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Three new species of Zodariidae (Araneae) from mainland Yemen and the Island Socotra

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ABSTRACT

Three new species of Zodariidae (Araneae) are described from Yemen. *Acanthinozodium ansieae* sp. n. (♂♀), is found on the island Socotra, whereas both the other species, *Zodarion yemenensis* sp. n. (♂♀) and *Dusmadiorea orientalis* sp. n. (♂♀), are from the continental mainland Yemen.

KEY WORDS: *Acanthinozodium*, *Zodarion*, *Dusmadiorea*, taxonomy, new species.

INTRODUCTION

Although Yemen and the Socotra Archipelago are part of Asia, from a biogeographical point of view they clearly belong to the Afrotropical Region. The Yemen mainland was part of the African plate until it was separated from it by the Afar plume rifting (Bosworth *et al.* 2005). Similarly, the island Socotra was initially attached to the mainland but never had a direct link with it since it was disconnected in the Paleogene (Rohling *et al.* 1998). Even during the glacial maximum (50 000 ybp) it remained separated from the continent by about 50 km (Van Damme 2006). Apart from the fact that they were initially part of the African continent, its vicinity to the Yemen mainland and Socotra in more recent times explains the strong Afrotropical character of their biota.

Spiders from this part of the world clearly are no exception to this statement. The many publications on the spider fauna corroborate the Afrotropical character of the fauna of the country (e.g. Rheims *et al.* 2004; Saaristo & van Harten 2006; Dippenaar-Schoeman & van Harten 2007; Grasshoff & van Harten 2007; Santos & van Harten 2007).

So far only two species of the spider family Zodariidae have been described from Yemen: *Trygetus nitidissimus* Simon, 1882 and *Zodarium aerium* Simon, 1890. They were described by Simon (1882, 1890) in two separate papers concerning the spider fauna of Yemen. The types of *T. nitidissimus* are in MCSG, like those of the other species described in the Simon (1882) paper. It is known from both sexes and has a large distribution in eastern Africa and the Middle East (Jocqué 1991; Levy 1992). The types of the species described in the second publication (Simon 1890) are in MNHN and many of them have been re-examined and redescribed. Unfortunately, the male type of *Z. aerium* could not be traced in the MNHN collections. Since the description of Simon lacks illustrations and is very superficial, and the only important detail mentioned is ‘the presence of a longitudinal, very blunt tibial apophysis’, the species must be considered as ‘*species inquirenda*’. It cannot be excluded that the ‘*Zodarion*’ here described is in fact *Z. aerium*, but as long as its type is untraceable we consider the description of this new species from the area as justified.

The present paper reports on three unknown zodariid species, two from the mainland and one from the island Socotra.

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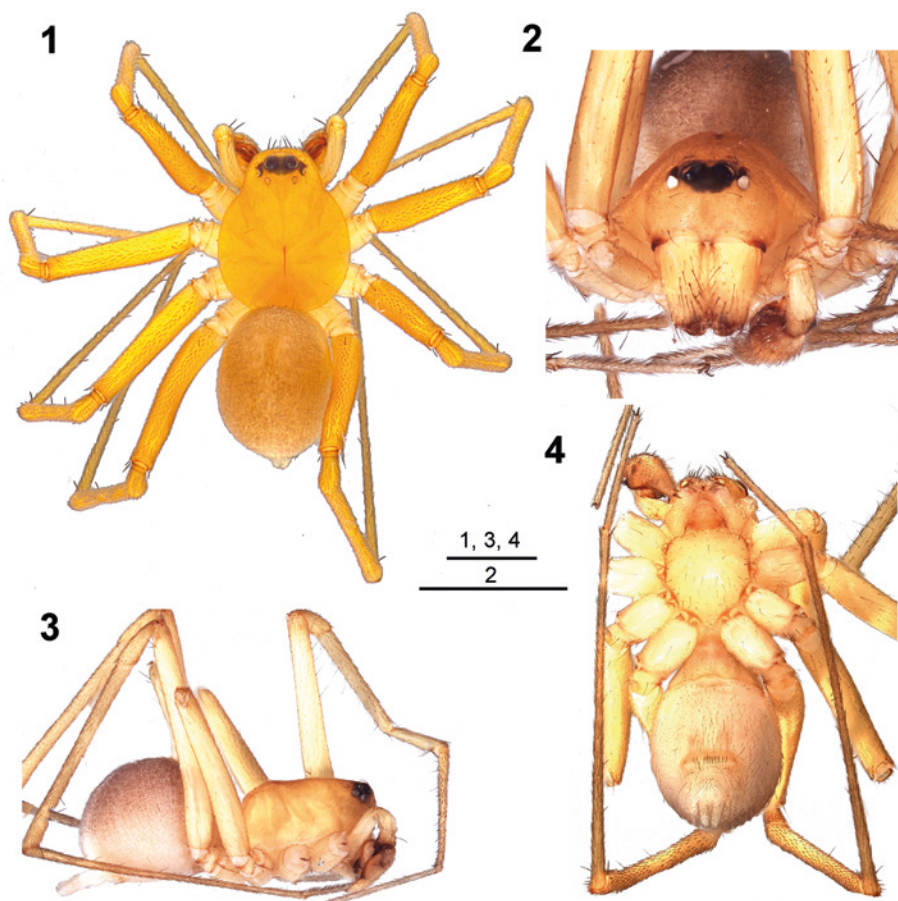
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MATERIAL AND METHODS

Specimens were observed, drawn and measured with a WILD M10 stereomicroscope. Details of the female genitalia and male palps were observed with a Zeiss Stemi 2000 stereomicroscope. Measurements and photographs of the habitus, details of mouthparts, detached male palps and female genitalia were taken with a Leica MZ16 using the LAS automontage software (ver. 3. 8). The female genitalia were dissected and cleared in methyl salicylate.

For SEM photos, specimens were dried in Hexamethyldisilazane (36h), gold coated, and examined and photographed with a JEOL 6480 LV scanning electron microscope. Types are deposited in the Royal Museum for Central Africa, Tervuren, Belgium (MRAC). All measurements are in millimetres (mm).

Abbreviations: ALE – anterior lateral eyes; AME – anterior median eyes; F – femur; MA – median apophysis; MCSG – Museo Civico di Storia Naturale (Genova, Italy); MNHN – Muséum national d'Histoire naturelle (Paris, France); MOQ – median ocular



Figs 1–4. *Acanthinozodium ansieae* sp. n. male holotype, Yemen: (1) habitus, dorsal view; (2) prosoma, frontal view; (3) habitus, lateral view; (4) habitus, ventral view. Scale bars = 1 mm.

quadrangle; MRAC – Musée royal de l'Afrique centrale (Tervuren, Belgium); MS – Median spinnerets; Mt – metatarsus; P – patella; PLE – posterior lateral eyes; PME – posterior median eyes; RTA – retrolateral tibial apophysis; SEM – scanning electron microscope; t – tarsus; T – tibia.

TAXONOMY

Acanthinozodium ansieae sp. n.

Figs 1–17

Etymology: The species is named in honour of Ansie Dippenaar, in esteem for her work on African spiders.

Diagnosis: The male of this species is recognised by the shape of the RTA — broad, with triangular, sharp superior part and short blunt inferior part; embolus central; MA with long truncated posterior appendage. The female is recognised by the epigyne with wide rounded scape and small separated atria.

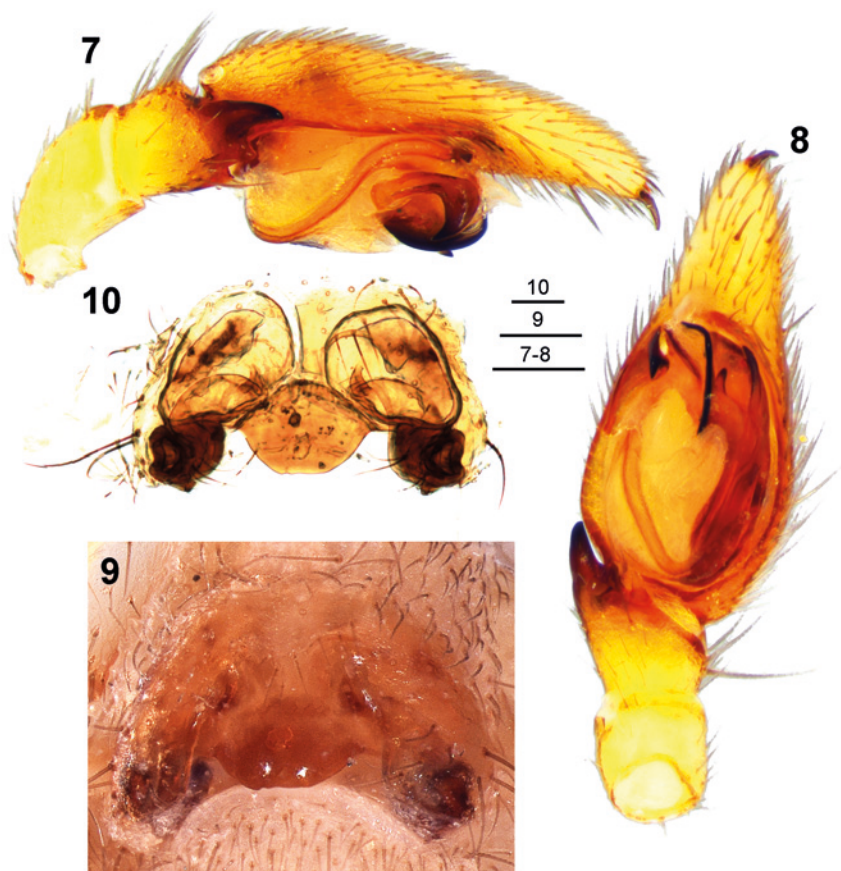
Description:

Male (holotype).

Total length 2.84. Carapace (Figs 1–4): 1.92 long, 1.35 wide. Colour (Fig. 1): Carapace and chelicerae yellowish orange; sternum pale yellow, mouthparts orange; legs uniform yellow. Abdomen: dorsum pale sepia, sides and venter pale cream, spinnerets white. Clypeus 0.21 high. Eyes: AME large, round; anterior eye row straight, posterior row procurved; PME oval; AME: 0.15; ALE: 0.08; PME: 0.08; PLE: 0.08; AME–AME: 0.07; AME–ALE: 0.03; PME–PME: 0.23; PME–PLE: 0.07. MOQ: width 0.34 in front, 0.34 at the back, 0.30 long. Sternum: 0.92 long, 0.79 wide. Legs: spination: all F with one dorsal spine and two rows of long ventral setae; all T with two ventral spines on distal margin;



Figs 5, 6. *Acanthinozodium ansieae* sp. n. female paratype, Yemen (MRAC 243309): (5) cephalothorax, dorsal view; (6) abdomen, ventral view. Scale bars = 1 mm.



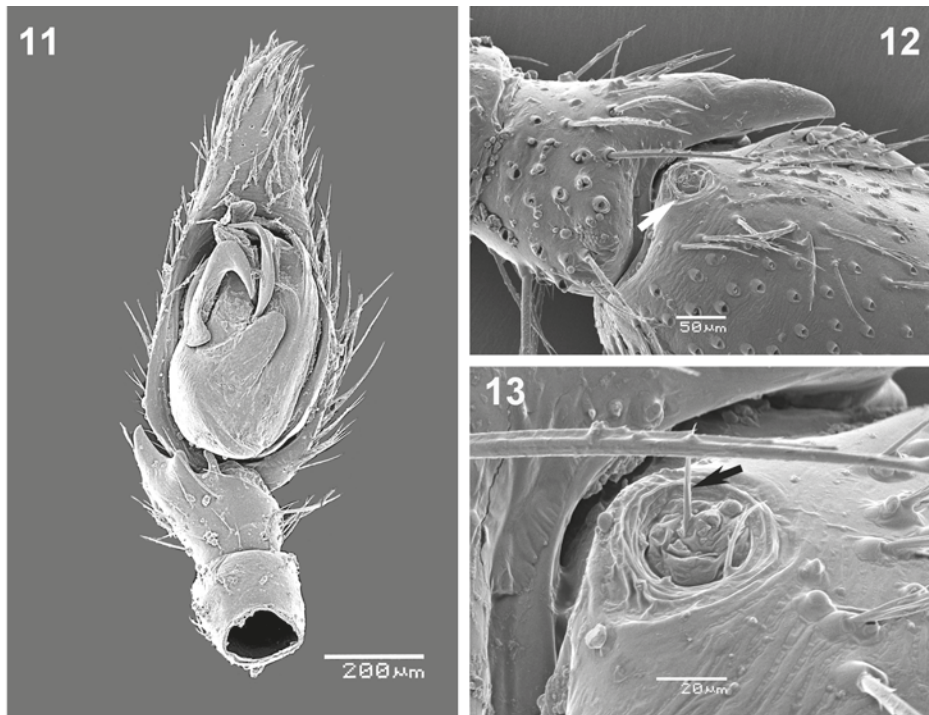
Figs 7–10. *Acanthinozodium ansieae* sp. n. male holotype, female paratype (MRAC 243309), Yemen: (7) male palp, retrolateral view; (8) idem, ventral view; (9) epigyne, ventral view; (10) epigyne, cleared in methyl salicylate, dorsal view. Scale bars = 200 μ m.

Mt and t with numerous short ventral spines. Abdomen with row of thin modified setae in front of spinnerets.

Leg measurements:

	F	P	T	Mt	t	tot
I	1.95	0.63	1.86	2.31	1.17	7.92
II	1.89	0.57	1.53	2.19	1.05	7.23
III	1.77	0.54	1.41	2.25	0.90	6.87
IV	2.31	0.57	2.07	2.85	1.08	8.88

Palp (Figs 7, 8, 11–15): Tibia: RTA broad with triangular dorsal part, tapered blunt tip, inferior part short, with rounded tip; cymbium with dorsal plug-pit near base; embolus originating in centre of bulbus strongly curved outward in distal part, thin, parallel-sided; MA with long, truncated posterior extension, strongly curved in distal part; conductor



Figs 11–13. *Acanthinozodium ansieae* sp. n. male paratype (MRAC 243308), Yemen, SEM views: (11) male palp, ventral view; (12) idem, tibia and base of cymbium, dorsal view; arrow indicates plug-pit; (13) detail of previous, remark thread of sticky matter (arrow).

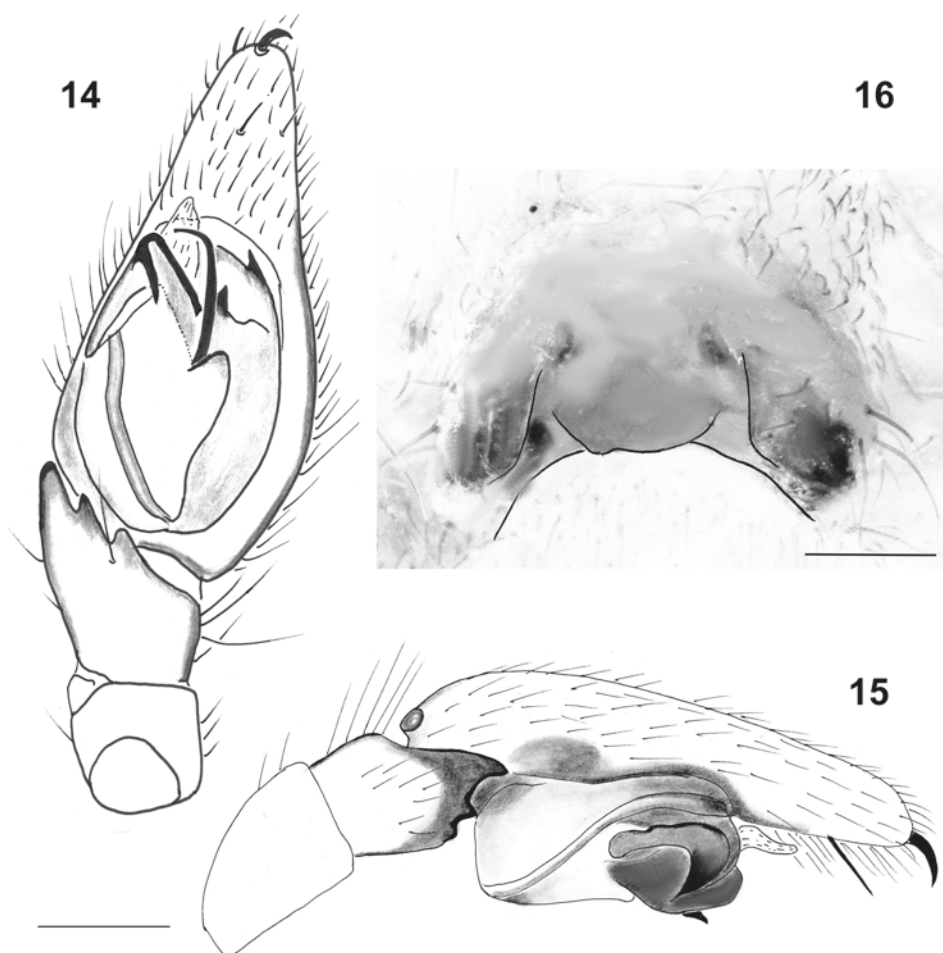
membranous; tegulum with one tooth near base of embolus and with subdistal and distal tapered extensions.

Female (paratype).

Total length 4.97. Carapace (Fig. 5): 2.49 long, 1.78 wide, 0.99 high. Colour (Figs 5, 6): Prosoma entirely uniform brownish yellow; abdomen uniform grey, spinnerets yellowish. Clypeus 0.39 high. Eyes: AME: 0.16; ALE: 0.10; PME: 0.08; PLE: 0.10; AME–AME: 0.07; AME–ALE: 0.05; PME–PME: 0.31; PME–PLE: 0.10. MOQ: width 0.38 in front, 0.44 at the back, 0.41 long. Sternum: 1.23 long, 1.08 wide. Legs: spination: all F with one dorsal spine and two rows of long ventral setae; all T with two ventral spines on distal margin; T, Mt and t with numerous short ventral spines. Abdomen with row of thin modified setae in front of spinnerets.

Leg measurements:

	F	P	T	Mt	t	tot
I	2.45	0.84	2.10	2.87	1.33	9.59
II	2.45	0.77	1.96	2.17	1.12	8.47
III	2.24	0.77	1.54	2.94	1.05	8.54
IV	3.15	0.77	2.80	3.71	1.19	11.62



Figs 14–16. *Acanthinozodium ansieae* sp. n. male holotype, Yemen: (14) male palp, ventral view; (15) idem, retrolateral view; female paratype, Yemen: (16) epigyne, ventral view. Scale bars = 0.2 mm.

Epigyne (Figs 9, 10, 16): Wider than long, posterior margin concave; with broad rounded scape separating ill-defined atria covered by lateral flap on either side of scape.

Holotype ♂: YEMEN: Socotra, Mogasu, 12°36'N 54°02'E, leg. A.R. Shamsam & A. Sallam, 3.iii.1999 (MRAC 243307).

Paratypes: YEMEN: 4♂ Socotra, Wadi Daneghan, 12°37'N 54°04'E, leg. A. van Harten, 28–30.x.2000 (pitfall trap) (MRAC 243308); 1♀ Socotra, Wadi Daneghan, leg. A. van Harten, 21.x.2000 (MRAC 243309).

Remark: *A. ansieae* sp. n. is a typical representative of the genus, as defined by Jocqué & Henrard (2015): it has the characteristic carapace shape, the rows of long ventral setae on the femora, the epigyne with large atria, and most importantly, the plug-pit on the cymbium (Figs 12, 13). The SEM shows (arrow) the smear of amorphous matter that is present in the pit.

Distribution: Known only from two localities on Socotra (Fig. 17).

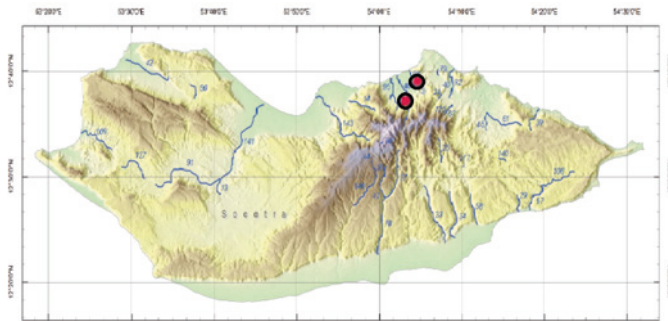


Fig. 17. Distribution map of *Acanthinozodium ansieae* sp. n.

***Zodarion yemenensis* sp. n.**

Figs 18–29

Etymology: The species is named after the country Yemen, from which it was collected.

Diagnosis: The male of this species is recognised by the shape of the palpal tibia, with a prolateral tooth, ventrolateral swelling and long straight blunt RTA. The female is characterised by the simple epigyne with inverted vase-shaped pattern.

Description:

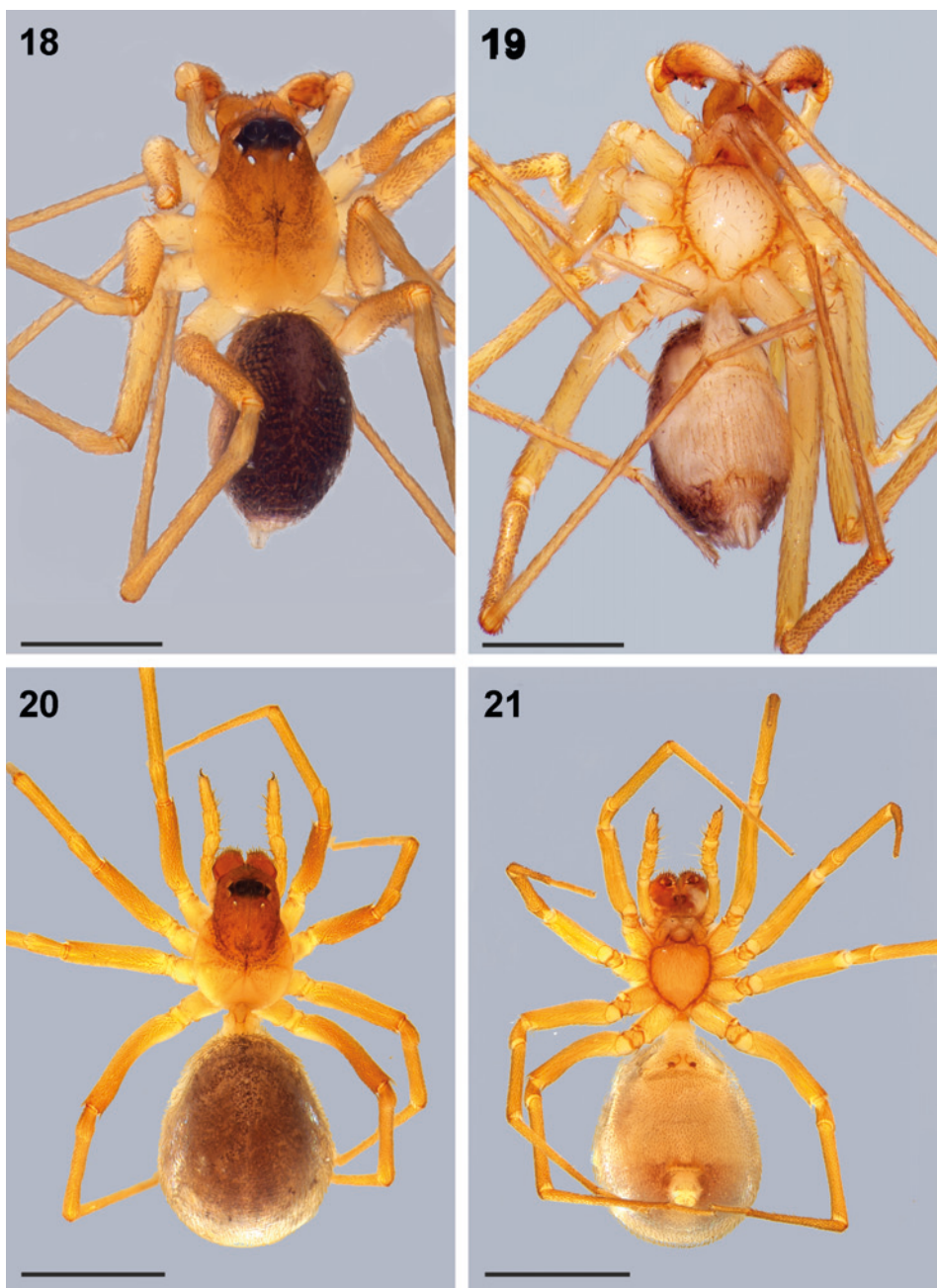
Male (holotype).

Total length 2.27. Carapace (Fig. 18): 1.28 long, 0.92 wide. Colour (Figs 18, 19): Carapace: cephalic area brownish yellow suffused with black; thoracic area pale yellow; chelicerae brownish yellow; legs yellow; sternum pale yellow; abdomen: dorsum dark sepia mottled with white, large white spot in front of spinnerets; sides, venter and spinnerets pale. Clypeus 0.16 high. Eyes: AME large, round; anterior eye row straight, posterior row procurved; PME oval; AME: 0.12; ALE: 0.10; PME: 0.08; PLE: 0.08; AME–AME: 0.08; AME–ALE: 0.02; PME–PME: 0.18; PME–PLE: 0.03. MOQ: width 0.31 in front, 0.30 at the back, 0.26 long. Sternum: 0.64 long, 0.58 wide. Legs: without spines; all F with dense cover of flattened incised hairs. Abdomen with row of very thin modified setae in front of spinnerets.

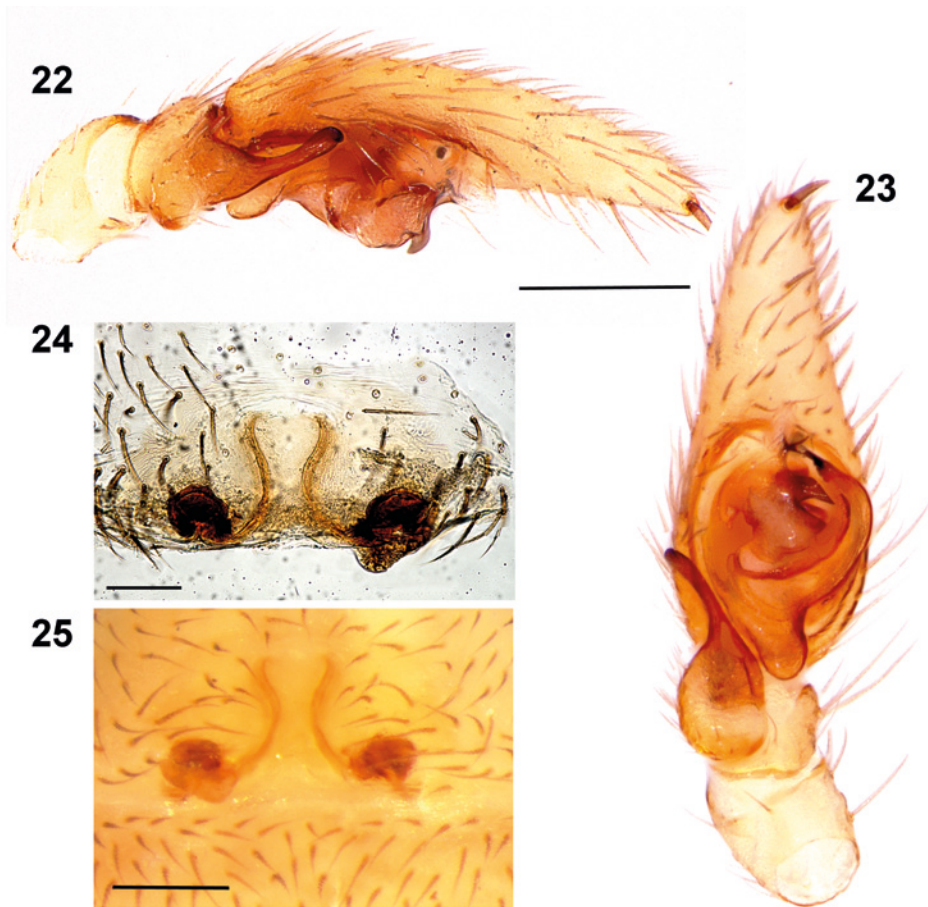
Leg measurements:

	F	P	T	Mt	t	tot
I	1.44	0.39	1.20	1.26	0.78	5.07
II	1.29	0.36	0.99	1.20	0.75	4.59
III	1.29	0.36	0.96	1.35	0.63	4.59
IV	1.80	0.42	1.56	1.86	0.69	6.33

Palp (Figs 22, 23, 26, 27): Tibia with prolateral tooth-like apophysis, ventrolateral swelling and long, straight blunt RTA, tip with shallow ventral incision; tegulum with large rounded, posterior extension, embolus base on its prolateral side; embolus broad, strongly curved, tip strongly tapered, lying dorsally of MA tip; MA large, rounded, with



Figs 18–21. *Zodarion yemenensis* sp. n. male holotype, Yemen: (18) habitus, dorsal view; (19) habitus, ventral view; female paratype, Yemen (MRAC 243303): (20) habitus, dorsal view; (21) habitus, ventral view. Scale bars = 0.5mm (18, 19); 1 mm (20, 21).



Figs 22–25. *Zodarion yemenensis* sp. n. male holotype, Yemen: (22) male palp, retrolateral view; (23) idem, ventral; female paratype, Yemen (MRAC 243303): (24) epigyne, cleared in methyl salicylate, dorsal view; (25) idem, ventral view. Scale bars = 0.2 mm (22, 23); 0.1 mm (24, 25).

prolateral excavation, median triangular tip pointing outward, distal tip thin, supporting membranous conductor.

Female (paratype, MRAC 243303).

Total length 4.26, Carapace (Fig. 20): 1.70 long, 1.49 wide, 0.85 high; with slight dip between eyes and fovea, with four setae along middle line. Colour (Figs 20, 21) as in males. Clypeus 0.28 high, with a few setae. Eyes: AME: 0.14; ALE: 0.10; PME: 0.07; PLE: 0.10; AME–AME: 0.07; AME–ALE: 0.02; PME–PME: 0.25; PME–PLE: 0.07. MOQ: width 0.34 in front, 0.36 at the back, 0.33 long. Sternum: 0.80 long, 1.02 wide. Chelicerae with numerous thick setae on paturon.

Legs and abdomen as in male.

Leg measurements:

	F	P	T	Mt	t	tot
I	1.32	0.42	1.11	1.35	0.87	5.07
II	1.29	0.42	0.96	1.35	0.75	4.77
III	1.32	0.45	0.96	1.38	0.69	4.80
IV	1.74	0.51	1.50	1.83	0.78	6.36

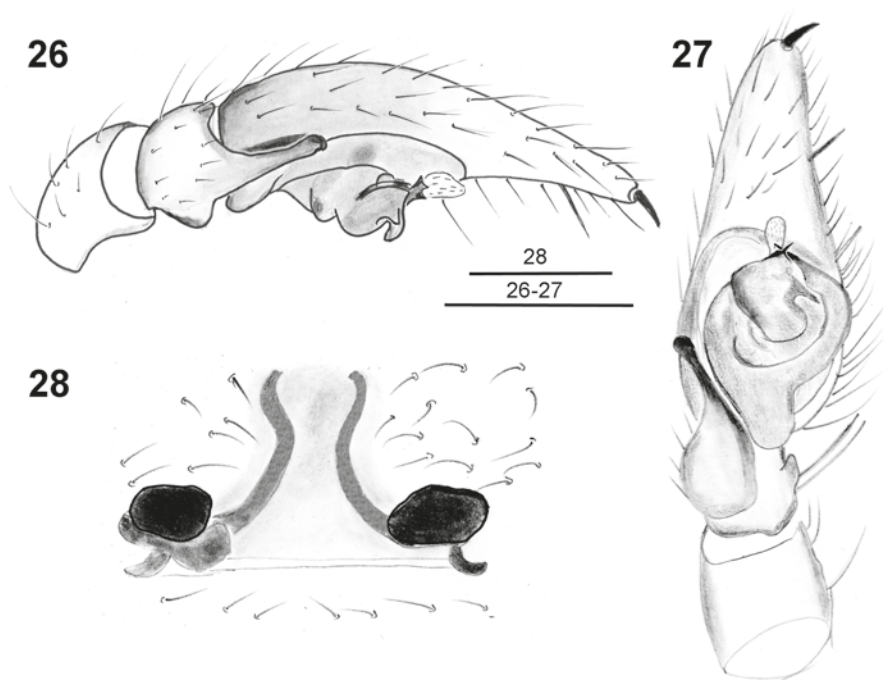
Epigyne (Figs 24, 25, 28): Poorly sclerotised area with spermathecae far apart, visible as dark areas; copulatory ducts form inverted vase-shaped pattern.

Holotype ♂: YEMEN: Sana'a, 15°22'N 44°11'E, leg. A. van Harten, 1.xii.1998 (MRAC 243304).

Paratypes: YEMEN: 1♂ Sana'a, 15°22'N 44°11'E, leg. A. van Harten, 29.i.1998 (MRAC 243298); 1♀ Sana'a, leg. A. van Harten, 15.vii.1998 (MRAC 243303); 1♀ Suq Bani Mansour, 15°06'N 48°50'E, leg. A. van Harten, 3.vii.2001 (MRAC 243889).

Remark: The attribution of this species to the genus *Zodariion* is tentative. The conformation of the palp is unusual, with the broad embolus and the massive MA, and we could not find any species with similar genitalia in *Zodariion* or in any other zodariid genus. A revision of the genus and its closest relative is needed to place the species correctly.

Distribution: Known from two Yemeni localities about 40 km apart (Fig. 29).



Figs 26–28. *Zodariion yemenensis* sp. n. male holotype, Yemen: (26) male palp, retrolateral view; (27) idem, ventral view; female paratype, Yemen (MRAC 243303): (28) epigyne, ventral view. Scale bars = 0.2 mm (26, 27); 0.1 mm (28).



Fig. 29. Distribution map of *Zodarion yemenensis* sp. n. Arrow indicates Socotra.

***Dusmadiores orientalis* sp. n.**

Figs 30–41

Etymology: The species name refers to its far eastern distribution.

Diagnosis: The male of this species is recognised by the shape of the RTA, with a broad base and long upturned prong, and broad strongly curved embolus with toothed base. The female is recognised by the epigyne with simple quadrangular central marking and lateral spermathecae seen in transparency.

Description:

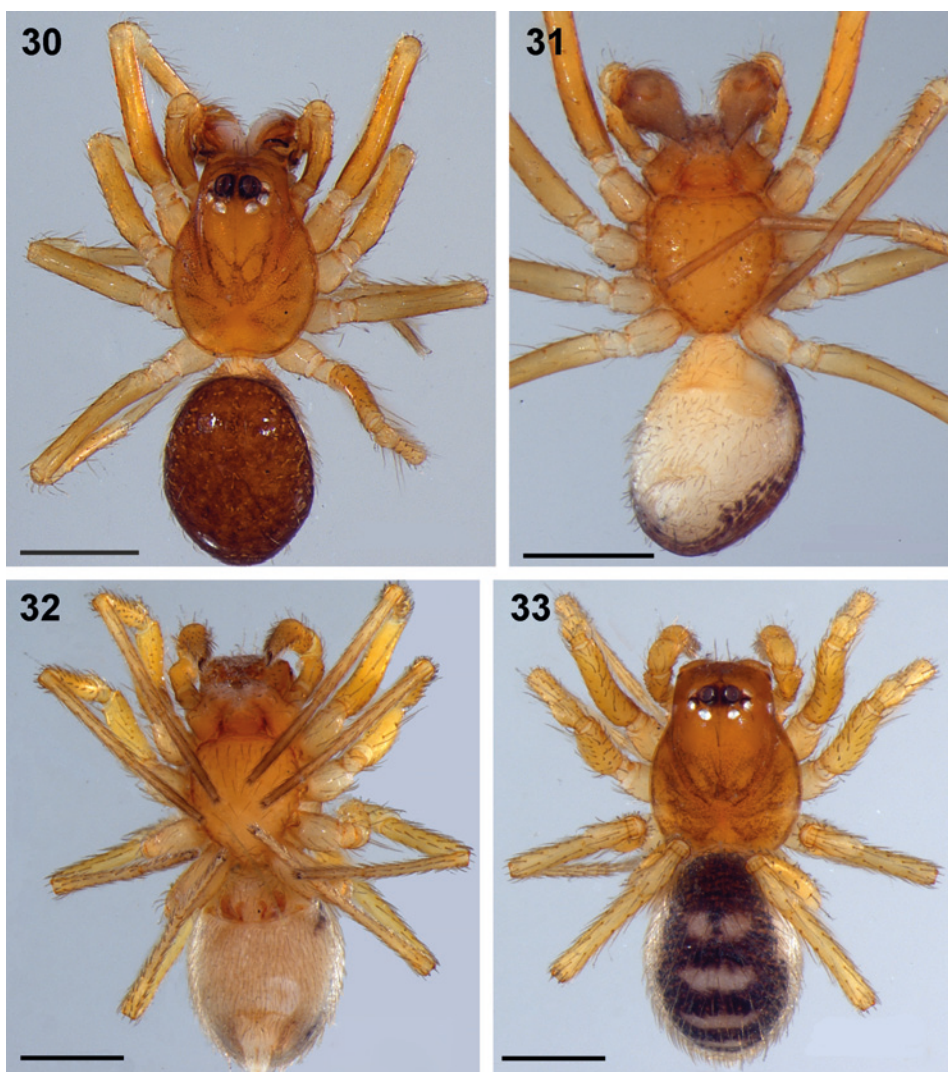
Male (holotype).

Total length 1.82. Carapace (Fig. 30): 0.90 long, 0.64 wide, 0.42 high. Colour (Figs 30, 31): Carapace and chelicerae brownish orange with faintly darkened radiating striae, cervical grooves and margin along midline of clypeus; darker around eyes; chelicerae, mouthparts and sternum brownish orange; legs uniform yellow, anterior femora orange. Abdomen: dorsum entirely covered by sepia scutum with pale mottling; sides, venter and spinnerets white; venter yellowish in front of epigastric fold. Carapace with a few long setae on clypeus. Clypeus 0.18 high. Eyes: AME large, round, dark; other eyes oval, pale; both eye rows procurved; AME: 0.10; ALE: 0.07; PME: 0.07; PLE: 0.05; AME–AME: 0.03; AME–ALE: touching; PME–PME: 0.08; PME–PLE: 0.18. MOQ: width 0.21 in front, 0.19 at the back, 0.18 long. Sternum: 0.51 long, 0.53 wide.

Legs: spination: F with three long ventral setae in large sockets.

Leg measurements:

	F	P	T	Mt	t	tot
I	0.69	0.24	0.57	0.57	0.42	2.49
II	0.63	0.27	0.45	0.51	0.39	2.25
III	0.60	0.21	0.45	0.45	0.42	2.13
IV	0.63	0.24	0.54	0.75	0.45	2.61

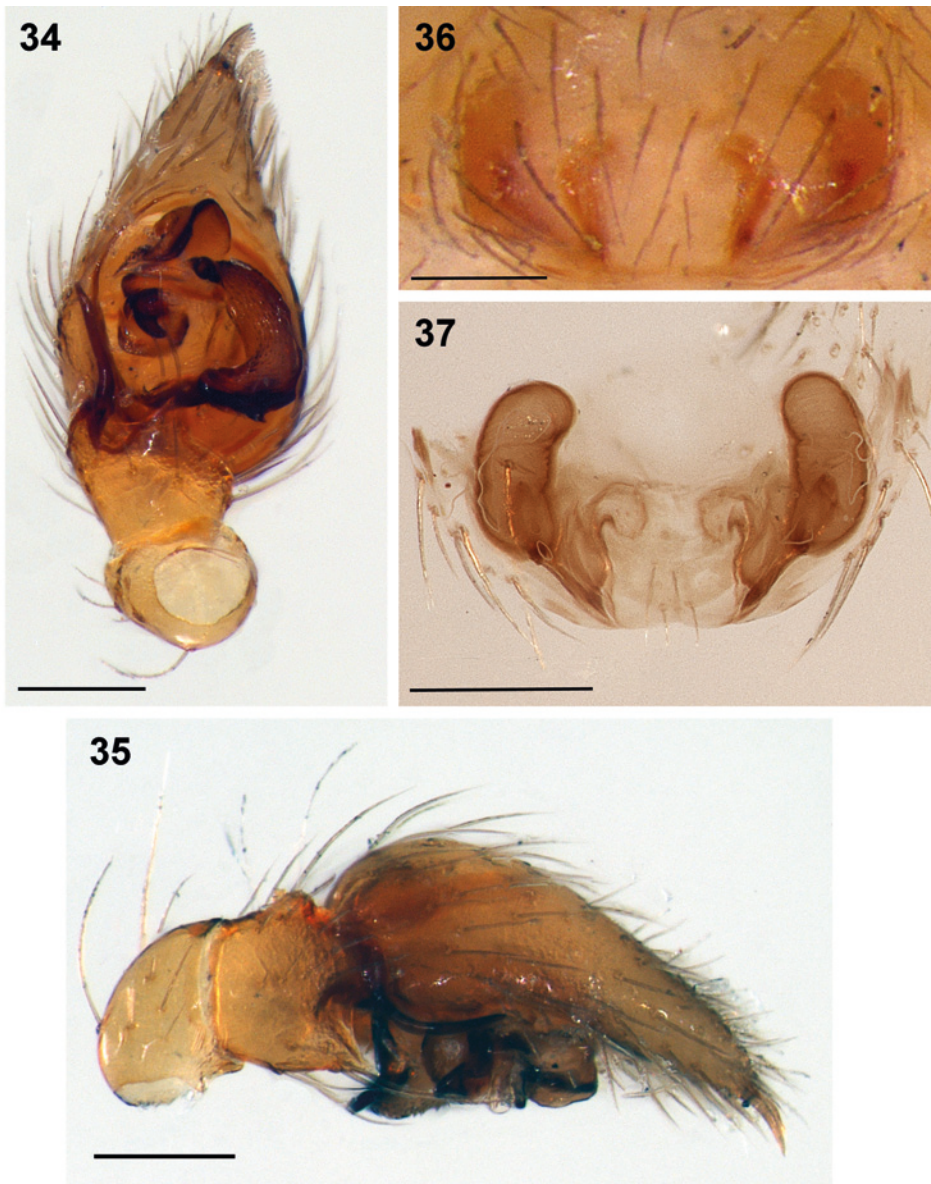


Figs 30–33. *Dismadiorea orientalis* sp. n. male paratype, Yemen (MRAC 243300): (30) habitus, dorsal view; (31) habitus, ventral view; female paratype, Yemen (MRAC 243310): (32) habitus, ventral view; (33) habitus, dorsal view. Scale bars = 0.5 mm.

Palp (Figs 34, 35, 38, 39): RTA with broad base and long parallel-sided prong, curved upward. Cymbium with distal spine and four retrolateral serrated setae. Embolus broad, strongly curved, with small prolateral tooth at base; tip strongly sclerotised, blunt. MA compact, with caudal appendage, curved backward with sharp tip. Conductor broad, sclerotised, rounded.

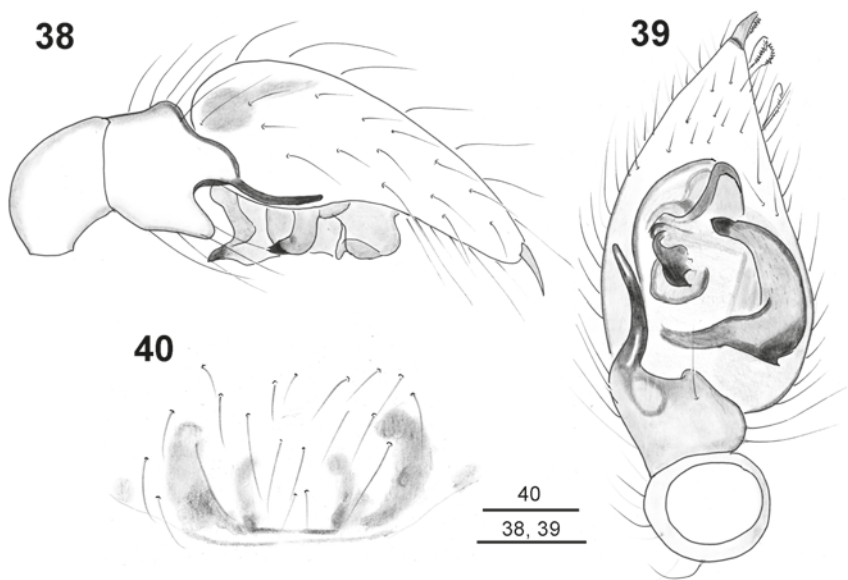
Female (paratype).

Total length 2.43. Carapace (Fig. 32): 1.06 long, 0.77 wide, 0.32 high. Colour (Figs 32, 33): similar to male except for dorsum of abdomen: dark sepia with pale pattern of



Figs 34–37. *Dusmadiores orientalis* sp. n. male paratype, Yemen (MRAC 243300): (34) male palp, ventral view; (35) idem, retrolateral view; female paratype, Yemen (MRAC 243310): (36) epigyne, ventral view; (37) epigyne, cleared, dorsal view. Scale bars = 0.1mm.

two round spots, followed by three transverse bars and white patch above spinnerets. Carapace with several long setae on clypeus and one between fovea and eyes. Clypeus 0.15 high. Eyes: AME: 0.08; ALE: 0.07; PME: 0.08; PLE: 0.07; AME–AME: 0.05; AME–ALE: 0.02; PME–PME: 0.08; PME–PLE: 0.03. MOQ: width 0.21 in front, 0.23 at the back, 0.18 long. Sternum: 0.64 long, 0.56 wide.



Figs 38–40. *Dismadioreis orientalis* sp. n. male holotype, Yemen: (38) male palp, retrolateral view; (39) idem, ventral view; female paratype, Yemen (MRAC 243310): (40) epigyne, ventral view. Scale bars = 0.1mm.

Legs: spination as in male.

Leg measurements:

	F	P	T	Mt	t	tot
I	0.81	0.30	0.60	0.63	0.48	2.82
II	0.75	0.30	0.45	0.57	0.48	2.55
III	0.66	0.301	0.45	0.69	0.36	2.46
IV	0.81	0.33	0.66	0.96	0.54	2.30

Epigyne (Figs 36, 37, 40): Wider than long, with roughly rectangular pale brown pattern in the centre, on either side with larger, brown kidney-shaped mark showing spermathecae in transparency. Spermathecae far apart, curved, with two constrictions visible as incisions on mesal side.

Variation: Males vary in total length between 1.6 and 1.8 mm. The dorsal scutum may be uniform dark sepia.

Holotype ♂: YEMEN: near Sana'a, 15°44'N 44°18'E, leg. A. van Harten, iv.1998 (pitfall trap) (MRAC 243301).

Paratypes: YEMEN: 3♀ Near Sana'a, leg. A. van Harten, ii.1998 (pitfall trap) (MRAC 243300); 1♀ Between Ta'izz, 14°47'N 44°02'E and Mafraq, 13°22'N 43°37'E, leg. A. van Harten, 13.vii.1999 (MRAC 243310); 1♂ Ta'izz, 13°59'N 44°02'E, leg. A. van Harten, i.1998, light trap (MRAC 243299).

Remark: With the species described in this volume, *Dismadioreis* now contains six species. The genus is widespread in the Afrotropical Region from west Africa to the Arabian Peninsula, where it reaches its easternmost distribution. Many species remain to be described.

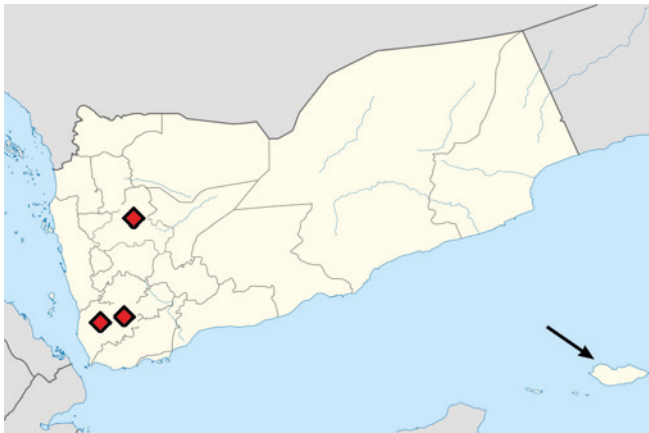


Fig. 41. Distribution map of *Dismadiorea orientalis* sp. n. Arrow indicates Socotra.

Distribution: Known only from three localities in Yemen (Fig. 41).

DISCUSSION

The fauna of Yemen and its island Socotra now contains five species of zodariids. It is quite likely that the inventory is still not complete since the collection treated here does not contain *Trygetus nitidissimus*. The collecting effort was indeed concentrated in the western part of the country. Large parts of Yemen and its island are difficult to access and it would not be surprising if more representatives of the family will be found in the future. Examination of the type of *Zodarium aerium* would be an interesting addition to the knowledge of this fauna.

ACKNOWLEDGEMENTS

We are indebted to Christine Rollard for information concerning *Zodarium aerium* in the collections of MNHN and to Robert Bosmans for his opinion about *Zodarium yemenensis* described in this paper. The two reviewers are thanked for their constructive comments that helped improve this paper.

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