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New Zodariidae (Araneae) from Mkomazi Game Reserve, Tanzania

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ABSTRACT

Four species of Zodariidae new to science are described from Mkomazi Game Reserve in northern Tanzania; *Diores similis* sp. n., *Dusmadiores laminatus* sp. n., *Heradida minutissima* sp. n. and *Ranops dippenaarae* sp. n. In addition, the female of *Diores murphyorum* Jocqué, 1990 is described for the first time. The reasons for the apparent abundance and high diversity of zodariids in Mkomazi are briefly discussed.

KEY WORDS: Afrotropical Region, Araneae, *Diores*, *Dusmadiores*, *Heradida*, *Ranops*, savannah, new species, spiders.

INTRODUCTION

Africa has a rich fauna of Zodariidae (Jocqué 1991) but many taxa are known from very few individuals, particularly amongst smaller species. Surveys of a range of African habitats suggest that both species diversity and abundance of zodariids is relatively modest compared with that of other ground-active hunting families such as Salticidae, Lycosidae and Gnaphosidae (World Spider Catalog 2015). During a three-year survey of the arachnid fauna of Mkomazi Game Reserve in northern Tanzania, pitfall trapping was carried out in 13 different savannah and montane forest habitats (Russell-Smith 1999). The most intensively sampled of these were *Acacia/ Commiphora* bushland and seasonally inundated grassland in the east of the reserve, where traps were operated for six days in each month between April 1995 and March 1996. Remarkably, zodariids comprised a significant proportion of all spiders captured in most of the habitats studied. For example, in the traps in *Acacia/Commiphora* bushland, zodariids were the second most abundant family after salticids, with 1 086 individuals trapped, while in the seasonally inundated grassland they were the most abundant family, with 927 individuals trapped.

Some of the zodariid species from Mkomazi have been described elsewhere. These include *Microdiores aurantioviolaceus* (Nzigidahera & Jocqué, 2010), *Systenoplacis minimus* (Jocqué, 2009), *S. waruii* (Jocqué, 2009), and *Palfuria caputlari* (Szüts & Jocqué, 2001). Additionally, a new species belonging to a new genus, *Suffrica*, closely related to *Suffasia* Jocqué, 1991 have been described (Henrard & Jocqué 2015). In this paper we describe four new species of zodariid spiders from Mkomazi and provide information on their biology and phenology, where available.

MATERIAL AND METHODS

Study area

Mkomazi Game Reserve is situated along the northern border of Tanzania with Kenya. The reserve is some 3 200 km^2 in extent and comprises primarily savannah with

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woodland and open grass plains (Homewood & Brockington 1999). Mkomazi varies in altitude from 630 to 1 600 m, and mean annual rainfall ranges from 800 mm in the west of the reserve to 200 mm in the east (McWilliam & Packer 1999). The vegetation of the reserve consists of a mosaic of woodland, bushland, wooded or bushed grassland and open grassland in which the boundaries between different vegetation types are often indistinct. Forest is restricted to small patches on the summits of hills that form outliers of the East Pare Mountains (Coe *et al*. 1999).

Taxonomy

All material is preserved in 70 % ethanol. Specimens were observed and measured with a Leica M10 stereomicroscope. Photographs were taken with a Leica MZ16 using LAS (Leica Application Suite; Leica Microsystems, 2011) automontage software.

Specimens were immersed in K-Y* brand jelly and a Z-stack of 12–20 images was generated. The Z-stack was subsequently merged into a single montaged image. Female epigynes were detached from the abdomen, cleared with methyl salicylate, and temporarily mounted for examination. They were photographed with a Leica M12 stereomicroscope and subjected to automontage with SYNCROSCOPY software (SYNCROSCOPY 2011). A Z-stack of 8–15 images was generated. The images were subsequently aligned and merged into a single file.

For SEM photos, specimens were dried in Hexamethyldisilazane (36h), gold coated, and examined and photographed with a JEOL 6480 LV scanning electron microscope. All material is deposited in the Royal Museum for Central Africa, Tervuren, Belgium (MRAC). Specimens were initially sorted per morphospecies and subsamples from several localities were combined in a single vial. The MRAC samples therefore contain many conspecific specimens originating from different Mkomazi localities under one register number. All of the material examined was collected by the first author. All measurements are in millimetres.

Abbreviations: ALE – anterior lateral eyes; AME – anterior median eyes; F – femur; Mt – metatarsus; P – patella; PLE – posterior lateral eyes; PME – posterior median eyes; RTA – retrolateral tibial apophysis; T – tibia; t – tarsus.

Abbreviations used in eye measurements and positions: a: always = 1.00; diameter of AME, taken as base for the calculation of the distances b–h; b, c, d: diameter of ALE, PME and PLE, respectively, as a fraction of a); e: AME–AME; f: AME–ALE; g: PME–PME; h: PME–PLE; all expressed as a fraction of a).

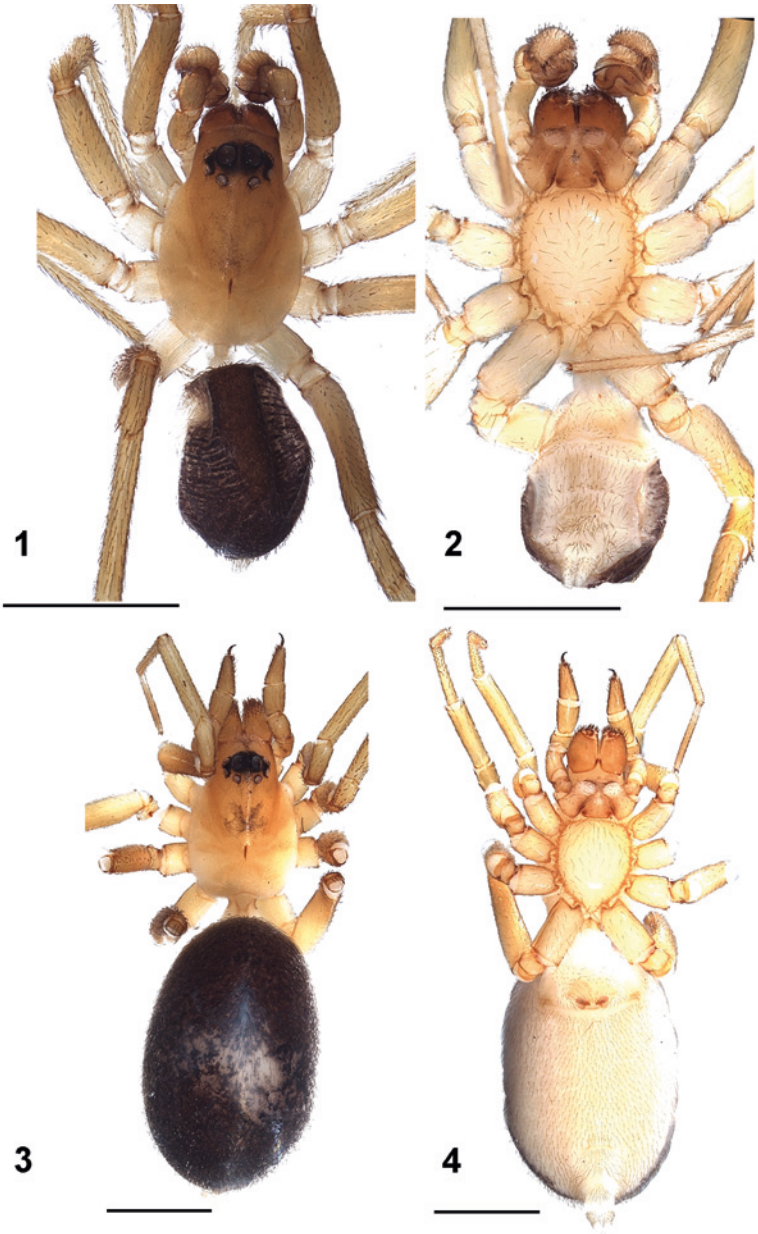
TAXONOMY

Diores similis sp. n.

Figs 1–17

Etymology: The specific name means "similar" in Latin and refers to the resemblance of this species to *Diores strandi* Caporiacco, 1949.

Diagnosis: *Diores similis* sp. n. belongs to the *Diores miombo* group (*sensu* Jocqué 1990) and somewhat resembles *D. strandi* in the form of the male palp, but differs in the shape of the bifid RTA, with the dorsal branch longer and possessing a thorn-like pointed excrescence that is lacking in the latter species. It is also significantly smaller than *D. strandi*.

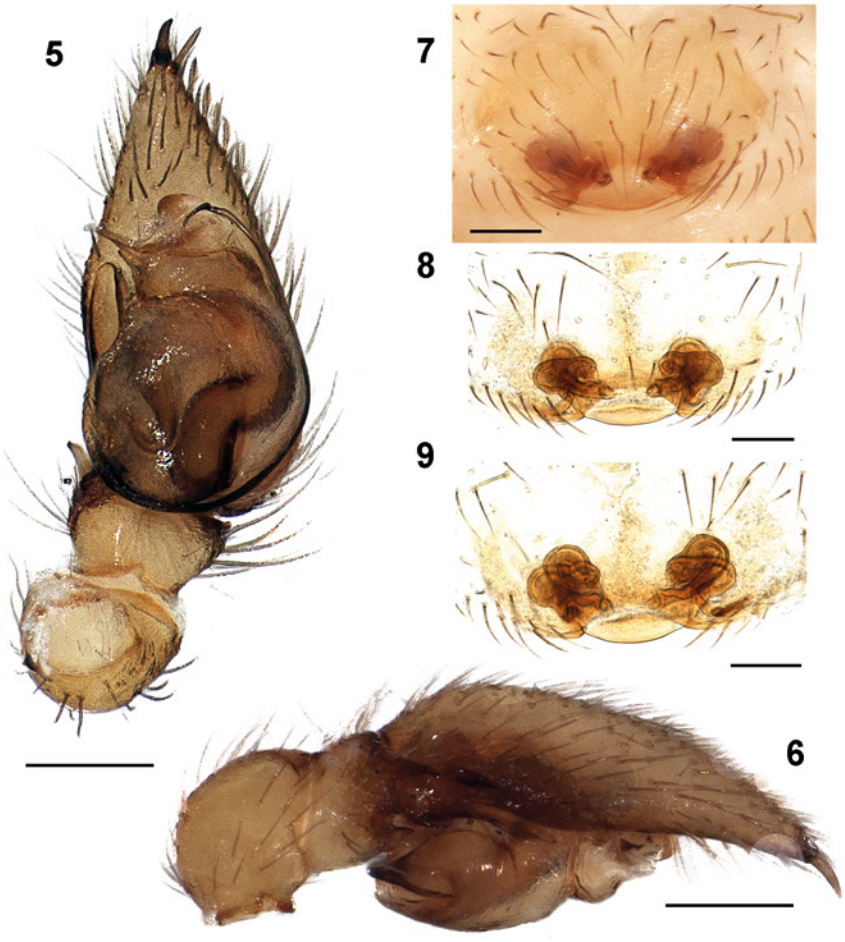


Figs 1–4. *Diores similis* sp. n. male and female, Mkomazi (MRAC 215733): (1) male habitus, dorsal view; (2) idem, ventral view; (3) female habitus, dorsal view; (4) idem, ventral view. Scale bars = 1 mm.

Description:

Male.

Total length: 2.62. Carapace: length 1.25, width 0.90. Colour (Figs 1, 2): Carapace golden yellow, paler around margins. Eye region black. Chelicerae orange suffused with black,

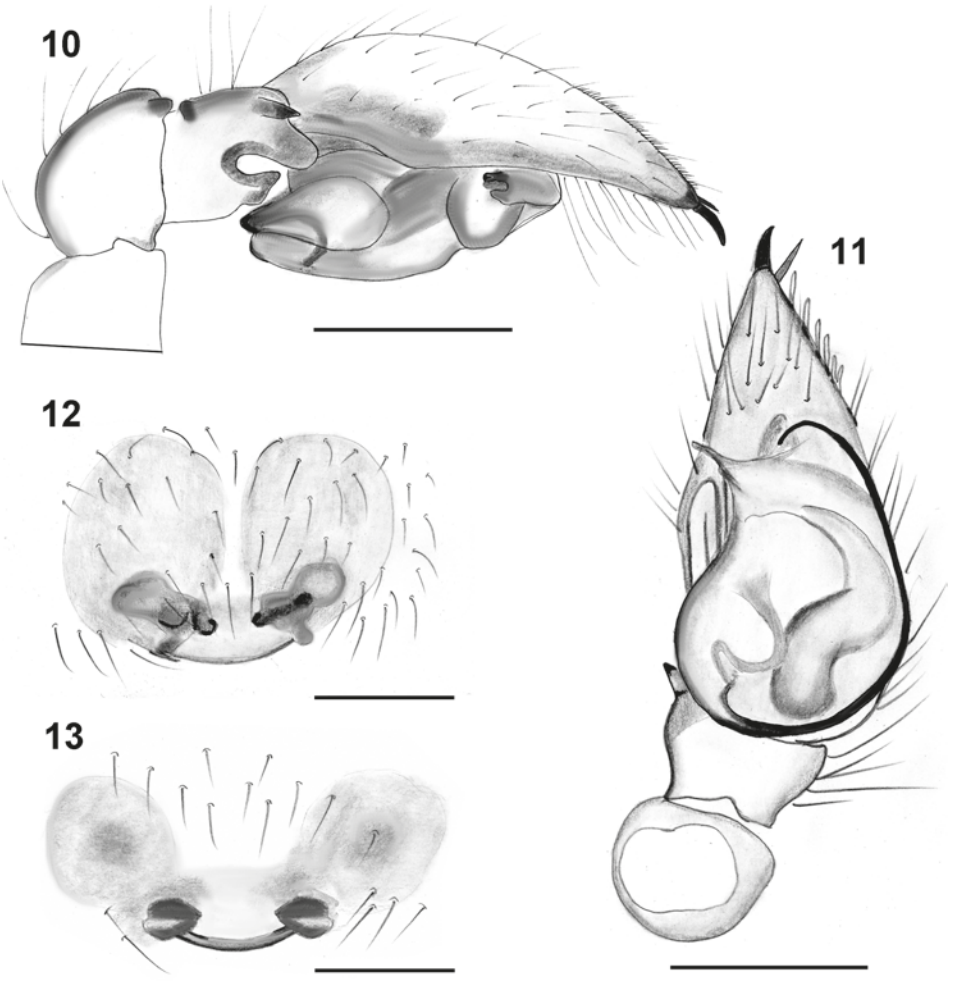


Figs 5–9. *Diores similis* sp. n. male and female, Mkomazi (MRAC 215733): (5) male palp, ventral view; (6) idem, retrolateral view; (7) epigyne, ventral view; (8) epigyne, cleared, dorsal view; (9) idem, ventral view. Scale bars = 200 µm.

distal half clothed in black setae. Sternum and maxillae cream. Abdomen dorsally dark purple, with narrow brown scutum extending approximately half its length; ventrally pale cream. Spinnerets cream. Legs pale golden yellow, tarsi somewhat darker. Eyes: a) 1.00; b) 0.80; c) 0.60; d) 0.40; e) 0.60; f) 0.10; g) 1.00; h) 0.40.

Leg measurements:

	F	P	T	Mt	t	Total
I	1.25	0.25	0.90	1.20	0.75	4.35
II	1.06	0.25	0.75	1.06	0.62	3.74
III	1.05	0.25	0.80	1.00	0.62	3.72
IV	1.32	0.32	1.00	1.62	0.80	5.06



Figs 10–13. (10–12) *Diores similis* sp. n. male and female, Mkomazi (MRAC 215733): (10) male palp, retrolateral view; (11) idem, ventral view; (12) epigyne, ventral view; (13) *D. murphyorum* Jocqué, 1991, female, Mkomazi (MRAC 215734): epigyne, ventral view. Scale bars = 200 µm.

Legs: Femoral organ with branching setae (Fig. 16).

Male palp (Figs 5, 6, 10, 11, 17): In retrolateral view, RTA divided, dorsal branch longer with rounded tip and short pointed excrescence above, ventral branch shorter, wedge-shaped. In ventral view, tegular apophysis sharply tapering to fine pointed tip, directed antero-mesad.

Female.

Total length: 3.65. Carapace: length 1.37, width 0.95. Colour (Figs 3, 4): Carapace as in male. Chelicerae orange, sternum and maxillae cream. Abdomen dorsally pale purple or grey but without scutum. Spinnerets, ventrally cream, dorsally grey. Legs golden yellow. Female palp (Fig. 14) with modified pectinated setae and truncated chemosensitive setae (Fig. 15). Eyes: a) 1.00; b) 0.70; c) 0.40; d) 0.60; e) 0.30; f) 0.15; g) 0.80; h) 0.40.

Leg measurements:

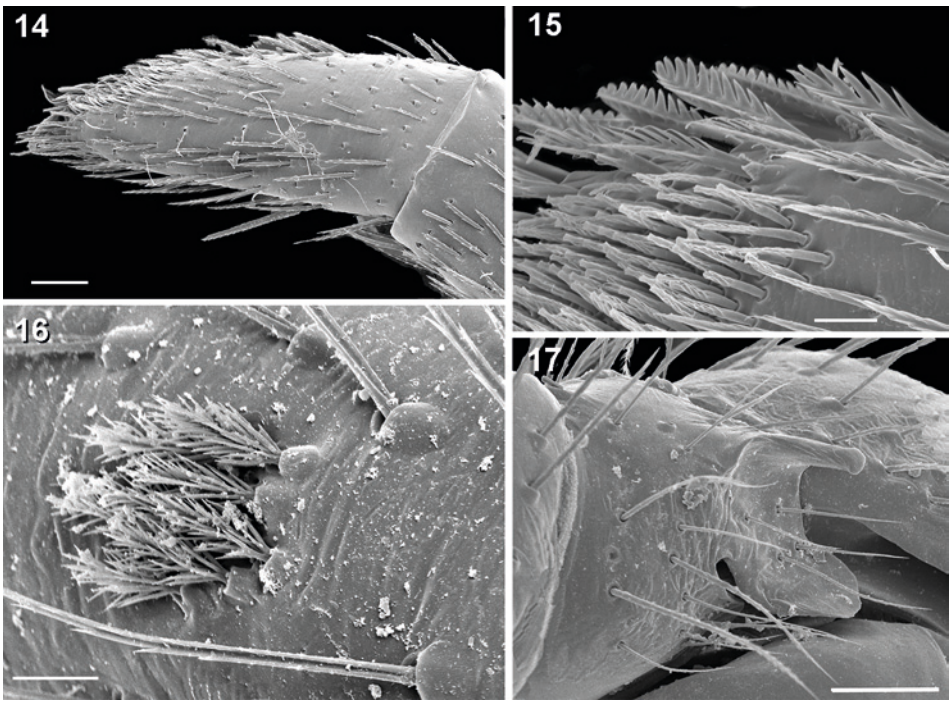
	F	P	T	Mt	t	Total
I	1.12	0.35	0.80	0.95	0.70	3.92
II	1.05	0.25	0.65	0.65	0.52	3.12
III	0.85	0.25	0.65	0.85	0.52	3.12
IV	1.38	0.75	1.00	1.37	0.62	5.12

Female epigyne (Figs 7–9): In ventral view, central plate with smoothly curved posterior margin. Spermathecae (seen through cuticle) oval, inclined at *ca.* 40° to gastric fold. Viewed dorsally in methyl salicylate as in Figs 8 and 9.

Holotype ♂: TANZANIA: Mkomazi G.R., Ibaya, *Acacia/Commiphora* bushland, pitfall traps, 4–9.iv.1995 (MRAC 244015).

Paratype ♀: Same location and dates as holotype (MRAC 215725).

Other material examined: TANZANIA: Mkomazi G.R., Ibaya, *Acacia/Commiphora* bushland, pitfall traps, 10–20.viii.1993, 23♂ 8♀; same site, pitfall traps, 15–16.xi.1994, 7♂ 1♀; same site, pitfall traps, 4–9.iv.1995, 2♂ 2♀; same site, pitfall traps, 3–8.viii.1995, 4♂ 4♀; same site, pitfall traps, 6–11.ix.1995, 3♂; same site, pitfall traps, 15–20.xi.1995, 2♂ 1♀; same site, pitfall traps, 21–26.xii.1995, 1♂ 2♀; same site, pitfall traps, 23–28.ii.1996, 1♂; same site, pitfall traps, 21–26.iii.1996, 8♂ 2♀; Mkomazi G.R., Ibaya, seasonally inundated grassland, pitfall traps, 10–14.viii.1993, 1♂ 3♀; same site, pitfall traps, 4–9.iv.1995, 7♂; same site, pitfall traps, 3–8.viii.1995, 13♂ 2♀; same site, pitfall traps, 6–11.ix.1995, 4♂; same site, pitfall traps,



Figs 14–17. *Diores similis* sp. n. SEM views; female, Mkomazi (MRAC 215697): (14) female palp, dorsal view; (15) detail of previous showing modified pectinated setae and truncated chemosensitive setae; male paratype, Mkomazi (MRAC 215731): (16) femoral organ leg 2, retrolateral view; (17) male palp, tibia, showing RTA. Scale bars: (14) = 100 µm, (15) = 200 µm, (16) = 20 µm, (17) = 50 µm.

15–20.xi.1995, 5♂ 2♀; same site, pitfall traps, 23–28.ii.1996, 2♂; same site, pitfall traps, 21–26.iii.1996, 2♂; same site, pitfall traps, 25–26.xi.1994, 3♂; Mkomazi G.R., between Ndeya & Mbula, in open *Senegalia senegal* woodland, pitfall traps, 21–24.xi.1994, 9♂ 4♀; Mkomazi G.R., Ubani, open *S. senegal/Vachellia nilotica* woodland, 12–13.i.1997, 2♂ 2♀ (MRAC 215697 and MRAC 215733).

Distribution: Only known from Mkomazi Game Reserve, Tanzania.

Natural history: This is the most abundant *Diores* species in Mkomazi. In pitfall traps in both bushland and grassland at Ibaya, it was found sporadically throughout the year and peaks of activity did not appear to coincide with the main rains. Apart from *Acacia/Commiphora* bushland and seasonally inundated grassland, it was fairly common in traps in *S. senegal* woodland and a few specimens were captured in traps in *S. senegal/V. nilotica* woodland.

Diores murphyorum Jocqué, 1990

Figs 13, 18–22

Diagnosis: The female epigyne is closest to that of *Diores triarmatus* Lessert, 1929 but the posterior margin is shorter than in *D. triarmatus* and reflexed inwards laterally. The spermathecae (seen through the cuticle) extend laterally rather than anteriorly, as in *D. triarmatus*.

Description:

Female.

Total length: 5.50. Carapace: length 2.37, width 1.66. Colour (Figs 18, 19): Carapace orange anteriorly, fading to yellow posteriorly. Eye region and central area of clypeus black. Chelicerae orange, sternum pale yellow. Legs yellowish orange. Abdomen deep purple dorsally and laterally with 3–4 white chevrons in the posterior half. Tracheal spiracle straight, rather wide (0.30) at 0.80. Venter and spinnerets creamy white. Eyes: a) 1.00 (0.17); b) 0.71; c) 0.57; d) 0.43; e) 0.43; f) 0.14; g) 1.00; h) 0.57.

Leg measurements:

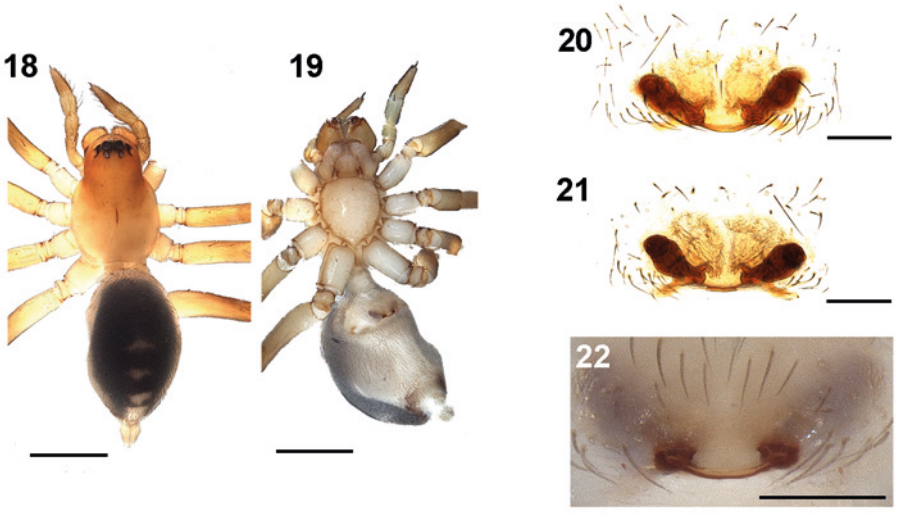
	F	P	T	Mt	t	Total
I	2.03	0.56	1.81	2.16	1.38	7.94
II	2.02	0.59	1.54	2.12	1.12	7.39
III	2.12	0.65	1.52	2.44	1.08	7.81
IV	2.17	0.59	2.10	2.66	1.07	8.59

Legs: With three tarsal claws, the unpaired claw tiny.

Epigyne (Figs 13, 20–22): In ventral view, similar to that of *D. triarmatus* but the posterior margin of the epigynal plate is shorter and reflexed inwards laterally. Spermathecae (as seen through the cuticle) extend laterally rather than anteriorly, as in *D. triarmatus* Lessert, 1929. Epigyne in methyl salicylate as in Figs 20, 21.

Material examined: TANZANIA: Mkomazi G.R., between Ndeya & Mbula, pitfall traps in *Senegalia senegal* woodland, 21–23.xi.1994, 2♂ 2♀; Mkomazi G.R., Kisima plot, in grass tussock, 25.i.1996, 1♂; Mkomazi G.R., below Kisima plot, in litter beneath *Newtonia* tree, 25.i.1996, 1♀; Mkomazi G.R., Ubani plot, in open *S. senegal/Vachellia nilotica* woodland, pitfall traps, 11–13.i.1997, 11♂ 6♀ 9 imm. (MRAC 215734).

Remark: This species was originally described from a single male from Kilifi, Kenya, located approximately 200 km northwest of Mkomazi G.R. (Jocqué 1990). The female is described here for the first time.



Figs 18–22. *Diores murphyorum* Jocqué, 1991, female, Mkomazi (MRAC 215734): (18) habitus, dorsal view; (19) idem, ventral view; (20) epigyne, cleared, ventral view; (21) idem, dorsal view; (22) epigyne, ventral view. Scale bars: (18, 19) = 1 mm, (20–22) = 200 µm.

Distribution: Southern Kenya and northern Tanzania.

Natural history: The majority of specimens were collected from pitfall traps in open *Acacia* woodlands in the eastern part of the reserve. A single female was taken from a more open grassy habitat at Kisima. All specimens were collected during the main early rains between November and January.

Dusmadiores laminatus sp. n

Figs 23–40

Etymology: The specific name is derived from the Latin *lamina* (flattened blade), and refers to the form of the male palpal embolus.

Diagnosis: This species can be distinguished from other members of the genus by the small translucent branches of the RTA, a broad, strongly curved embolus and bulky S-shaped MA, and the cup-shaped tegular apophysis of the male palp. The female is recognised by the poorly sclerotised epigyne showing the wide entrance ducts in transparency and with an ill-defined posterior plate with recurved anterior margin.

Description:

Male.

Total length: 1.87. Carapace: length 0.85, width 0.65. Colour (Figs 23–24): Carapace chestnut brown suffused with grey. Chelicerae coloured as carapace, sternum and maxillae pale chestnut brown. Legs pale chestnut brown, femora slightly darker. Abdomen with chestnut scutum covering whole dorsal surface, ventrally creamy white. Spinnerets white. Eyes: a) 1.00; b) 0.50; c) 0.50; d) 0.25; e) 0.25; f) 0.25; g) 0.70; h) 0.38.

Leg measurements:

	F	P	T	Mt	t	Total
I	0.72	0.25	0.62	0.52	0.47	2.58
II	0.62	0.17	0.45	0.52	0.45	2.21
III	0.50	0.17	0.37	0.42	0.40	1.86
IV	0.75	0.22	0.52	0.80	0.47	2.76

Legs: Femoral organ (Figs 37–40) with a group of either 3 or 2 flattened, feather-shaped setae.

Male palp (Figs 27, 28, 30, 31, 33–35): In retrolateral view, RTA small, bifid; upper branch shorter with a rounded tip; lower branch longer and tapering to sharp tip. Both branches semi-translucent and difficult to discern. Conductor with two rows of small teeth. Cymbium with short row of modified hairs mesally, terminal spine short and pale. In ventral view, embolus arising basally as in other *Dusmadiores* species, but relatively narrow. Tegular apophysis a dished, cup-like sclerite not resembling that of any previously described species.

Female.

Total length: 2.12. Carapace: length 1.20, width 0.70. Colour (Figs 25–26): Carapace, chelicerae and sternum as in male. Legs as in male but slightly paler. Abdomen dorsally dark purple-black, without scutum. Ventrally creamy white. Spinnerets white. Legs as in male. Eyes: a) 1.00; b) 0.50; c) 0.50; d) 0.37; e) 0.25; f) 0.20; g) 0.75; h) 0.25.

Leg measurements:

	F	P	T	Mt	t	Total
I	0.65	0.17	0.45	0.45	0.37	2.09
II	0.62	0.15	0.45	0.40	0.15	1.77
III	0.37	0.15	0.31	0.28	0.29	1.40
IV	0.66	0.18	0.42	0.85	0.40	2.51

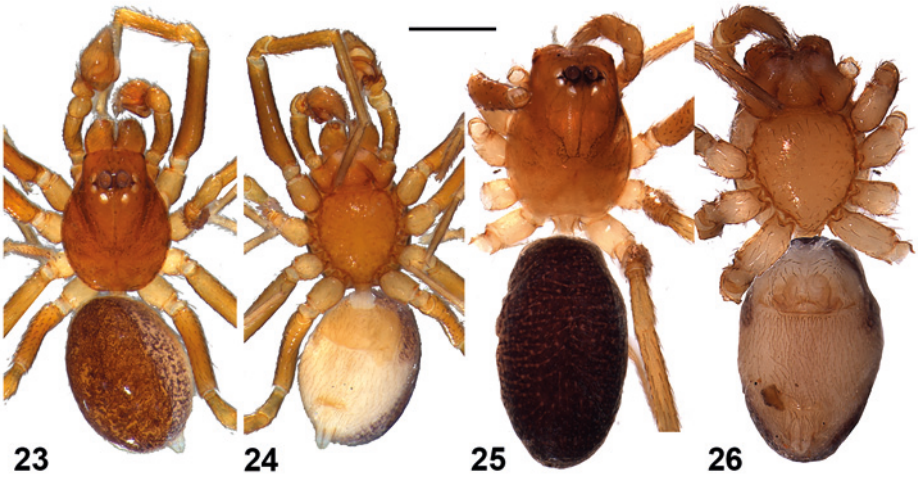
Female epigyne (Figs 29, 32, 36): Viewed ventrally, rather indistinct, central plate with a more or less straight posterior margin and spermathecae widely separated. Epigyne in methyl salicylate as in Fig. 29.

Holotype ♂: TANZANIA: Mkomazi G.R., between Ndeya and Mbula, 03°55'S 37°52'E, *Senegalia senegal* woodland, 22–24.xi.1994 (MRAC 244014).

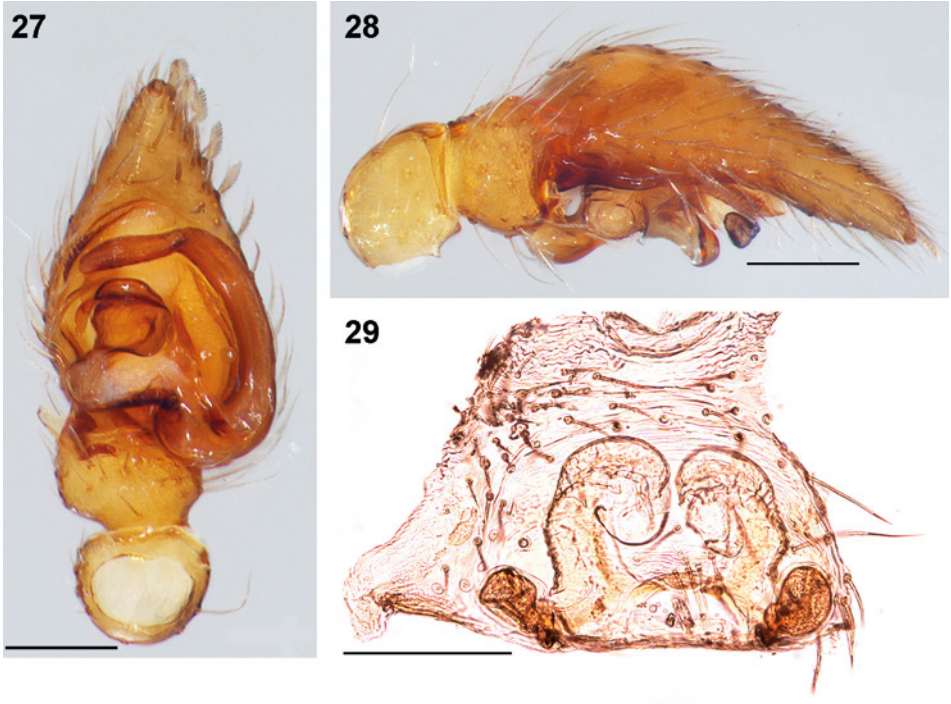
Paratypes: Same data as holotype, 3♂1♀ (MRAC 244007); Mkomazi G.R., Ibaya Camp, 03°58'S 37°46'E, burnt grassland, 8.v.1995, 1♀ (MRAC 215707).

Other material examined: Mkomazi G.R., Dindira, in *Vachellia drepanolobium* woodland, vlei near dam, 2.ii.1996, 7♂ 3♀ (MRAC 215716).

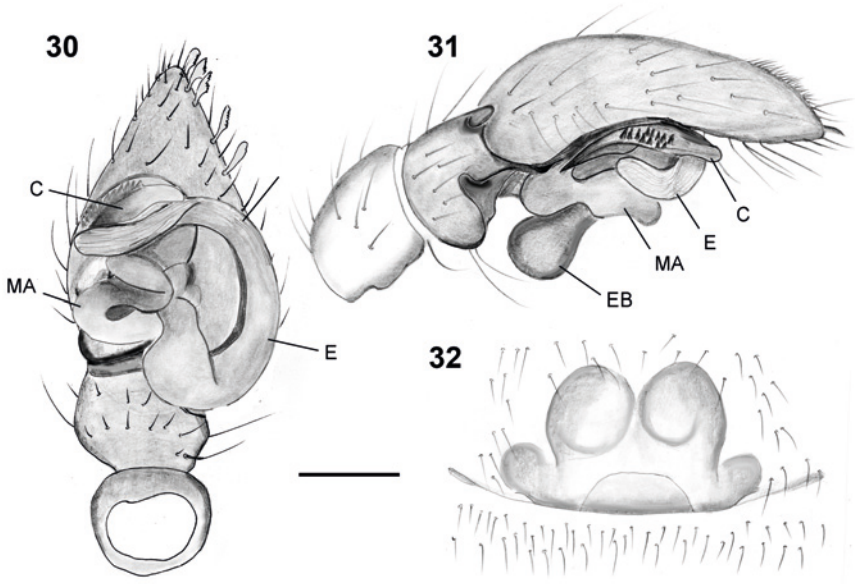
Remarks: *Dusmadiores* is now known from six described and many more undescribed species. The genus is distributed across Africa from the Cape Verde Islands (unpublished) to the Arabian Peninsula (Jocqué & van Harten, this volume). Species of the genus are sometimes mistaken for *Microdiores*, in which the embolus has a rounded section and the spermathecae in the epigyne are adjacent. In *Dusmadiores* the embolus is flat and the spermathecae widely separated.



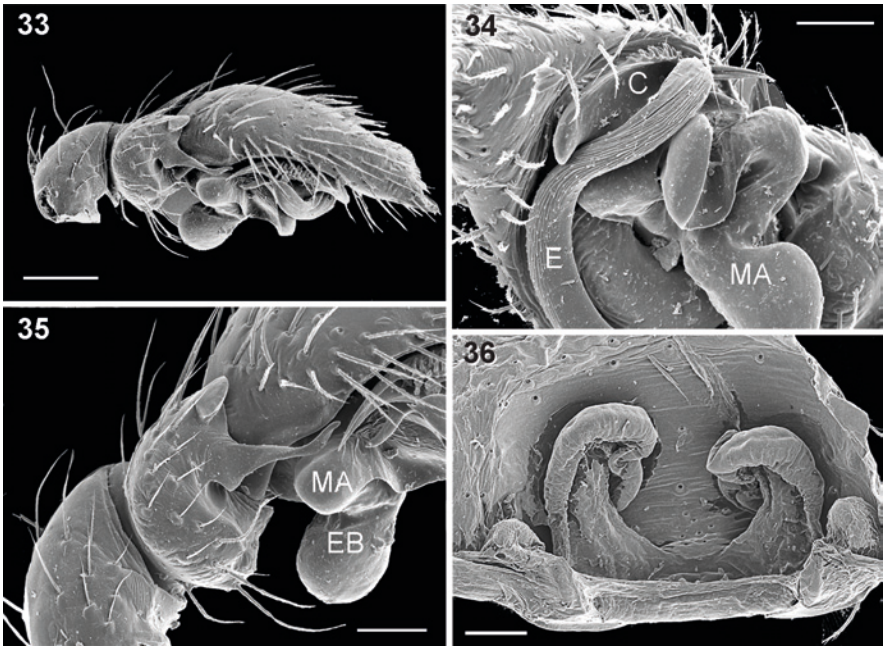
Figs 23–26. *Dusmadiores lamellatus* sp. n. male paratype (MRAC 215725), female (MRAC 215716) Mkomazi: (23) male habitus, dorsal view; (24) idem, ventral view; (25) female habitus, dorsal view; (26) idem, ventral view. Scale bar = 0.5 mm.



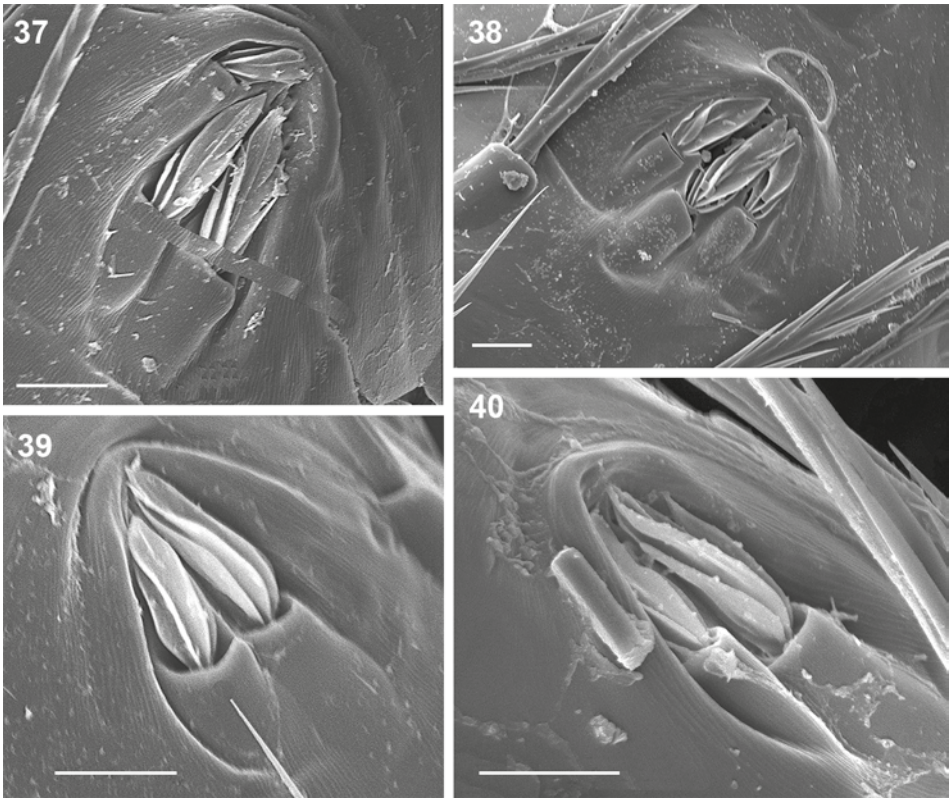
Figs 27–29. *Dusmadiores lamellatus* sp. n. male paratype (MRAC 215725), female (MRAC 215716) Mkomazi: (27) male palp, ventral view; (28) idem, retrolateral view; (29) epigyne, cleared, dorsal view. Scale bars: (27, 28) = 100 µm, (29) = 200 µm.



Figs 30–32. *Dusmadiores lamellatus* sp. n. male paratype (MRAC 215725), female (MRAC 215716) Mkomazi: (30) male palp, ventral view; (31) idem, retrolateral view; (32) epigyne, ventral view. C: conductor, E: embolus, EB: embolus base, MA: median apophysis. Scale bar = 100 µm.



Figs 33–36. *Dusmadiores lamellatus* sp. n. SEM views; male (MRAC 215716), female (MRAC 215716) Mkomazi: (33) male palp, retrolateral view; (34) part of male palp, ventral view; (35) male palp, tibia and base of bulbus, retrolateral view; (36) epigyne, after digestion, dorsal view. Scale bars = 100 µm (33), 50 µm (34–36). C: conductor, E: embolus, EB: embolus base, MA: median apophysis.



Figs 37–40. *Dusmadiores lamellatus* sp. n. dorsolateral SEM views of femoral organ, male, Mkomazi (MRAC 215716): (37) leg 1; (38) leg 2; (39) leg 3; (40) leg 4. Scale bars = 10 µm.

Distribution: Only known from Mkomazi Game Reserve, Tanzania.

Natural history: *D. laminatus* was found in pitfalls together with specimens of *Microdiores aurantioviolaceus* Nzigidahera & Jocqué, 2010, in *S. senegal* bushland, *V. drepanolobium* woodland and in burnt grassland.

Heradida minutissima sp. n.

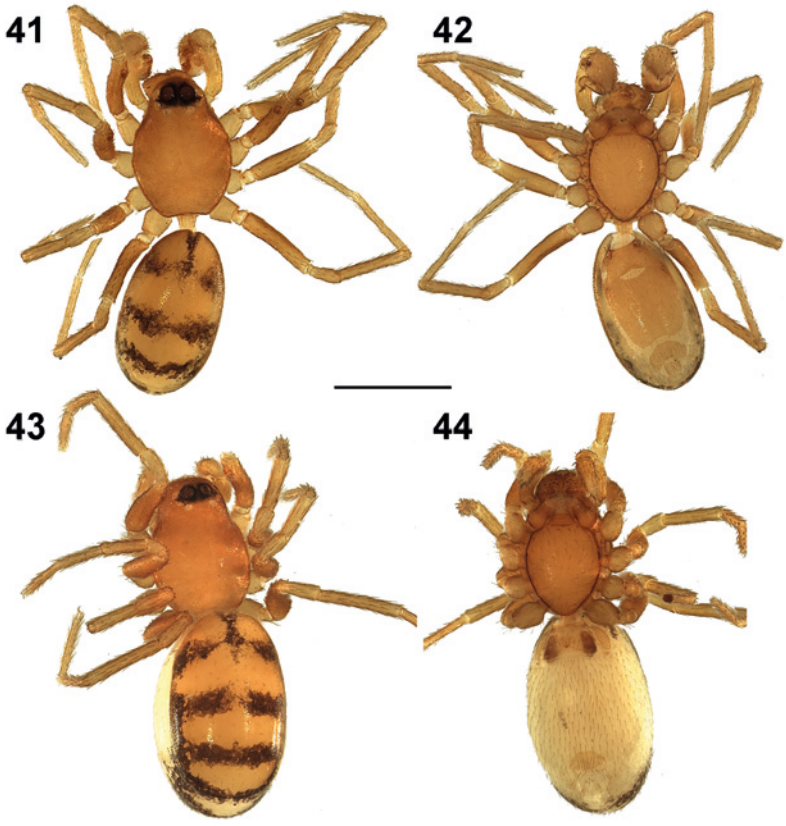
Figs 41–51

Etymology: The specific name is derived from the Latin meaning "exceedingly little", in recognition that this is the smallest zodariid species described to date.

Diagnosis: This species is recognised by the very enlarged AMEs, approximately twice the diameter of the PLEs. Unlike *H. griffinae* Jocqué, 1987 (the only other species for which males are known), the male palpal cymbium lacks a cymbial furrow and excrescences or specialised hairs. The RTA is long, narrow and hooked at the tip, unlike that of *H. griffinae*.

Description:

Male.



Figs 41–44. *Heradida minutissima* sp. n. male and female, Mkomazi (MRAC 215727): (41) male habitus, dorsal view; (42) idem, ventral view; (43) female habitus, dorsal view; (44) idem, ventral view. Scale bar = 0.5 mm.

Total length: 1.50. Carapace: length 0.62, width 0.42. Colour (Figs 41, 42): Carapace golden yellow suffused with brown marginally, area of AMEs black. Chelicerae and sternum coloured as carapace. Palps golden yellow, cymbium slightly darker yellow brown. Legs coloured as carapace, with femora slightly darker. Abdomen with dorsal scutum golden yellow with three diffuse black transverse bands, anterior two joined by narrow longitudinal stripe. Ventral scutum golden yellow. Spinnerets white. Eyes: a) 1.00 (0.07); b) *ca.* 0.50; c) *ca.* 0.33; d) *ca.* 0.40; e) 0.33; f) 0.20 g) 2.50; h) 0.25.

Leg measurements:

	F	P	T	Mt	t	Total
I	0.47	0.15	0.35	0.25	0.30	1.52
II	0.35	0.10	0.27	0.25	0.27	1.24
III	0.27	0.10	0.22	0.20	0.25	1.04
IV	0.40	0.15	0.35	0.37	0.35	1.62

Legs: Without spines but clothed in indented hairs. Femoral organ on I and II an oval alveolus with prominent club-shaped central hair.

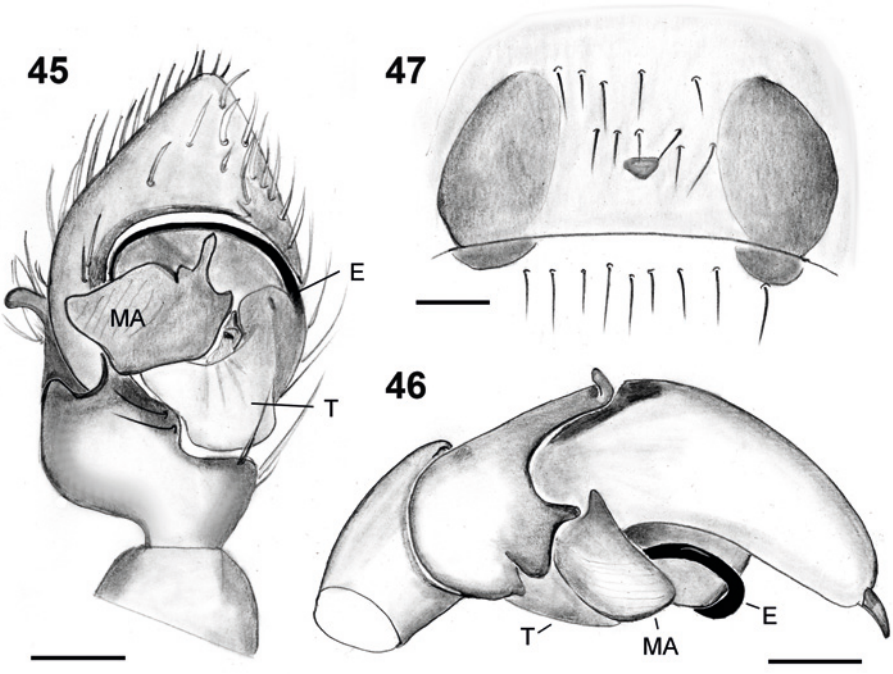
Male palp (Figs 45, 46, 48, 49): Viewed dorsally, cymbium without dividing furrow and excrescences but with specialised setae at tip (Fig. 49). Viewed laterally, RTA one third length of cymbium, broad at base but tapering and curved to hooked tip. Tegular apophysis with ventrally directed sclerotised spike. Viewed ventrally, tegular apophysis large, complex and projecting beyond external margin of cymbium. Embolus arising basally, thin, curving around inner margin of cymbium, with tip concealed beneath tegular apophysis.

Female.

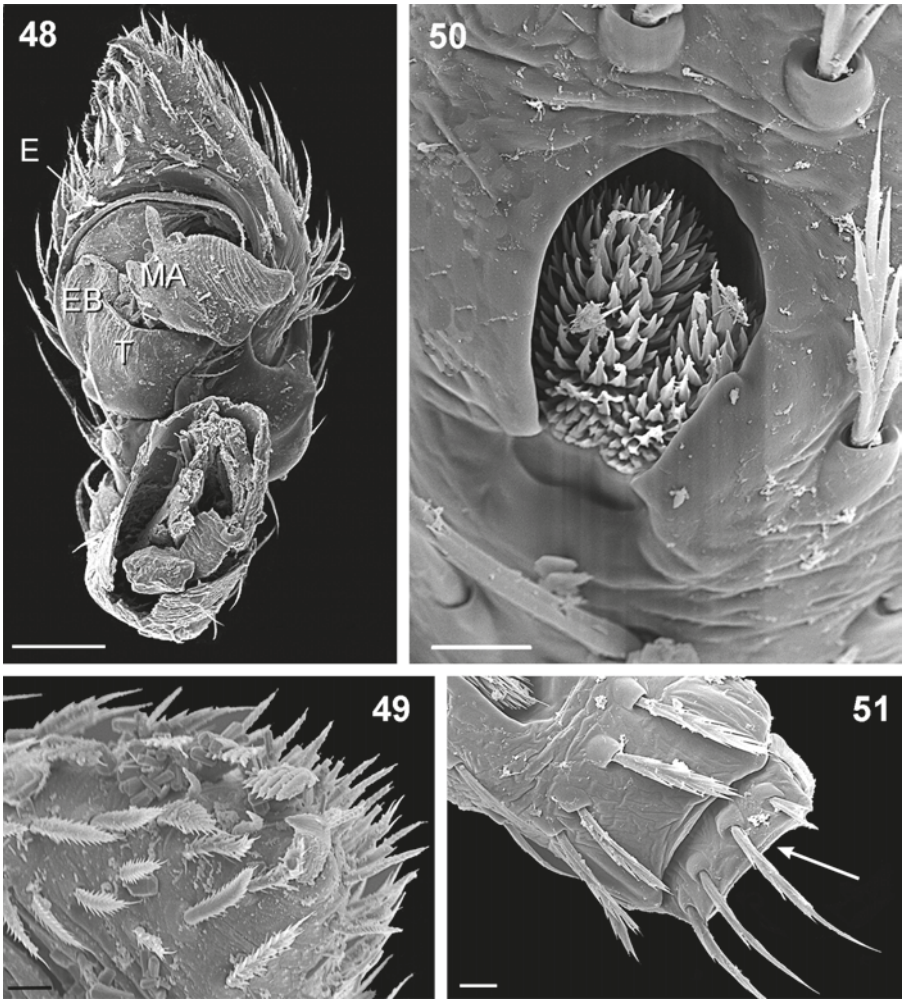
Total length: 1.75. Carapace: length 0.62, width 0.42. Colour (Figs 43, 44): Carapace, chelicerae and sternum as in male. Legs pale brown with femora slightly darker. Dorsal scutum of abdomen golden yellow with transverse dark bands very faint, first almost absent. Ventral scutum absent, venter and spinnerets white. Eyes: a) 1.00 (0.05); b) *ca.* 0.70; c) *ca.* 0.25; d) *ca.* 0.25; e) *ca.* 0.20; f) *ca.* 0.10; g) *ca.* 4.00; h) *ca.* 0.10.

Leg measurements:

	F	P	T	Mt	t	Total
I	0.40	0.12	0.42	0.32	0.32	1.58
II	0.37	0.10	0.27	0.25	0.27	1.26
III	0.32	0.12	0.25	0.22	0.27	1.18
IV	0.42	0.17	0.40	0.42	0.32	1.73



Figs 45–47. *Heradida minutissima* sp. n. male and female, Mkomazi (MRAC 215727): (45) male palp, ventral view; (46) idem, retrolateral view; (47) epigyne, ventral view. Scale bars = 50 µm.



Figs 48–51. *Heradida minutissima* sp. n. SEM images; male and female, Mkomazi (MRAC 215727): (48) male palp, ventral view; (49) idem, distal part of cymbium, showing modified setae and pectinated setae; dorsal view; (50) female, femoral organ, leg 2, dorsal view; (51) female, right femur and patella 2, showing patellar crack. Scale bars = 50 µm.

Legs: As in male. Femoral organ (Fig. 50) with numerous short spine-like setae. Femoral organ on II smaller than that of male.

Female epigyne (Fig. 47): In ventral view, spermathecae (seen through cuticle) very large, reniform.

Holotype ♂: TANZANIA: Mkomazi G.R., Ibaya, *Acacia/Commiphora* bushland, pitfall traps, 21–26. xi.1995 (MRAC 244013).

Paratype ♀: Same location and dates as holotype (MRAC 244006).

Other material examined: TANZANIA: Mkomazi G.R., Ibaya, *Acacia/Commiphora* bushland, pitfall traps, 19–20.xi.1994, 1♂; same site, pitfall traps, 5–10.vii.1995, 3♂; same site, pitfall traps, 3–8.viii.1995, 3♂; same site, pitfall traps, 6–11.ix.1995, 6♂ 3♀; same site, pitfall traps, 11–16.x.1995, 3♂ 3♀; same site, pitfall traps, 15–20.xi.1995, 6♂ 1♀; same site, pitfall traps, 21–26.xii.1995, 16♂ 3♀; same site, pitfall

traps, 19–24.i.1996, 5♂ 2♀; same site, pitfall traps, 23–28.ii.1996, 2♀; same site, pitfall traps, 21–26.iii.1996, 8♂ 2♀; Mkomazi G.R., Ibaya, seasonally inundated grassland, pitfall traps, 5–10.vii.1995, 4♂; same site, pitfall traps, 6–11.ix.1995, 1♂; same site, pitfall traps, 21–26.xii.1995, 1♂; same site, pitfall traps, 21–26.iii.1996, 1♀; Mkomazi G.R., Kisima, *Vachellia reficiens/Senegalia mellifera* woodland, pitfall traps, 3.i.1997, 1♂ (MRAC 215730).

Remarks: All previously described species of *Heradida* are from southern Africa (South Africa and Namibia), making *H. minutissima* sp. n. the species with the most northerly distribution in the genus.

Distribution: Only known from Mkomazi Game Reserve, Tanzania.

Natural history: *Heradida minutissima* sp. n. was frequently collected in pitfall traps in *Acacia/Commiphora* bushland, where peak activity was observed in December 1995, coinciding with the main early rains. Small numbers were trapped in seasonally inundated grassland also at Ibaya, and a single male was collected at Kisima in *V. reficiens/S. mellifera* woodland.

Ranops dippenaarae sp. n.

Figs 52–68

Etymology: The specific name is in honour of Dr Ansie Dippenaar-Schoeman, who has made outstanding contributions to the study of African spiders.

Diagnosis: This species resembles *Ranops caprivi* Jocqué, 1991 in the form of the RTA but differs in that the tip is not bifid. The tegular apophysis also resembles that of *R. caprivi* but is more sickle-shaped, while the tegulum lacks a sinuous dentate ridge as seen in the latter species. The female epigyne viewed ventrally is similar to that of *R. caprivi* but the central plate has a circular pit, absent in the latter species.

Description:

Male.

Total length: 2.25. Carapace: length 1.25, width 0.85. Colour (Figs 52, 53): Carapace chestnut brown, chelicerae and sternum pale yellowish brown. Legs: coxae yellow, femora chestnut brown suffused with black, other segments pale yellowish brown. Abdomen deep purple to black with 3–4 cream chevrons dorsally. Spinnerets pale cream dorsally. Palpal patella and femur chestnut brown, cymbium blackish brown. Eyes: a) 1.00 (0.07); b) *ca.* 0.85; c) *ca.* 0.80; d) *ca.* 0.75; e) 1.00; f) 0.70; g) 2.33; h) 0.30.

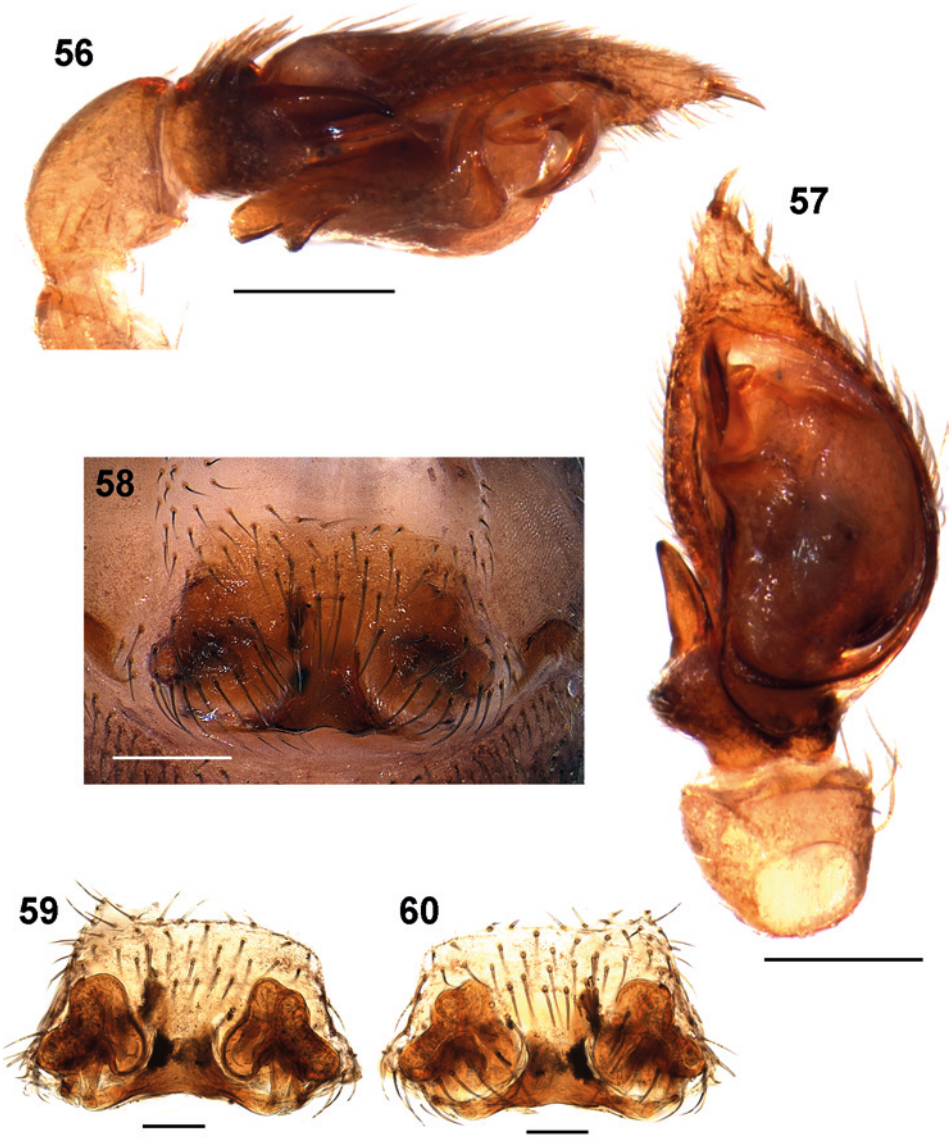
Leg measurements:

	F	P	T	Mt	t	Total
I	1.00	0.15	0.82	1.05	0.65	3.67
II	1.17	0.25	0.92	1.25	0.70	4.29
III	1.27	0.25	1.20	1.55	0.77	5.04
IV	1.62	0.35	1.20	1.80	0.95	5.92

Legs: No distinct spines, all segments clothed in flattened indented setae.

Male palp (Figs 56, 57, 61, 62, 64, 65): In lateral view, tibia with down-curved lateral apophysis tapering to a fine tip, not bifid. In ventral view, tegulum lacks a sinuous dentate ridge, tegular apophysis sharply recurved, sickle-shaped. Embolus arises basally, following border of cymbium and smoothly tapered to tip, which is not reflexed.

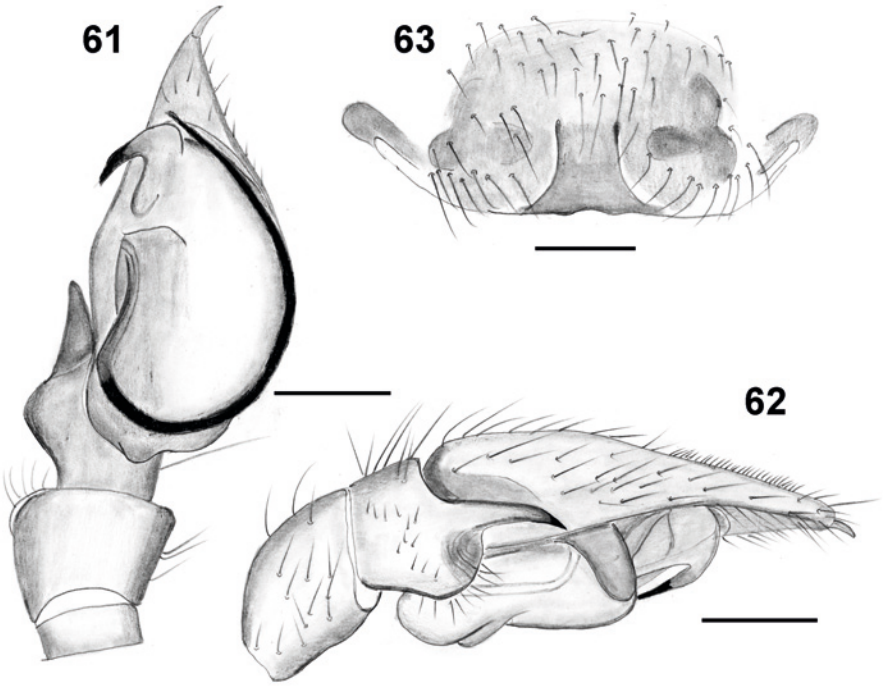
Figs 52–55. *Ranops dippenaarae* sp. n. male (MRAC 215713) and female (MRAC 215719), Mkomazi: (52) male habitus, dorsal view; (53) idem, ventral view; (54) female habitus, dorsal view; (55) idem, ventral view. Scale bar = 0.5 mm.



Figs 56–60. *Ranops dippenaarae* sp. n. male (MRAC 215713) and female (MRAC 215719), Mkomazi: (56) male palp, retrolateral view; (57) idem, ventral view; (58) epigyne, ventral view; (59) epigyne, cleared, dorsal view; (60) idem, ventral view. Scale bars: (56, 57) = 200 µm, (58–60) = 100 µm.

Female.

Total length: 2.87. Carapace: length 1.25, width 0.87. Colour (Figs 54, 55): Carapace, chelicerae and sternum as in male. Abdomen somewhat darker than in male and dorsal chevrons larger, occupying most of dorsal surface. Legs as in male, palps pale chestnut suffused with grey. Eyes: a) 1.00 (0.07); b) *ca.* 0.50; c) *ca.* 0.35; d) *ca.* 0.75; e) 1.00; f) 0.80; g) 3.00; h) 0.50.



Figs 61–63. *Ranops dippenaarae* sp. n. male and female (MRAC 215520), Mkomazi: (61) male palp, ventral view; (62) idem, retrolateral view; (63) epigyne, ventral view. Scale bars: (61, 62) = 200 µm, (63) = 100 µm.

Leg measurements:

	F	P	T	Mt	t	Total
I	0.90	0.15	0.60	0.92	0.41	2.98
II	1.02	0.21	0.71	1.00	0.61	3.55
III	1.20	0.25	0.95	1.12	0.68	4.20
IV	1.50	0.25	1.00	1.50	0.82	5.07

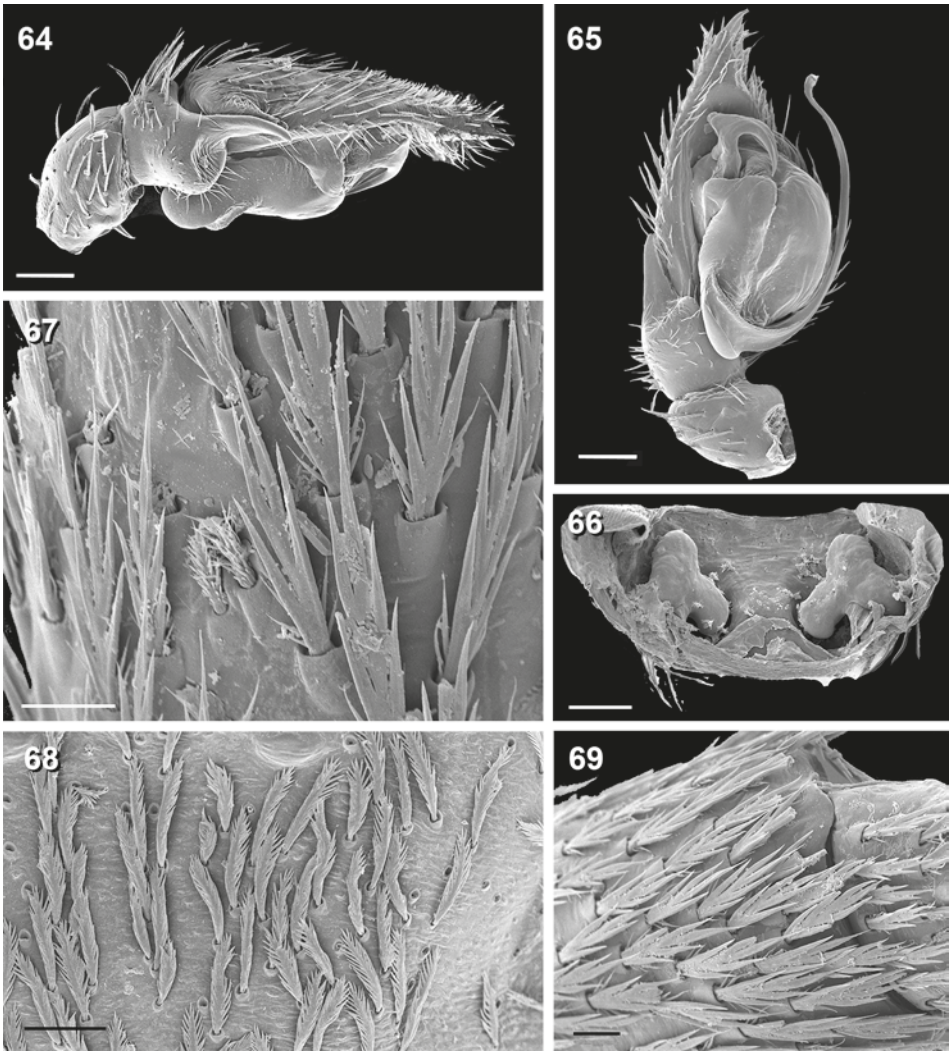
Legs: Spination as in male.

Female epigyne (Figs 58–60, 63, 66): In ventral view with elongate central plate with curved margins and central circular pit *ca.* 0.5× width of plate. Epigyne in methyl salicylate as in Figs 59, 60.

Holotype ♂: TANZANIA: Mkomazi Game Reserve, between Ndeya & Mbula, pitfall traps in *Senegalia senegal* woodland, 21–23.xi.1994 (MRAC 215719).

Paratype ♀: same locality, 21–23.xi.1994 (MRAC 244006).

Other material examined: TANZANIA: Mkomazi G.R., Ibaya, seasonally inundated grassland, pitfall traps, 19–20.viii.1993, 1♂; same site, pitfall traps, 14–28.xi.1994, 5♂ 1♀; same site, pitfall traps, 4–9.iv.1995, 13♂ 7♀; same site, pitfall traps, 5–10.v.1995, 23♂ 6♀; same site, pitfall traps, 7–12.vi.1995, 9♂ 7♀; same site, pitfall traps, 5–10.vii.1995, 2♂ 3♀; same site, pitfall traps, 21–26.xi.1995, 10♂ 1♀; same site, pitfall traps, 19–24.i.1996, 23♂ 4♀; same site, pitfall traps, 23–28.ii.1996, 60♂ 12♀; same site, pitfall traps, 21–26.iii.1996, 52♂ 10♀; same site, pitfall traps, 5–10.v.1995, 1♀; same site, pitfall traps, 7–12.vi.1995, 1♂; same site, pitfall traps, 3–8.viii.1995, 1♀; same site, pitfall traps, 11–16.x.1995, 1♀; same site, pitfall



Figs 64–69. *Ranops dippenaarae* sp. n. male (64, 65) and female (66–69) (MRAC 215520), Mkomazi: (64) male palp, retrolateral view; (65) idem, ventral, slightly retrolateral view; (66) epigyne, digested, dorsal view; (67) female, femoral organ amidst flattened incised setae on leg 2; (68) flattened setae pointing forwards, in front of fovea; (69) flattened incised setae on tip of tibia 4. Scale bars: (64–66) = 100 µm, (67) = 20 µm, (68, 69) = 50 µm.

traps, 19–24.i.1996, 1♂; same site, pitfall traps, 28.ii.1996, 2♂; same site, pitfall traps, 21–26.iii.1996, 1♂ 1♀; Mkomazi G.R., Ibaya, *Acacia/Commiphora* bushland, pitfall traps, 19–20.viii.1993, 1♂; same site, pitfall traps, 14–28.xi.1994, 79♂ 20♀; Mkomazi G.R., between Ndeya & Mbula, in open *Senegalia senegal* woodland, pitfall traps, 21–24.xi.1994, 10♂ 3♀; Mkomazi G.R., Dindira, in *Dichrostachys cinerea* scrub, pitfall trap, 12.v.1995, 1♂; Mkomazi G.R., near Dindira dam, in open *Combretum* bushland, pitfall trap, 16.i.1996, 1♂ (MRAC 215730).

Remarks: The genus *Ranops* is only known from two species, the type species *R. caprivi* Jocqué, 1991 and *R. expers* (O. Pickard-Cambridge, 1876). The genus is among the best-defined genera in the femoral organ clade: the dense cover of the teguments with

overlapping incised setae (Figs 67–69) and the very broad sternum (Figs 53, 55) make representatives easily recognisable, and several undescribed species from southern Africa match this diagnosis. *Ranops expers*, however, does not have these characters and is misplaced here (Levy 1992). As with *Heradida minutissima* sp. n., *R. dippenaarae* sp. n. appears to be the northernmost species in the genus.

Distribution: Only known from Mkomazi Game Reserve, Tanzania.

Natural history: This species was the most abundant small zodariid in pitfall traps in *Acacia/Commiphora* bushland at Ibaya but was almost absent from closely adjacent grassland, where only 9 specimens were collected as opposed to 242 in bushland. In the bushland habitat, it showed a strong peak of adults in February and March during the main early rains (when more than half of all specimens were trapped) and a smaller peak in April and May during the short rains. Adults were absent during the dry season from August to November. It also occurred in *S. senegal* woodland, dense *D. cinerea* scrub and open *Combretum* bushland in the eastern half of the reserve.

DISCUSSION

In most surveys of spiders of particular sites or habitats in Africa, members of the family Zodariidae have not figured prominently and numbers rarely exceed 5% of all spiders sampled. However, this was not the case in Mkomazi Game Reserve, where they accounted for 24% of all spiders caught in pitfall traps operated over a year in *Acacia/Commiphora* bushland and 26% in seasonally inundated grassland.

As well as being among the most abundant species in pitfall traps, zodariids were exceptionally diverse when compared with most other sites in Africa. In addition to the four new species included in this paper and the five previously described (see introduction), a further eight, namely *Akyttara akagera* Jocqué, 1987, an undescribed *Asceua*, *Diores* and *Chariobas* species, *Diores initialis* Jocqué, 1990, *Mallinella kibonotensis* (Bosmans & Van Hove, 1986), *Mastidiores kora* Jocqué, 1987, Suffrica exotica Henrard & Jocqué, 2015 and *Systenoplacis maculatus* (Marx, 1893) were also recorded. This brings the total number for the reserve to 18 species, all but five of which were new to science at the time of reporting.

The only other sites for which similar species numbers are recorded are Ndumo Game Reserve (Haddad *et al*. 2006) and the De Hoop Nature Reserve (Haddad & Dippenaar-Schoeman 2009) in South Africa, both with 11 species. Nearly all other surveys have reported between two and six species of zodariid. A comparison between the zodariid fauna of Mkomazi and of Ndumo Game Reserve in South Africa (Haddad *et al*. 2006) shows that five genera (*Chariobas*, *Diores*, *Heradida*, *Ranops* and *Systenoplacis*) were recorded in both areas. Five genera (*Caesetius*, *Cyrioctea*, *Procydrela*, *Psammorygma* and *Rotundrela*) were only recorded in Ndumo while another five (*Akyttara*, *Asceua*, *Dusmadiores*, *Mallinella* and *Mastidiores*) were only recorded in Mkomazi. What is unclear is whether the high diversity in Mkomazi is a result of zoogeographical or ecological factors, or alternatively, is an artefact of the different sampling protocols used in the various surveys. Certainly, few other sites in Africa have been surveyed as intensively using pitfall traps over a full year.

It was noticeable that many of the zodariid species were relatively small (including the *Dusmadiores*, *Palfuria*, *Heradida* and *Ranops* species) and were not collected by

hand in Mkomazi. It is possible that if pitfall trapping were used more widely, many additional smaller species of zodariids would be recorded. This is particularly true for *Heradida minutissima*, the smallest zodariid species described to date, which was only collected in pitfall traps in the reserve. It is likely that if intensive pitfall trapping was used more widely in surveys, this family might prove to be more abundant and species rich than has hitherto been appreciated.

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