three species was sampled but has not yet been described: the females of *Hogna adjacens* Roewer, 1959 (Lycosidae), *Anyphops leleupi* Benoit, 1972 (Selenopidae) and *Tmarus natalensis* Lessert, 1925 (Thomisidae).

Only 5 species, *H. distincta*, *Heliophanus ndumoensis* Wesolowska & Haddad, 2013, *Langona hirsuta* Haddad & Wesolowska, 2011, *Thyenula sempiterna* Wesolowska, 1999 and *B. legala* were previously recorded from the LNR (Haddad & Wesolowska 2013; Wesolowska *et al.* 2014; Jocqué & Henrard 2015) and 263 spp. are recorded from the reserve for the first time. Presently, 2220 spider species are known from South Africa, thus 12.2% of South African species are protected in this reserve.

## Family diversity

Results from the Savanna Biome indicated that four spider families consistently dominate assemblages in terms of species richness (Foord *et al.* 2011b): Araneidae, Gnaphosidae, Salticidae and Thomisidae. In this study, three families correspond to this pattern, with the Salticidae (41 spp.), Araneidae (38 spp.) and Thomisidae (32 spp.) being the most species rich. The only deviation was the high diversity in the Theridiidae (20 spp.), while the Gnaphosidae was represented by only 9 spp. (Table 2 and Online Appendix 1). The low diversity of Gnaphosidae could be explained by their generally higher diversity in more arid savanna habitats in South Africa, while most of the sites in Lekgalameetse are mesic in character.

**Salticidae:** The Salticidae are free-living spiders found on tree trunks, soil, rocks and vegetation. They build small silk nests attached to various substrates, in which they moult, oviposit and sometimes mate, or which they occupy during periods of inactivity (Dippenaar-Schoeman 2014). Of the 41 spp. sampled, 37 are new records for the LNR, 1 is a LNR endemic (*H. distincta*), *Belippo calcarata* is recorded from South Africa for the first time and the *Rhene* sp. has been identified as possibly new to science (data deficient). Three other species are LE (7.3%), a further 9 species are South African endemics (21.9%), 10 species are southern African endemics (24.4%), while the rest (18 spp., 43.9%) are more widely distributed in Africa (Online Appendix 1).

**Araneidae:** The Araneidae are WB and produce typical orb-webs (OWB) and modified orb-webs (MOWB). The taxonomy of many genera in Africa is still unresolved and some of the species listed here might even be new. The family is very diverse, and most genera and species have a wide African distribution. Of the 38 species, 5 spp. (13.2%) are data deficient and the rest (33 spp., 86.8%) are of LC because of their wide distribution throughout Africa. Only three species, *Nemoscolus elongatus* Lawrence, 1947, *Ideocaira transversa* Simon, 1903 and *Larinia natalensis* (Grasshoff, 1971), are South African endemics, but they all have a wide distribution in the country. Members of two genera, *Acanthepeira* and *Larinioides*, were reported for the first time from South Africa (Dippenaar-Schoeman 2014). Species of four genera (*Acanthepeira*, *Araneus*, *Larinioides* and *Gea*) have been identified as possibly new, while one species could not be placed in a genus.

**Thomisidae:** The thomisids are free-living spiders commonly found on grass, shrubs, flowers and trees, and only few species were sampled from the soil surface. Thomisids are easily dispersed by wind and most species have a wide distribution. In the LNR, 17 genera represented by 33 spp. were sampled. Of these, only 6 spp. (18.2%) are known South African endemics, while the rest (27 spp., 81.8%) are widely distributed throughout Africa.

**Theridiidae:** The theridiids are WB commonly making their webs on vegetation or close to the soil surface. Their webs are known as cob-webs or gumfoot-webs. Thirteen genera represented by 20 spp. have been sampled, but half of these species are data deficient, representing either new species or unidentifiable because of unresolved taxonomy and only 4 spp. (20.0%) are South African endemics.

## Functional groups

Previously, general statements were made in placing species in functional groups or guilds, but with more detailed information becoming available through surveys in savanna where a wide variety of sampling methods were used, guild placement has improved considerably for some taxa (Dippenaar-Schoeman *et al.* 2009; Foord *et al.* 2008; Muelelwa *et al.* 2010). For the present study, two main guilds were recognised, namely wandering free-living spiders (W) and (WB), with further subdivisions based on micro-habitat and general behaviour, as observed during surveys (Online Appendix 1).

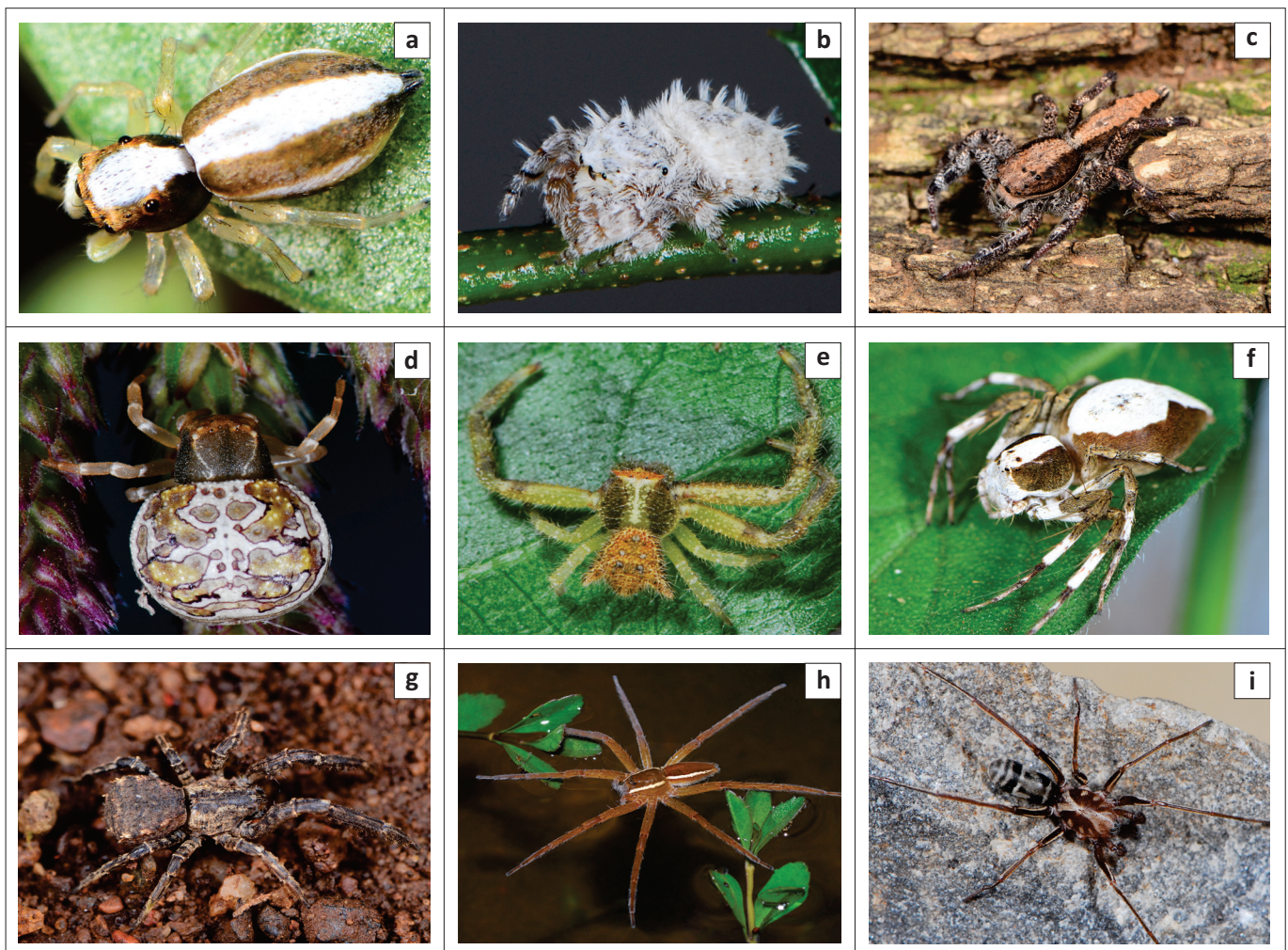
**Wanderers:** A total of 172 spp. (64.2%) are free-living spiders, with some species living on vegetation and others on the ground surface, and a few species occurring in both strata. The PW sampled from the grass and tree layer (Figure 3a–f) are represented by 90 spp. (33.6%). The Thomisidae (32 spp.), Salticidae (31 spp.) and Oxyopidae (10 spp.) were the most diverse plant dwellers found on grasses, shrubs and trees. Five spider species (1.9%) occur both on the ground and on vegetation and belong to Corinnidae and Salticidae (Online Appendix 1). A specimen in the genus *Neotama* (Hersilliidae) were collected in the Church Forest and represents the first record of this genus outside the Kwa-Zulu Natal province (Foord & Dippenaar-Schoeman 2005).

The majority of ground dwellers (Figure 3g–j) are free-living soil dwellers (72 spp., 26.9%), not including those living in burrows (5 spp., 1.9%). Most of the burrow dwellers belong to the suborder Mygalomorphae and include three trapdoor spider species, *Homostola vulpecula* Simon, 1892 (Cyrtachenidae), *Segregara transvaalensis* (Hewitt, 1913) (Idiopidae) and *Entypesa schoutedeni* Benoit, 1965 (Nemesiidae),

and a baboon spider species *Harpactirella overdijki* Gallon, 2010 (Theraphosidae). One species of wolf spider, *H. adjacens*, also constructs burrows. The Gnaphosidae (9 spp.) and Lycosidae (18 spp.) are the more diverse families of ground dwellers. Two of the ground dwellers are associated with fresh water, *Nilus margaritatus* (Pocock, 1898) and *Nilus rossi* (Pocock, 1902) (Pisauridae) and are commonly known as fish-eating spiders.

**Web-dwellers:** The web-dwellers (Figure 3k–o) are represented by 96 spp. (35.8%), with the largest number making orb-webs (57 spp., 19.0%), followed by gumfoot-webs (20 spp., 7.5%), retreat-webs (10 spp., 3.7%), sheet-webs (3 spp., 1.1%), space-webs (3 spp., 1.1%), funnel-webs (2 spp., 0.7%) and tube-webs (1 spp., 0.4%).

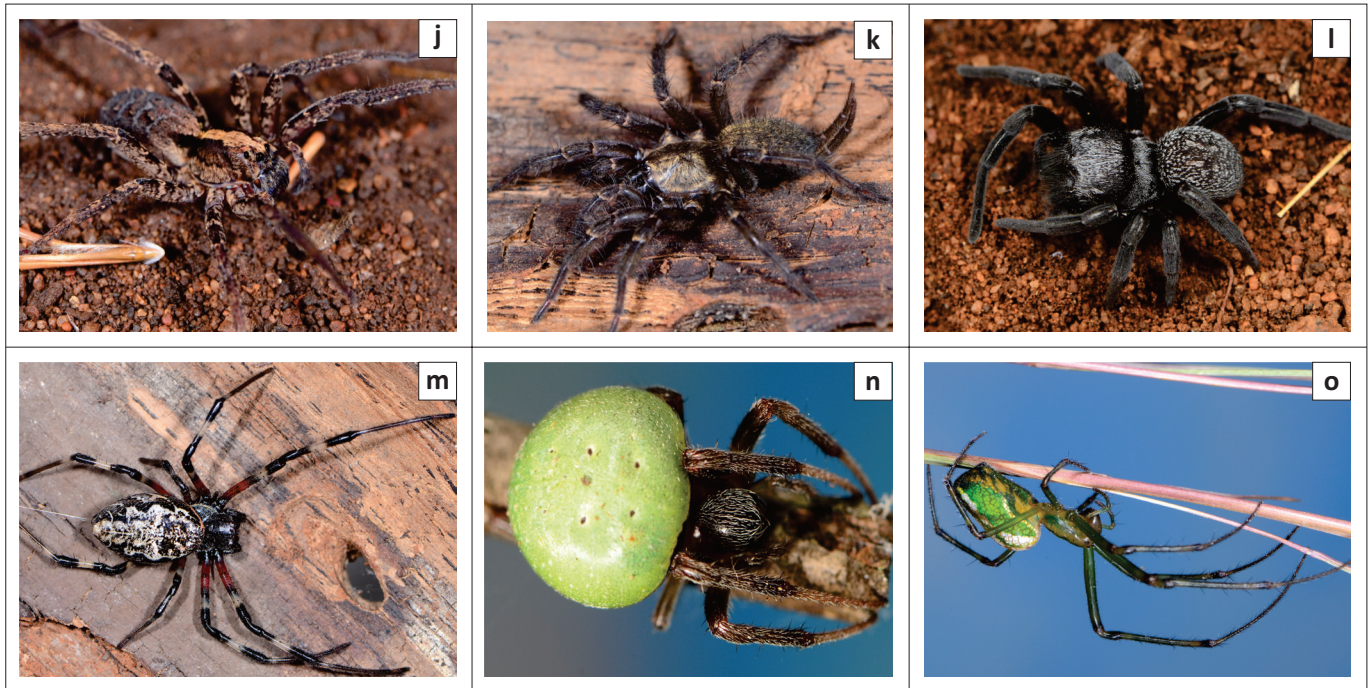
The physical structure of the habitat plays a role in the composition of the web-dwelling fauna, as it not only provides the necessary support for anchoring webs but also increases the availability of retreat space and modification of the microclimate, which could have an effect on spiders, as well as their prey. Several of the orb-web spiders recorded from the LNR, that is, *Argiope* (4 spp.), *Caerostris* (1 sp.),



Source: Photos taken by Peter Webb

**FIGURE 3:** Some common spiders of Lekgalameetse Nature Reserve: (a–f) plant dwellers, (g–j) ground dwellers, (k–o) web builders: (a) *Phintella lajuma* (Salticidae), (b) *Rhene* sp. (Salticidae), (c) *Menemerus eburnensis* (Salticidae), (d) *Thomisops pupa* (Thomisidae), (e) *Thomisus granulatus* (Thomisidae), (f) *Oxyopes affinis* (Oxyopidae), (g) *Barboropactus silvicola* (Thomisidae), (h) *Nilus margaritatus* (Pisauridae), (i) *Castianeira* sp. (Corinnidae), (j) *Ctenus transvaalensis* (Ctenidae), (k) *Thelechoris striatipes* (Dipluridae), (l) *Dresserus* sp. (Eresidae), (m) *Nephilingis cruentata* (Nephilidae), (n) *Araneus apricus* (Araneidae) and (o) *Leucauge festiva* (Tetragnathidae).

Figure 3 continues on the next page →



Source: Photos taken by Peter Webb

**FIGURE 3 (Continues...):** Some common spiders of Lekgalameetse Nature Reserve: (a–f) plant dwellers, (g–j) ground dwellers, (k–o) web builders: (a) *Phintella lajuma* (Salticidae), (b) *Rhene* sp. (Salticidae), (c) *Menemerus eburnensis* (Salticidae), (d) *Thomisops pupa* (Thomisidae), (e) *Thomisus granulatus* (Thomisidae), (f) *Oxyopes affinis* (Oxyopidae), (g) *Borboropactus silvicola* (Thomisidae), (h) *Nilus margaritatus* (Pisauridae), (i) *Castianeira* sp. (Corinnidae), (j) *Ctenus transvaalensis* (Ctenidae), (k) *Thelechoris striatipes* (Dipluridae), (l) *Dresserus* sp. (Eresidae), (m) *Nephilingis cruentata* (Nephilidae), (n) *Araneus apricus* (Araneidae) and (o) *Leucauge festiva* (Tetragnathidae).

*Gasteracantha* (3 spp.), *Isoxya* (2 spp.), Nephilidae (3 spp.) and Tetragnathidae (9 spp.), make large orb-webs that they attach to trees and shrubs. Most of these species are diurnal and they are found in their webs during the day.

The LNR is water-rich, which is reflected in the number of web-dwelling tetragnathids, a group usually associated with water. This includes two species of *Diphya*, five species of the silver vlei spiders (*Leucauge* spp.) and the long-jawed water orb-web spiders (*Tetragnatha boydi* O.P. Cambridge, 1898). A large number (15 spp.) of OWB are associated with grasslands (*Araneus*, *Kilima*, *Larinioides*, *Lipocrea* and *Neoscona*). Most of these species are nocturnal, making their orb-webs at night and resting in retreats, usually constructed in grass inflorescences, during the day. Four species make modified orb-webs, ranging from the tropical tent-web (*Cyrtophora*) to the single line orb-webs of the Uloboridae (*Miagrammopes*). In the Malta Forest, the Dipluridae funnel-web spider, *Thelechoris striatipes* (Simon, 1889), was sampled from trees, where their webs covered the bark with the silk and were decorated with moss.

## Conclusion

The current study provides the first report on the spider diversity of the LNR. As signatories to the Convention on Biodiversity, South Africa is obliged to develop a strategic plan for the conservation and sustainable utilisation of its diverse and species-rich fauna and flora. Preliminary investigations into the biodiversity of the invertebrate fauna in South Africa have highlighted the dilemma caused by a lack of baseline information on the ecology and diversity of

most arachnid groups (Dippenaar-Schoeman 2002). With the ecology and diversity of the spider fauna of South Africa so poorly known, each survey contributes to our knowledge on the geographical distribution of spider species. Established reserves, such as LNR, can make a substantial contribution towards invertebrate conservation. However, the contribution of existing reserves can only be highlighted through studies such as the present. This survey formed part of the SANSA for the Savanna Biome, as well as the Limpopo province, and as such, represents new distribution records for 263 species. Although this paper probably represents only a portion of the spider fauna present, we hope this information will stimulate further interest and research.

## Acknowledgements

### Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

### Authors' contributions

S.H.F. undertook and organised the SANSA survey and assisted in writing of manuscript; A.S.D-S. is the SANSA project manager, did the identifications and wrote the first draft of the manuscript; R.J. undertook a survey to LNR and assisted in the sorting and identification of the material sampled; C.R.H. is the SANSA assistant project manager and assisted with the identifications of some families and editing of manuscript; R.L. is the curator of the National Collection of Arachnida and assisted with the curation,

databasing and conservation assessment of the sampled material and P.W. undertook three of the field surveys, photographed all the specimens and assisted with editing the manuscript.

## References

- Azarkina, G.N. & Foord, S.H., 2014, 'A revision of the Afrotropical species of *Festucula* Simon, 1901 (Araneae: Salticidae)', *African Invertebrates* 55, 351–375. <http://dx.doi.org/10.5733/afin.055.0201>
- Dippenaar, S.M., Modiba, M.A., Khoza, T.T. & Dippenaar-Schoeman, A.S., 2008, 'A checklist of the spiders (Arachnida, Araneae) of the Polokwane Nature Reserve, Limpopo Province, South Africa', *Koedoe* 50, 10–17. <http://dx.doi.org/10.4102/koedoe.v50i1.128>
- Dippenaar-Schoeman, A.S., 2002, *Baboon and trapdoor spiders of Southern Africa: An identification manual*. Agricultural Research Council, Pretoria.
- Dippenaar-Schoeman, A.S., 2013, 'First national species lists of South African arachnids available', *Plant Protection News* 95, 6.
- Dippenaar-Schoeman, A.S., 2014, *Field guide of the spiders of South Africa*, Lapa Publisher, Pretoria.
- Dippenaar-Schoeman, A.S., Foord, S.H. & Haddad, C.R., 2013, *Spiders of the Savanna Biome*, University of Venda & Agricultural Research Council, Limpopo.
- Dippenaar-Schoeman, A.S., Haddad, C.R., Foord, S.H., Lyle, R., Lotz, L.N., Helberg, L. *et al.*, 2010, *First Atlas of the Spiders of South Africa*, South African National Survey of Arachnida Technical Report Version 1. Agricultural Research Council, Pretoria.
- Dippenaar-Schoeman, A.S., Haddad, C.R., Foord, S.H., Lyle, R., Lotz, L.N. & Marais, P., 2015, 'South African National Survey of Arachnida (SANSA): Review of current knowledge, constraints and future needs for documenting spider diversity (Arachnida: Araneae)', *Transactions of the Royal Society of South Africa* 70, 245–275. <http://dx.doi.org/10.1080/0035919X.2015.1088486>
- Dippenaar-Schoeman, A.S. & Leroy, A., 2003, 'A check list of the spiders of the Kruger National Park, South Africa (Arachnida: Araneae)', *Koedoe* 46, 91–100. <http://dx.doi.org/10.4102/koedoe.v46i1.40>
- Dippenaar-Schoeman, A.S., Van den Berg, A. & Prendini, L., 2009, 'Spiders and Scorpions (Arachnida: Araneae, Scorpiones) of the Nylsvley Nature Reserve, South Africa', *Koedoe* 51, 1–9. <http://dx.doi.org/10.4102/koedoe.v51i1.161>
- Foord, S.H. & Dippenaar-Schoeman, A.S., 2005, 'First records of the genus *Neotama* Baehr & Baehr (Araneae: Hersiliidae) from the Afrotropical Region', *African Invertebrates* 45, 125–132.
- Foord, S.H., Dippenaar-Schoeman, A.S. & Haddad, C.R., 2011a, 'South African spider diversity: African perspectives on the conservation of a mega-diverse group', in O. Grillo & G. Venora (eds.), *Changing diversity in changing environment*, pp. 163–182, In Tech Publishing, Rijeka.
- Foord, S.H., Dippenaar-Schoeman, A.S. & Haddad, C.R., 2011b, 'The faunistic diversity of spiders (Arachnida, Araneae) of the Savanna Biome in South Africa', *Transactions of the Royal Society of South Africa* 66, 170–201. <http://dx.doi.org/10.1080/0035919X.2011.639406>
- Foord, S.H., Mafadza, M.M., Dippenaar-Schoeman, A.S. & Van Rensburg, B.J., 2008, 'Micro-scale heterogeneity of spiders (Arachnida: Araneae) in the Soutpansberg, South Africa: A comparative survey and inventory in representative habitats', *African Zoology* 43, 156–174. <http://dx.doi.org/10.3377/1562-7020-43.2.156>
- Haddad, C.R., 2009, '*Vendaphaea*, a new dark sac spider genus apparently endemic to the Soutpansberg Mountains, South Africa (Araneae: Corinnidae)', *African Invertebrates* 50, 269–278. <http://dx.doi.org/10.5733/afin.050.0204>
- Haddad, C.R. & Dippenaar-Schoeman, A.S., 2015, 'Diversity of non-acarine arachnids of the Ophathe Game Reserve, South Africa: Testing a rapid sampling protocol', *Koedoe* 57(1), Art. #1255, 1–15. <http://dx.doi.org/10.4102/koedoe.v57i1.1255>
- Haddad, C.R. & Wesolowska, W., 2013, 'Additions to the jumping spider fauna of South Africa (Araneae: Salticidae)', *Genus* 24, 459–501.
- Jocqué, R. & Henrard, A., 2015, '*Ballomma*, a new Afrotropical genus in the Cryptothelinae (Araneae, Zodariidae): Eyes on the run', *European Journal of Taxonomy* 163, 1–24. <http://dx.doi.org/10.5852/ejt.2015.163>
- McGeoch, M.A., Sithole, H., Samways, M.J., Simaika, J.P., Pryke, J.S., Picker, M. *et al.*, 2011, 'Conservation and monitoring of invertebrates in terrestrial protected areas', *Koedoe* 53(2), Art. #1000, 1–13. <http://dx.doi.org/10.4102/koedoe.v53i2.1000>
- Modiba, M.A., Dippenaar, S.M. & Dippenaar-Schoeman, A.S., 2005, 'A checklist of spiders from Sovenga Hill, an inselberg in the Savanna Biome, Limpopo Province, South Africa (Arachnida: Araneae)', *Koedoe* 48, 109–115. <http://dx.doi.org/10.4102/koedoe.v48i2.95>
- Mucina, L. & Rutherford, M.C., 2006, 'The vegetation of South Africa, Lesotho and Swaziland', *Strelitzia* 19, 1–807.
- Muelelwa, M.I., Foord, S.H., Dippenaar-Schoeman, A.S. & Stam, E.M., 2010, 'Towards a standardized and optimized protocol for rapid assessments: Spider species richness and assemblage composition in two savanna vegetation types', *African Zoology* 45, 273–290. <http://dx.doi.org/10.3377/004.045.0206>
- Wesolowska, W., Azarkina, G.N. & Russell-Smith, A., 2014, 'Euophryine jumping spiders of the Afrotropical Region – New taxa and a checklist (Araneae: Salticidae: Euophryinae)', *Zootaxa* 3789, 1–72. <http://dx.doi.org/10.11646/zootaxa.3789.1.1>
- Wesolowska, W. & Haddad, C.R., 2013, 'New data on the jumping spiders of South Africa (Araneae: Salticidae)', *African Invertebrates* 54, 177–240.
- Whitmore, C., Crouch, T.E., Slotow, R. & Dippenaar-Schoeman, A.S., 2001, 'Checklist of spiders (Araneae) from Makalali Private Game Reserve, Northern Province, South Africa: Including a new family record', *Durban Museum Novitates* 26, 10–19.
- Williams, M.C. & Altenroxel, B., 2014, 'The butterflies (Lepidoptera: Papilionoidea) of Leggalameetse Provincial Park, Limpopo Province, South Africa', *Metamorphosis* 25, 126–137.