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Checklist of the spiders (Arachnida, Araneae) of the Table Mountain National Park, South Africa

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The Table Mountain National Park (TMNP) is an iconic protected area in South Africa, renowned for the high levels of plant and animal species richness and endemism. An annotated species list of spiders presently known from the TMNP is provided. The checklist was compiled from data collected from the South African National Survey of Arachnida (SANSA) database. A total of 261 species from 50 families and 167 genera are presently protected in the park. The most species-rich families are the Salticidae (31 spp.), Thomisidae (26 spp.) and Araneidae (20 spp.), while 13 families are represented by singletons. The global distribution, endemicity and International Union for the Conservation of Nature (IUCN) Red List status of each species is provided.

Conservation implications: Seventy-seven per cent of the species have a wide distribution range and are of Least Concern (200 spp.), while 31 species are Data Deficient, four species were not evaluated, and 26 species of special concern are identified. Of these, 13 spp. are Rare, three each are Critically Rare and Endangered, six are Vulnerable and one is near threatened. The TMNP protects approximately 11.4% of the total South African spider fauna and it is the type locality for 31 species. Although the TMNP and Cape Peninsula more broadly is a hotspot of endemic species for various plant and animal taxa: a proportionally small proportion of the spider species are of significant conservation concern.

Keywords: conservation; endemicity; Fynbos biome; South African National Survey of Arachnida; Table Mountain National Park.

Introduction

The South African National Survey of Arachnida (SANSA) was initiated in 1997 with the main aim to discover, describe and make an inventory of the South African arachnid fauna (Dippenaar-Schoeman et al. 2015). Species distribution data provided essential foundational information necessary for the conservation assessments to compile a Red Data List of the Araneae of South Africa (Foord et al. 2020). The recently published national checklist (Dippenaar-Schoeman et al. 2023a) was based on data collected for preparation of the First Atlas of South African Spiders (Dippenaar-Schoeman et al. 2010), but with continued surveys and new taxonomic data, updated information is now available.

In South Africa, the Western Cape province, with 966 described species recorded (Dippenaar-Schoeman et al. 2015), is one of the best-sampled provinces, with several published articles on conserved areas: Karoo National Park (Dippenaar-Schoeman et al. 1999), Swartberg Nature Reserve (Dippenaar-Schoeman et al. 2005), De Hoop Nature Reserve (Haddad & Dippenaar-Schoeman 2009), Cederberg Wilderness Area (Foord & Dippenaar-Schoeman 2016), Bontebok National Park (Dippenaar-Schoeman et al. 2021), Baviaanskloof Mega Reserve (Dippenaar-Schoeman et al. 2023b), Gondwana Private Game Reserve (Dippenaar-Schoeman & Buck 2023) and Fernkloof Nature Reserve. In addition, spiders have been included in ecological studies in arthropods carried out in the Kogelberg Biosphere Reserve (Van Schalkwyk et al. 2019a, 2019b, 2020; Yekwayo et al. 2018, 2019), Jonkershoek Valley (Swart, Pryke & Roets 2017) and Garden Route National Park (Swart et al. 2018, 2019, 2020a; Swart, Samways & Roets 2020b).

The Table Mountain National Park (TMNP) is one of the most iconic protected areas in South Africa, even though it was only formally declared in 1998. It has an extent of approximately 265 km^2, covering most of the natural vegetation of the Cape Peninsula. Aside from the significance of the park from a tourism and socioeconomic perspective (Dube & Muresherwa 2019), it is also exceptionally rich in both terrestrial and marine biodiversity, with recently published reviews highlighting the richness of endemic taxa (e.g. Picker & Samways 1996; Rebelo et al. 2011),

Note: Additional supporting information may be found in the online version of this article as Online Appendix 1.

including cave invertebrates (Ferreira et al. 2020; Sharratt, Picker & Samways 2000), harvestmen (Lotz 2009), plants (Helme & Trinder-Smith 2006) and marine organisms (Kock et al. 2022), but being less significant for grasshoppers compared with other protected areas in the Cape Floristic Kingdom (Matenaar, Bazelet & Hochkirch 2015).

Historically, the TMNP has been far better sampled for spiders than any other protected area in the Western Cape. Spiders and other invertebrates formed part of surveys to address several ecological questions around the conservation of biodiversity on Table Mountain (Picker & Samways 1996; Pryke 2008; Pryke & Samways 2008, 2009a, 2009b, 2010, 2012; Rebelo et al. 2011; Uys 2012). This also included surveys from several temperate sandstone caves falling within the TMNP (Dippenaar-Schoeman & Myburgh 2009; Ferreira et al. 2020; Lawrence 1964; Sharratt et al. 2000). From Kirstenbosch National Botanical Garden three published accounts of the fauna (Le Roux & Dippenaar-Schoeman 2016; Pryke & Samways 2009b; Tucker 1920) are available, but a comprehensive checklist will be available soon (Dippenaar et al. 2023b).

This study presents the first annotated checklist of the TMNP. Data for this checklist were primarily obtained from taxonomic articles and faunistic surveys that formed part of the data collation process for SANSA. All historical and existing published records, as well as newly sampled records, were used to compile the list. Recently collected specimens from several surveys that were undertaken by the Universities of Stellenbosch, Rhodes, Free State and Cape Town are also included. The annotated checklist contains information on the species' global distribution, endemicity and conservation status, with notes on the species of special conservation concern occurring in the park.

Research methods and design

Study area

The TMNP is found within the Cape Peninsula, an area in the southwestern corner of Africa. It was proclaimed on 19 May 1998 for the purpose of protecting the natural environment of the Table Mountain Chain, and in particular the rare and endemic fynbos vegetation.

The park covers an area of 250 km^2 and is part of the larger UNESCO World Heritage Site known as the Cape Floral Region Protected Area World Heritage Site. It is an area of outstanding biological diversity, as it is located within the Cape Floristic Region (CFR): a region recognised as one of the six floral kingdoms of the world (Goldblatt 1997) and one of the 34 global biodiversity hotspots (Mittermeier et al. 2011). The TMNP represents 53% of the area of the Cape Peninsula and is one of the largest protected areas in the Western Cape. With a buffer zone of 5 km around the borders of the TMNP, it covers the entire Peninsula (Rebelo et al. 2011). The entire TMNP is embedded within the greater City of Cape Town. Thus, this area covers the Peninsula Mountain Chain, as well as a portion of the lowland areas to the east, traditionally known as the Cape Flats.

Rebelo et al. (2014) produced an updated vegetation map of the Cape Peninsula, distinguishing 14 vegetation units. Much of the area of the TMNP is dominated by Peninsula Granite Fynbos, while the top of the mountain and some slopes predominantly contain Peninsula Sandstone Fynbos. There are also patches of natural indigenous Southern Afrotemperate Forests on the eastern and southern sides and top of the mountain, with patches concentrated in ravines. Aside from the natural vegetation, there are also parts of recovering indigenous forests and fynbos (pines removed within the last 5 years), alien pine plantations and various alien invasive plant species. Additionally, the world famous Kirstenbosch National Botanical Gardens are located on the southern slope of Table Mountain.

Four vegetation types, namely Peninsula Granite Fynbos, Peninsula Sandstone Fynbos, Peninsula Shale Fynbos and Peninsula Shale Renosterveld, are endemic to the Peninsula and conserved exclusively in the TMNP (Rebelo et al. 2011). Some 158 plant species are endemic to the Cape Peninsula (Helme & Trinder-Smith 2006), and many species of conservation concern are declining and are under severe threat (Cowell et al. 2023). A recent study indicated that the extent of Afrotemperate and Milkwood forests on the Cape Peninsula expanded overall by 65.3% over the course of 64 years (Poulsen & Hoffman 2015), which could be regarded as positive considering their highly fragmented nature and the geographical isolation of their associated fauna within the fynbos-dominated matrix. Although fire is an essential management tool and ecological disturbance in fynbos systems, the frequency of fires has increased and the return intervals has decreased in recent decades (Forsyth & Van Wilgen 2008), having potentially negative impacts on biodiversity.

Specimen data

Spiders and other taxa have been sampled on the Cape Peninsula for a long time, with species descriptions of spiders from '*Cap*' (Cape) or '*Cap de bon Esperance*' (Cape of Good Hope) dating back more than 200 years (Walckenaer 1805). Most of the early material was collected and deposited in museums in Europe, but the species described from the region have all been recorded and accounted for through a comprehensive literature search that formed the basis of SANSA (Dippenaar-Schoeman et al. 2010, 2015, 2023a). Once the South African Museum (SAMC) was established in Cape Town in 1825, much of the material collected from the Cape Peninsula by local researchers was deposited there and included in later taxonomic studies (Van Noort & Robertson 2012). However, much of the type material of species described by European taxonomists was kept in their collections, typical practice at that time. According to the South African collections audit of Hamer (2012), the SAMC has the largest number of zoological type specimens and the second highest number of species represented by types in the country, making it a collection of great significance for spiders and other animals.

More recently, a wide range of invertebrate sampling techniques have been used during surveys in the TMNP, including pitfall trapping, quadrat searches, Berlese-Tullgren funnel litter extractions, aerial surveys, window trapping, D-vac suction sampling, pan traps, beating, sweep-netting and litter sifting. Most of the voucher specimens sampled during these surveys, and other ad hoc collecting efforts, are deposited in the National Collection of Arachnida (NCA) at the Agricultural Research Council (ARC), the KwaZulu-Natal Museum (NMSA) and the National Museum in Bloemfontein (NMBA).

Conservation status

We evaluated the conservation status of all spiders (Online Appendix 1) using the IUCN Red List categories indicated in Table 1. Species that were only recorded from immatures, those representing possible new species and those that could not be identified to species level using current taxonomic literature were not evaluated (NE). Species known from only one sex, old material or that had not been revised or redescribed were considered data deficient either for taxonomic reasons or a lack of accurate distribution data (DD). Species with a broad distribution (endemism categories 0–4 described next) were considered to be of least concern (LC), including those of categories 3–4, which are broader South African endemics (SAE). The species included in categories 5–6 are Western Cape endemics (WCE). Species with a score of 0 occur beyond the Afrotropical Region too and include generally widespread cosmopolitan species, African species that have been introduced elsewhere, as well as alien species that have been introduced into South Africa.

Species endemicity

The endemicity index was provided for each species (Online Appendix 1). It was calculated based on current distribution, which included six endemicity categories, ranging from: 6 = endemic, known only from type locality or one locality only (TMNP; 5 = known from the Western province only, wider than type locality (WCE); 4 = known from two adjoining provinces only; 3 = South Africa, > two provinces or not adjoining (South African endemic, SAE); 2 = Southern Africa (south of Zambezi and Kunene Rivers) (Southern African endemic, STHE); 1 = Afrotropical Region (African Endemic, AE); 0 = Africa and wider (Cosmopolitan, C).

TABLE 1: Conservation status and endemicity of the spider species sampled at the Table Mountain National Park.

Conservation and endemicity indexes	SPP.	%
Conservation status		
DD – data deficient	30	11.5
LC – least concern	201	77.1
NE – not evaluated	4	1.5
Species of special concern		
Rare	13	5.0
CR – critical rare	3	1.1
VU – vulnerable	6	2.3
NT – near threatened	1	0.4
EN – endangered	3	1.1
Endemicity		
0 – Africa and wider (C)	24	9.2
1 – Africa endemics (AE)	50	19.2
2 – Southern African endemics (STHE)	47	18.0
3 – South African endemics (SAE)	43	16.5
4 – South African endemics (SAE): two adjacent provinces	29	11.1
5 –Western Cape endemics (WCE)	60	23.0
6 – Table Mountain National Park endemics (TMNP)	4	1.5
Not evaluated	4	1.5

Ethical considerations

Ethical clearance to conduct this study was obtained from the South African National Parks Permit (No. CRC/2022/TEMP_01/V1).

Results and discussion

Species present

This is the first checklist of the spiders of the TMNP. A total of 50 families represented by 167 genera and 261 species have been collected from TMNP (Table 2; Online Appendix 1). The Salticidae (31 spp.), Thomisidae (26 spp.), Araneidae (20 spp.) and Gnaphosidae (19 spp.) were the most species-rich families (Table 2). There was a very high proportion of singleton families (15), that is represented by a single species only. This pattern is consistent with the faunal composition of the De Hoop Nature Reserve (252 spp.; Haddad & Dippenaar-Schoeman 2009) and, to a slightly lesser extent, the Fernkloof Nature Reserve (206 spp.; Hamilton-Attwell & Dippenaar-Schoeman 2023), which have also been well sampled.

TABLE 2: Spider diversity of the Table Mountain National Park (TMNP), with families and their total number of genera and species sampled.

FAMILIES	GEN	SPP	FAMILIES	GEN	SPP
Agelenidae	2	3	Migidae	1	3
Amaurobiidae	4	6	Mimetidae	1	1
Anapidae	1	2	Oecobiidae	1	1
Anyphaenidae	1	1	Oonopidae	1	1
Araneidae	13	20	Oxyopidae	2	5
Bemmeridae	1	2	Palpimanidae	2	2
Caponiidae	2	2	Philodromidae	5	7
Cheiracanthiidae	2	5	Pholcidae	3	5
Clubionidae	1	2	Phyxelididae	2	2
Corinnidae	1	1	Pisauridae	5	5
Ctenidae	1	1	Prodidomidae	2	4
Cyatholipidae	4	4	Salticidae	22	31
Cyrtaucheniidae	1	1	Scytodidae	1	3
Deinopidae	1	1	Segestriidae	1	3
Desidae	1	1	Selenopidae	1	2
Drymusidae	1	1	Sparassidae	2	4
Dysderidae	1	1	Tetragnathidae	4	6
Entypesidae	1	1	Theraphosidae	2	4
Eresidae	3	4	Theridiosomatidae	1	1
Gallieniellidae	1	1	Theridiidae	7	12
Gnaphosidae	11	19	Thomisidae	17	26
Hahniidae	1	5	Trachelidae	5	8
Linyphiidae	6	6	Uloboridae	1	1
Liocranidae	2	3	Zodariidae	7	13
Lycosidae	6	16	Zoropsidae	2	2

Note: Total number of families = 50; total number of GEN = 167 and total number SPP = 261.
GEN, number if genera sampled; SPP, number of species sampled.

Common species

Spiders can generally be divided into two broad guilds, based on their prey capture behaviour, that is hunters and web builders. Some of the common hunting spiders reported on plants in the TMNP include long-legged sac spiders (Cheiracanthiidae; Figure 1a) and sac spiders (Clubionidae; Figure 1b), the lynx spider, *Oxyopes bothai* Lessert, 1915 (Oxyopidae; Figure 1c), the jumping spiders *Dendryphantes purcelli* Peckham & Peckham, 1903 (Figure 1d), *Heliophanus capensis* Wesołowska, 1986 (Figure 1e) and *Thyene inflata* (Gerstäcker, 1873) (Salticidae; Figure 1g), the huntsman spiders *Palystes castaneus* (Latreille, 1819) (Figure 1h) and *Parapalystes megacephalus* (C.L. Koch, 1845) (Sparassidae; Figure 1i) and various crab spiders (Thomisidae; Figure 1i–m). Two hunting species commonly encountered around human habitation are the cosmopolitan jumping spider, *Menemerus bivittatus* (Dufour, 1831) (Salticidae; Figure 1d) and *Palystes castaneus*. The rare Cape Peninsula endemic, *Chariobas navigator* Strand, 1909 (Zodariidae; Figure 1n), can be found in grasses and restios, where it stitches stalks together to form a retreat, while the WCE *Phanotea ceratogyna* Griswold, 1994 (Zoropsidae; Figure 1o) occurs in forest leaf litter.

Web-building spiders construct silk structures between vegetation or under rocks and logs, in which prey becomes entangled and can be captured. Common taxa on foliage include *Chresiona* spp. (Amaurobiidae; Figure 2a), orb-web spiders (Araneidae; Figure 2b–e), *Microlinyphia sterilis* (Pavesi, 1883) (Linyphiidae; Figure 2h), orchard spiders such as *Leucauge festiva* (Blackwall, 1866) (Tetragnathidae; Figure 2k), and various theridiid (Figure 2m), undescribed theridiosomatid (Figure 2n) and uloborid spiders (Figure 2o). Tiny Cyatholipidae such as *Ubacisi capensis* (Griswold, 1987) (Figure 2f) often have restricted distributions and are typically found in Afromontane forests, while the small daddy long-legs spiders of the genera *Spermophora* Hentz, 1841 (Figure 2i) and *Quamtana* Huber, 2003 (Pholcidae), false violin spiders, *Izithunzi capense* (Simon, 1893) (Drymusidae; Figure 2g), and mesh-web spiders, *Malaika longipes* (Purcell, 1904) (Phyxelididae; Figure 2j) are especially common in forest leaf litter and under logs. The highly venomous *Latrodectus indistinctus* O.P.-Cambridge, 1904 (Theridiidae; Figure 2l) builds its webs under rocks and logs and in crevices in fynbos.

Conservation status

Of the 261 species sampled, 30 spp. (11.5%) are DD, that is lacking taxonomic or distribution data, while four species (1.5%) were NE (Table 1; Online Appendix 1). The majority of the species (197 spp., 75.8%) sampled have a wide distribution range and are listed as being LC (Table 1). Twenty-six of the species recorded are of special concern, falling into one of five threat categories (Table 3). Two species, *Crozetulus scutatus* (Lawrence, 1964) (Anapidae) and *Lepthyphantes rimicola* Lawrence, 1964 (Linyphiidae), previously thought to be endemic to caves on the Cape Peninsula (Sharratt et al. 2000), have been more widely collected in South Africa recently (Dippenaar-Schoeman et al. 2010, 2023a) and can no longer be considered as local endemics.

A considerable proportion of the species of special concern are associated with the Wynberg Caves, a sandstone cave system on top of Table Mountain. Several articles have included spiders in consideration of its biodiversity and endemism of its fauna (Dippenaar-Schoeman & Myburgh 2009; Ferreira et al. 2020; Sharratt et al. 2000) of which some species remain undescribed, so a more thorough expert study on the cave fauna in the TMNP is essential to describe new species and evaluate their levels of endemism, particularly in light of the threats posed to this system by humans and climate change (Ferreira et al. 2020).

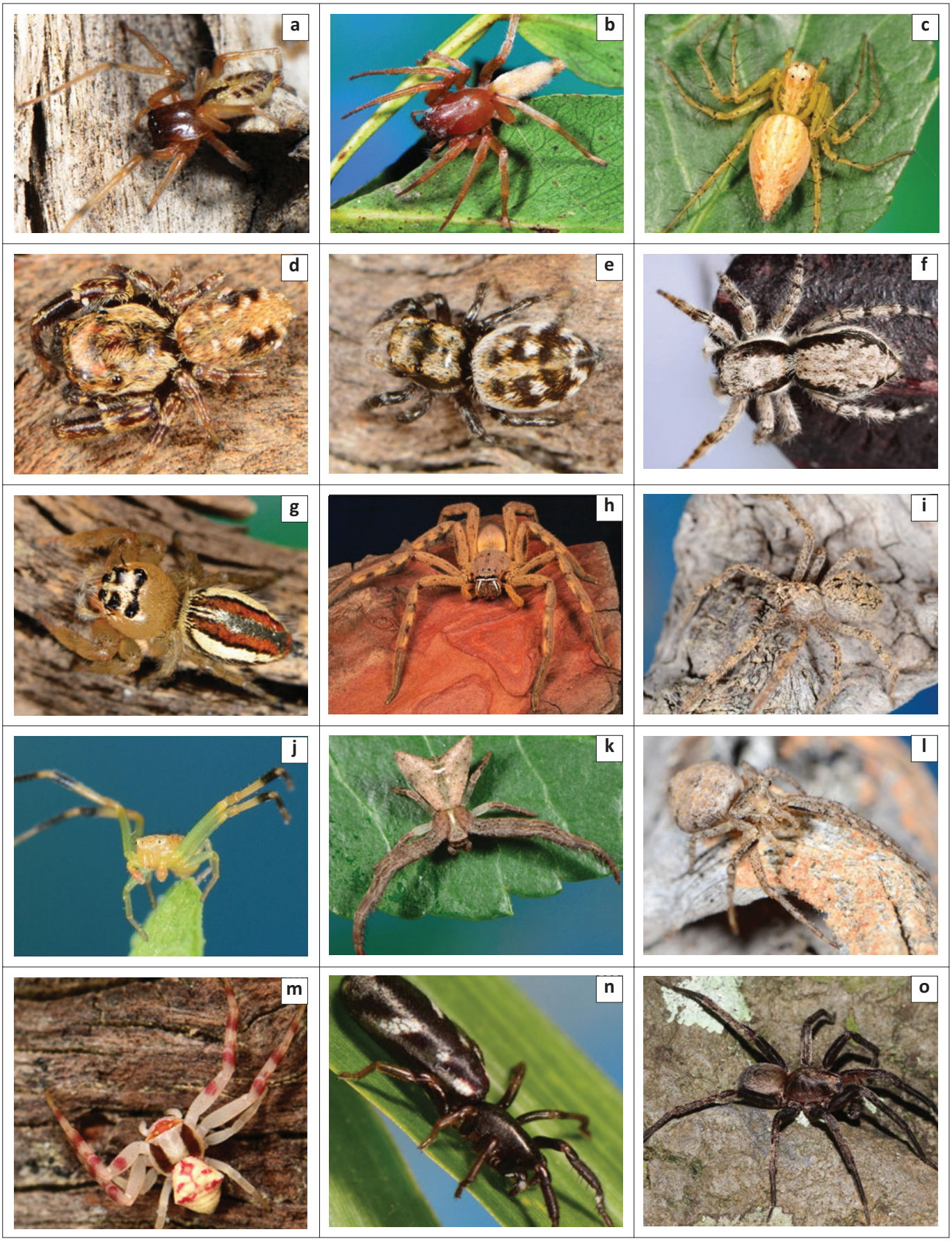
Species endemicity

A large number of species (50 spp.; 19.2%) are African endemics and have a wide distribution throughout Africa, while 24 spp. (9.6%) are found in countries outside Africa; 47 spp. (18.0%) are endemic to southern Africa, and 136 spp. (52.1%) are South African endemics.

Most taxonomic research in South Africa was undertaken period from 1700 to 1950, focusing largely on the fauna of the coastal provinces, as most of the practicing arachnologists were stationed there. This resulted in a large number of species being described that are endemic to the Western Cape (65 spp.; 24.9%) although some endemics have only recently been described. Of these, four species are known only from the TMNP: *Myrmarachne albosetosa* Wanless, 1978 (Salticidae), *Afroceto bisulca* Lyle & Haddad, 2010 (Trachelidae), *Chariobas navigator* and *Palystes megacephalus*. However, more data are needed for all four species, as they are currently listed as data deficient. Several new species have been discovered that belong to the Philodromidae and Theridiosomatidae.

Conclusion

A total of 261 species have been recorded from the TMNP to date, with most of them included in the recently completed Spider Red Listing project and National Spider Checklist. The spider fauna of the TMNP represents 11.4% of the currently recorded South African species, with 26 species being considered of special conservation concern that require further collecting and monitoring to improve our knowledge of their distribution. Although the TMNP and Cape Peninsula are considered an area rich in endemics for various plant and animal taxa, it is not exceptionally unique where the spider fauna is concerned. Nonetheless, populations of the species of special conservation concern require particular management interventions that can form part of integrate management plans to conserve other biota in the TMNP, which are subject to similar threat. This should aim to reduce anthropogenic impacts on their habitats, particularly with respect to urban expansion, the spread of alien invasive vegetation and uncontrolled and unprescribed fires in fynbos.



Source: Photo credits (photographers retain image copyright): a–e, g, i–n Peter Webb; f Vida van der Walt; h Jan Bossealaers; o Jolandie Buck

FIGURE 1: Selected hunting of the Table Mountain National Park: (a) *Cheiramiona clavigera* (Cheiracanthiidae); (b) *Clubiona lawrencei* (Clubionidae); (c) *Oxyopes bothai* (Oxyopidae); (d) *Dendryphantes purcelli* (Salticidae); (e) *Heliophanus capensis* (Salticidae); (f) *Menemerus bivittatus* (Salticidae); (g) *Thyene inflata* (Salticidae); (h) *Palystes castaneus* (Sparassidae); (i) *Parapalystes megacephalus* (Sparassidae); (j) *Misumenops rubrodecoratus* (Thomisidae); (k) *Phyrnarachne melloleitoai* (Thomisidae); (l) *Pherecydes tuberculatus* (Thomisidae); (m) *Thomisus citrinellus* (Thomisidae); (n) *Chariobas navigator* (Zodariidae); (o) *Phanotea ceratogyna* (Zoropsidae).

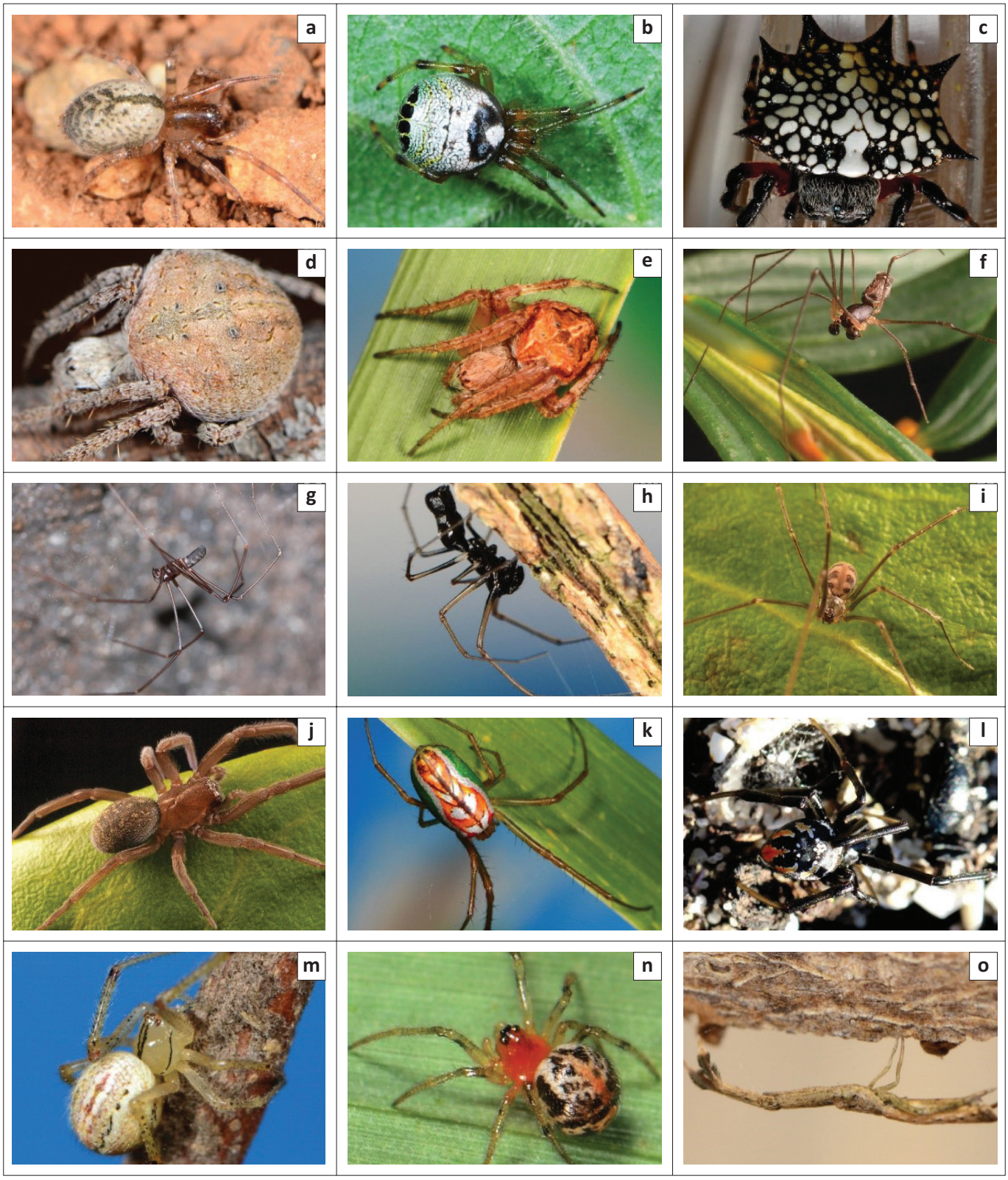


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FIGURE 2: Selected web-building spiders of the Table Mountain National Park: (a) *Chresiona convexa* (Amaurobiidae); (b) *Bijoaraneus legonensis* (Araneidae); (c) *Isoxya cicatrocosa* (Araneidae); (d) *Neoscona hirta* (Araneidae); (e) *Neoscona subfusca* (Araneidae); (f) *Ubacisi capensis* (Cyatholipidae); (g) *Izithunzi capense* (Drymusidae); (h) *Microlinyphia sterilis* (Linyphiidae); (i) *Spermophora peninsulae* (Pholcidae); (j) *Malaika longipes* (Phyxelididae); (k) *Leucauge festiva* (Tetragnathidae); (l) *Latrodectus indistinctus* (Theridiidae); (m) *Enoplognatha inornata* (Theridiidae); (n) Undescribed Theridiosomatidae sp.; (o) *Miagrammopes brevicaudus* (Uloboridae).

TABLE 3: Species of special concern recorded from the Table Mountain National Park.

IUCN category	Family	Species
Rare	Cyatholipidae	*Ilisoa conjugalis* Griswold, 1987
	Drymusidae	*Izithunzi capense* (Simon, 1893)
	Migidae	*Moggridgea teresae* Griswold, 1987
	Pholcidae	*Spermophora gordimerae* Huber, 2003
		Spermophora peninsulae Lawrence, 1964
	Phyxelididae	*Malaika longipes* (Purcell, 1904)
	Salticidae	*Chinophrys trifasciata* Wesołowska, Azarkina & Russell-Smith, 2014
		Rumburak lateripunctatus Wesołowska, Azarkina & Russell-Smith, 2014
		Tanzania striatus Wesołowska, Azarkina, Russell-Smith, 2014
	Scytodidae	*Scytodes montana* Purcell, 1904
	Selenopidae	*Anyphops kraussi* (Pocock, 1898)
	Trachelidae	*Afroceto capensis* Lyle & Haddad, 2010
	Zoropsidae	*Phanotea ceratogyna* Griswold, 1994
Critically rare	Anapidae	*Crozetulus scutatus* (Lawrence, 1964)
	Linyphiidae	*Lepthyphantes rimicola* Lawrence, 1964
	Pholcidae	*Quamtana leptopholcica* (Strand, 1909)
Endangered	Migidae	*Moggridgea quercina* Simon, 1903
	Sparassidae	*Palystes kreuzmanni* Jäger & Kunz, 2010
	Zodariidae	*Rotundrela rotunda* Jocqué, 1999
Vulnerable	Migidae	*Moggridgea terricola* Simon, 1903
	Scytodidae	*Scytodes gooldi* Purcell, 1904
	Trachelidae	*Fuchibotulus bicornis* Haddad & Lyle, 2008
	Zodariidae	*Diores capensis* Tucker, 1920
		Diores dowsetti Jocqué, 1990
		Psammoduon arenicola (Simon, 1910)
Near threatened	Thomisidae	*Simorcus haddadi* Van Niekerk & Dippenaar-Schoeman, 2010

Source: Dippenaar-Schoeman, A.S., Haddad C.R., Lotz, L.N., Booysen, R., Steenkamp, R.C. & Foord, S.H., 2023a 'Checklist of the spiders (Araneae) of South Africa', *African Invertebrates* 64, 221–281. https://doi.org/10.3897/AfrInvertebr.64.111047

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IUCN, International Union for the Conservation of Nature.

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Competing interests

The authors have declared that no competing interest exists.

Authors' contributions

C.R.H. applied for permits, conducted field work, assisted with data processing, conservation assessments and analysis, wrote part of the first draft, prepared the figure plates, and prepared the final draft. A.S.D-S. conceptualised the study, sourced and managed collection data, applied for permits, prepared the conservation assessments and checklist, and contributed to writing the first draft.

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Data availability

The species collection records that form the foundation of this study are available from the corresponding author, C.R.H., upon reasonable request.

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