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Survey of the Moroccan arachnids (Araneae, Scorpiones & Solifugae) in the collections of the Institute of Biodiversity and Ecosystem Research, Bulgaria

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Abstract. Material belonging to a small collection of Moroccan arachnids housed in the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences was examined and the results are presented here. A total of 28 species belonging to 16 families from three orders of arachnids were provided, as follows: Araneae (16 species, 12 families), Scorpiones (nine species, two families) and Solifugae (three species, two families). Five spider species, *Adonea* cf. *fimbriata* (Eresidae), *Plexippus* cf. *clemens* (Salticidae), *Thanatus oblongiusculus* (Philodromidae), *Aelurillus aeruginosus* (Salticidae) and *Steatoda incomposita* (Theridiidae), represent new or potential new records for the fauna of Morocco. Furthermore, the latter two are new for the African continent.

Keywords: camel spiders, High Atlas, Maghreb, Northern Africa, spiders

Zusammenfassung. Liste der marokkanischen Arachniden (Araneae, Scorpiones & Solifugae) in den Sammlungen des Instituts für Biodiversität und Ökosystemforschung. Das Material aus einer kleinen Sammlung von marokkanischen Arachniden im Institut für Biodiversitäts- und Ökosystemforschung an der bulgarischen Akademie der Wissenschaften wurde untersucht und die Ergebnisse werden hier präsentiert. 28 Arten in 16 Familien aus drei Ordnungen werden vorgestellt: Araneae (16 Arten, 12 Familien), Scorpiones (neun Arten, zwei Familien) und Solifugae (drei Arten, zwei Familien). Fünf Spinnenarten, *Adonea* cf. *fimbriata* (Eresidae), *Plexippus* cf. *clemens* (Salticidae), *Thanatus oblongiusculus* (Philodromidae), *Aelurillus aeruginosus* (Salticidae) und *Steatoda incomposita* (Theridiidae), stellen neue oder potentiell neue Nachweise für die Fauna von Marokko dar. Die letzten zwei sind zudem neu für den afrikanischen Kontinent.

Morocco is located in the Mediterranean Basin Hotspot, one of the biologically richest and most endangered ecoregions in the world. It houses the second greatest concentration of terrestrial biodiversity in the Mediterranean basin and the greatest concentration of marine biodiversity. Morocco has a species diversity of more than 31000 species of which about 11% are endemic (Cuttelod et al. 2008, Mittermeier et al. 2004, USAID 2010). The spider fauna of Morocco is relatively poorly studied and the number of known species amounts to only 493 (Alioua & Bosmans 2020, Alioua et al. 2020, Barrientos et al. 2020, 2021, Benhalima & Bosmans 2020, Bosmans & Hervé 2021, Bosmans et al. 2019, 2022, Habita et al. 2022, Huber 2021, 2022, Jäger 2020, Lecigne et al. 2020, Nentwig et al. 2023). The Moroccan scorpion fauna is much better studied and was recently surveyed in some detail (El Hidan et al. 2018, Touloun & Boumezzough 2011, Touloun et al. 2016a, 2016b), with several new species described (Lourenço & Geniez 2005, Lourenço & Leguin 2011a, 2011b, Lourenço et al. 2011, 2012, Turiel 2014). From about 55 scorpion species and subspecies in Morocco, 41 are known to be endemic (Touloun et al. 2016b). The list of the camel spiders of Morocco includes 25 species and one subspecies from 5 families, and 10 of them appear to be endemic (Harvey 2013, World Solifugae Catalog 2023).

The collection of arachnids (excluding Acari) in the Institute of Biodiversity and Ecosystem Research (IBER) at the Bulgarian Academy of Sciences were created simultaneously with the foundation of the institute in 2010, and consists of material collected during the current century. The collections include about 10000 samples and more than 50000 partially identified specimens of arachnids, mostly spiders from the Balkans, predominantly from Bulgaria. During an ongoing internal inventory, all material from Morocco was reviewed

and identified. The aim of this study is to present a detailed survey of the Moroccan spiders, camel spiders and scorpions deposited in the IBER collections.

Material and methods

Material was collected with tweezers or by hand picking in 2013 and 2019 from 25 localities (Fig. 1) in Morocco, between 69 and 2843 m a.s.l., mostly under stones. Specimens were examined and measured using Zeiss SM and Wild M5A stereomicroscopes with eyepiece scales and preserved in 70–85% ethanol. Identification of the spiders was in accordance with all taxonomic references listed in the World Spider Catalog (2023) for each species. Identification of the scorpions follows Lourenço (1999, 2003), Lourenço & Qi (2006), Touloun & Boumezzough (2011) and Vachon (1952). Identification of the camel spiders follows Roewer (1933, 1934). Nomenclature follows Fet et al. (2000), Harvey (2013), the World Solifugae Catalog (2023) and the World Spider Catalog (2023). All taxa are listed alphabetically. The reference ID codes are given in square brackets. The geographical coordinates are given in decimal degrees. The initials of the collectors are given in brackets, as follows: Dragan Chobanov (DCh), Kostadin Andonov (KA), Nikola Stanchev (NS) and Toshko Ljubomirov (TL).

Abbreviations

E – East, N – North, S – South, W – West, j – juvenile, sa – subadult.

Results

A total of 56 individuals of arachnids belonging to three orders, 16 families and 28 species are deposited in the IBER as follows: spiders 24 indiv./16 species/12 families, scorpions 27 indiv./9 species/2 families and camel spiders 4 indiv./3 species/2 families. Two spider genera are new records for the country. Five spider species represent new or potentially new country records and two of them are new for the African continent. Two spiders and seven scorpion species occur only in Morocco and are regarded as local endemics.

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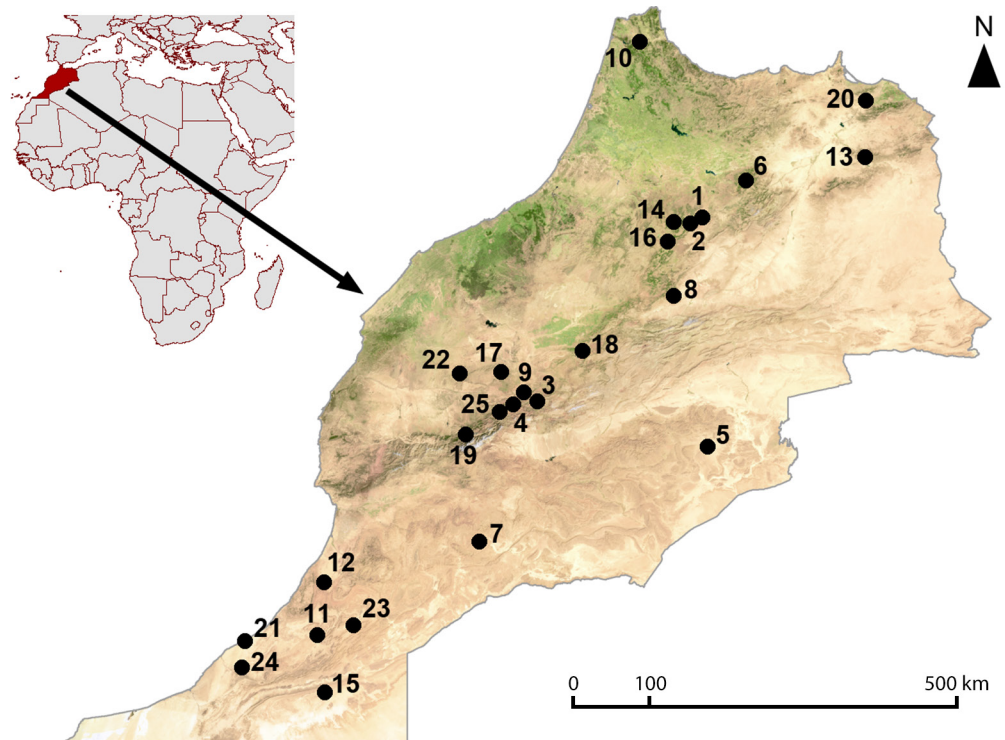


Fig. 1: Location of the collection sites in Morocco. 1. Ait Arefa; 2. Ait Daoud Ou Moussa; 3. Ait Hammou; 4. Azrif; 5. Bou Bib; 6. Bou Rha-leb; 7. Bou Soummoum; 8. Bou-mia; 9. Douar Abadou; 10. El Fendek; 11. Fask; 12. Id Yahya; 13. Ifkirene; 14. Ifrane; 15. Inerne; 16. Khazzouza; 17. Marakesh; 18. Ouaouizeght; 19. Oukaime-den; 20. Ouled Mehalhal; 21. Plage Blanche; 22. Sidi Bou Othmane; 23. Taghijit; 24. Tidergit; 25. Touf-tiht

Survey of species

ARANEAE

Araneidae

Argiope trifasciata (Forsskal, 1775)

Material. 2 sa♀ [Mo-AAr.0001], 35 km N Marakesh, 31.9103N, -7.416E, 520–600 m a.s.l., 31. Mar. 2019, (DCh).

Distribution. North, Central and South America. Introduced to Africa, Canary Islands, Portugal to Israel, Iran, China, Japan, Australia (Tasmania), Pacific Islands (Nentwig et al. 2023, World Spider Catalog 2023). Abel et al. (2020) showed that *A. trifasciata* consists of five reciprocally monophyletic clades, one of them mainly distributed in Africa and the rest of the Palearctic excluding India and China.

Cyrtophora citricola (Forsskal, 1775)

Material. 1 ♀, 1 sa♀ [Mo-AAr.0002], 35 km N Marakesh, 31.9103N, -7.4162E, 520–600 m a.s.l., 31. Mar. 2019, (DCh).

Distribution. Widespread in tropical and subtropical parts of Asia, Africa and Australia; also occurs in the Middle East, Southern Europe and in the Canary Islands; introduced into the Caribbean and both Americas; accidentally imported into Poland (Rozwałka et al. 2017, Segura-Hernández et al. 2023, World Spider Catalog 2023).

Eresidae

Adonea cf. fimbriata Simon, 1873

Material. 1 sa♀ [Mo-AE.0001], NW Boumia, 32.7555N, -5.1366E, 1763 m a.s.l., 29.. May 2013, (TL); 1 sa♀ [Mo-AE.0002], N Ifrane, 33.5744N, -5.0991E, 1585 m a.s.l., 8. Jun. 2013, (TL).

Distribution. Mediterranean, distribution and synonymy not well researched. Reported from Algeria, Tunisia, Greece and Israel (Nentwig et al. 2023, World Spider Catalog 2023). New genus and potential species record for Morocco.

Note. Both specimens are subadult females and have been tentatively identified based on their somatic traits (see Miller

et al. 2012: figs 1A, 8A-D, 19E-H) and habitats (known from desert habitat with low shrubs, often in valleys (Miller et al. 2012)).

Filistatidae

Sabastata cf. wunderlichi Magalhaes, Stockmann, Marusik & Zonstein, 2020 (Fig. 2)

Material. 1 sa♀ [Mo-AF.0001], W Bou Soummoum, 29.9969N, -7.6986E, 1052 m a.s.l., 25.. May 2013, (TL)

Distribution. Endemic to Morocco (Magalhaes et al. 2020).

Note. The specimen is a subadult female with underdeveloped genitalia and has been tentatively identified based on its somatic traits (Figs 2-7) and location (according to Magalhaes et al. 2020).

Gnaphosidae

Haplodrassus dalmatensis (L. Koch, 1866)

Material. 1 ♂ [Mo-AG.0001], W Oukaïmeden, 31.2013N, -7.8661E, 2690 m a.s.l., 21. May 2013, (TL).

Distribution. Europe except the north, Atlantic Islands, North Africa, Türkiye, Israel. In the Mediterranean region often confused with *Haplodrassus omissus* (O. Pickard-Cambridge, 1872) (Bosmans et al. 2018).

Micaria albobittata (Lucas, 1846)

Material. 2 ♀♀ [Mo-AG.0002], W Oukaïmeden, 31.2013N, -7.8661E, 2690 m a.s.l., 21. May 2013, (TL).

Distribution. From Morocco and Mediterranean Europe, through Russia (Europe to Central Asia), to Turkmenistan and China (World Spider Catalog 2023, Zamani et al. 2017).

Zelotes scrutatus (O. P.-Cambridge, 1872)

Material. 1 ♂ [Mo-AG.0003], NW Sidi Bou Othmane, 31.880N, -7.950E, 572 m a.s.l., 21. May 2013, (TL); 1 ♂ [Mo-AG.0004], N Tidergit, 28.5825N, -10.8525E, 179 m

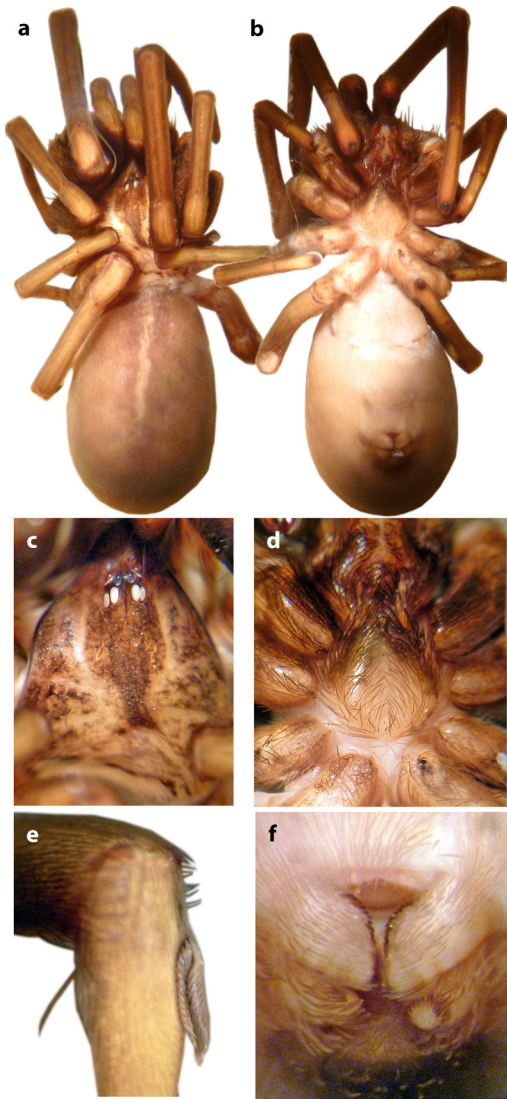


Fig. 2: *Sahastata* cf. *wunderlichii*, subadult female. **a.** habitus, dorsal view; **b.** habitus, ventral view; **c.** carapax; **d.** sternum and coxae; **e.** calamistrum; **f.** cribellum and spinnerets

a.s.l., 25. May 2013, (TL); 1 ♀, 1 sa♀ [Mo-AG.0005], El Fendek, 35.5813N, -5.5819E, 395 m a.s.l., 6. Jun. 2013, (TL).

Distribution. Canary Islands, Africa to Central Asia, Greece and Türkiye (Nentwig et al. 2023, World Spider Catalog 2023).

Hersiliidae

Hersiliola simoni (O. P.–Cambridge, 1872)

Material. 1 ♀ [Mo-AHe.0001], SE Ifkirene, 34.31189N, -2.6216E, 1334 m a.s.l., 2. Jun. 2013, (TL); 1 sa♀ [Mo-AHe.0002], NE Id Yahya, 29.5294N, -9.7502E, 427 m a.s.l., 24. May 2013, (TL).

Distribution. Iberian Peninsula, Northern Africa, Middle East, Iran (Foord & Dippenaar-Schoeman 2005, Nentwig et al. 2023, World Spider Catalog 2023).

Palpimanidae

Palpimanus denticulatus Hernández-Corral & Ferrández, 2017 (Fig. 3)

Material. 1 ♀ [Mo-APa.0001], SW Bou Rhaleb, 34.0508N, -4.1819E, 1382 m a.s.l., 4. Jun. 2013, (TL).

Distribution. Moroccan endemic (Hernández-Corral & Ferrández 2017).

Note. The specimen is an adult female and has been identified based on the shape of the posterior edge of the abdominal scutum and post-scutal sclerotization, which fits well to *P. denticulatus* (see Hernández-Corral & Ferrández 2017: fig 4b) and differs significantly from *P. maroccanus* Kulczyński, 1909 (see Hernández-Corral & Ferrández 2017: fig. 4c; Platnick 1981: fig. 14).

Philodromidae

Thanatus oblongiusculus (Lucas, 1846)

Material. 1 ♀ [Mo-APhi.0001], W Oukaïmeden, 31.2013N, -7.8661E, 2690 m a.s.l., 21. May 2013, (TL).

Distribution. Southern Europe, Türkiye, North Africa (Algeria, Libya), Ukraine, Russia (Europe) to Central Asia, Iran, China (Nentwig et al. 2023, World Spider Catalog 2023). New genus and species for Morocco.

Salticidae

Aelurillus aeruginosus (Simon, 1871) (Fig. 4)

Material. 1 ♀ [Mo-ASa.0001], NW Sidi Bou Othmane, 31.8808N, -7.9502E, 572 m a.s.l., 21. May 2013, (TL), det. G. Azarkina.

Distribution. North Mediterranean (Cyprus, Greece (incl. Chios and Rhodos Islands), Israel, Italy (incl. Sicily), Spain, Syria) (Nentwig et al. 2023, Szűts & Azarkina 2002, World Spider Catalog 2023). First record for Africa and for Morocco, respectively.

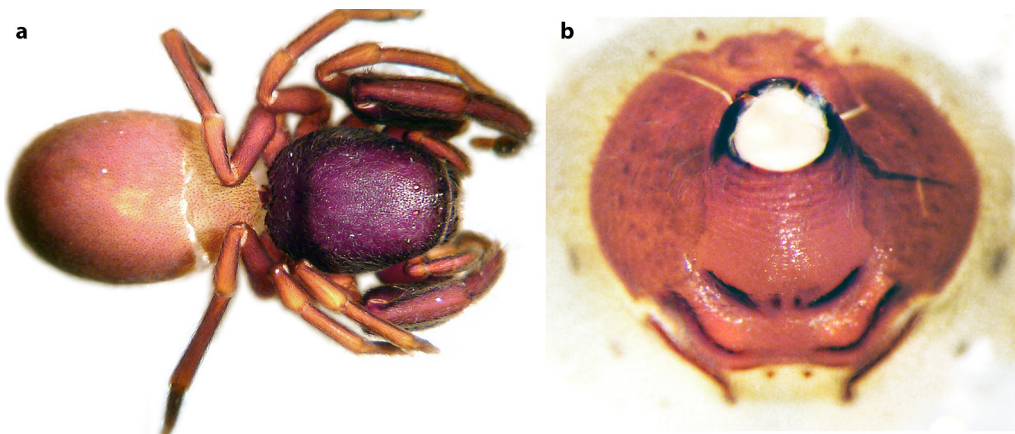


Fig. 3: *Palpimanus denticulatus*, female. **a.** habitus, dorsal view; **b.** epigyne, ventral view

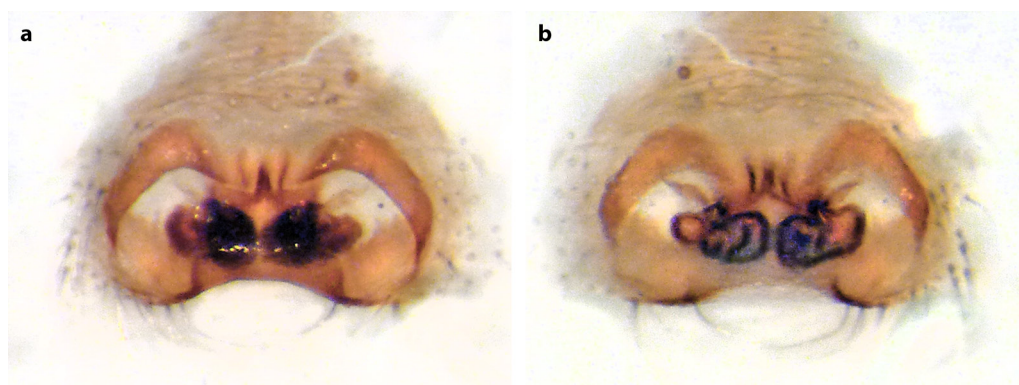


Fig. 4: *Aelurillus aeruginosus*, epigyne/vulva: **a.** ventral view; **b.** dorsal view

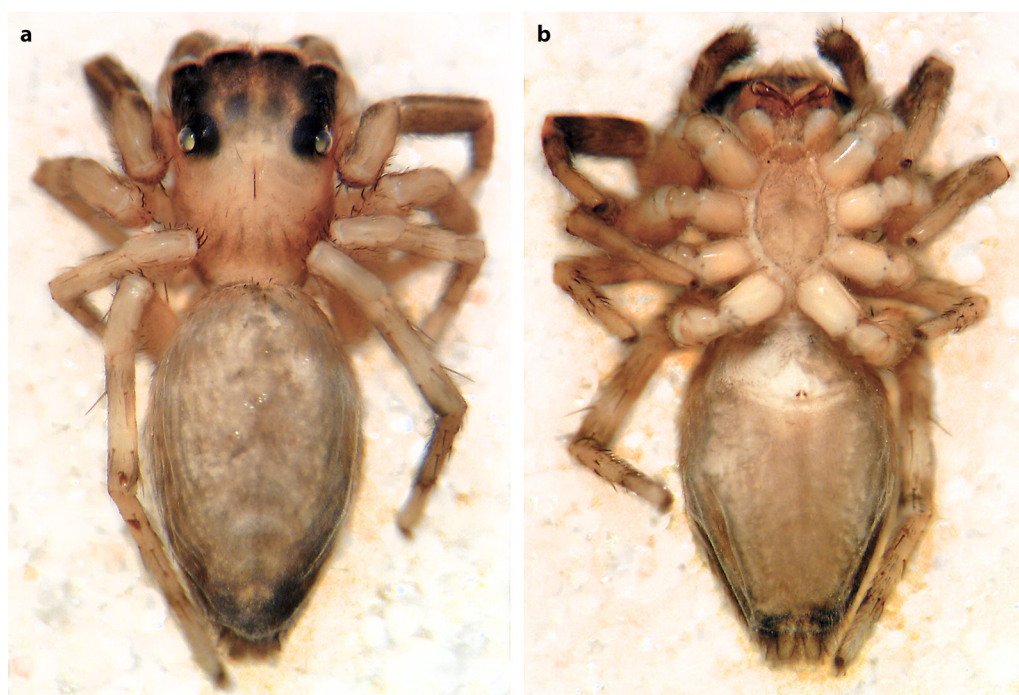


Fig. 5: *Plexippus cf. clemens*, subadult female, habitus. **a.** dorsal view; **b.** ventral view

Plexippus cf. clemens (O. Pickard–Cambridge, 1872)

(Fig. 5)

Material. 1 sa♀ [Mo–ASa.0002], S Douar Abadou, 31.6380N, –7.1316E, 1461 m a.s.l., 28. May 2013, (TL).

Distribution. Algeria, China, Egypt, India, Iran, Israel, Libya, Pakistan, Türkiye, Yemen (Prószyński 2017, World Spider Catalog 2023). Potential new species for Morocco.

Note. The specimen is a subadult female with underdeveloped epigyne and has been tentatively identified mainly based on its somatic traits (Figs 12–13) and the known distribution of the species.

Segestriidae

Ariadna cf. insidiatrix Audouin, 1826

Material. 1 sa♀ [Mo–ASe.0001], E Oukameden, 31.2036N, –7.8027E, 2843 m a.s.l., 26. May 2013, (TL).

Distribution. Mediterranean (Nentwig et al. 2023, World Spider Catalog 2023).

Note. The specimen is a subadult female with underdeveloped genitalia and has been tentatively identified mainly based on its somatic traits and the known distribution of the species.

Sparassidae

Eusparassus oraniensis (Lucas, 1846)

Material. 1 ♂ [Mo–ASp.0001], S Inerne, 29.3033N, –9.7308E, 1091 m a.s.l., 24. May 2013, (TL); 1 sa♀ [Mo–ASp.0002], N Tidergit, 28.5686N, –10.8286E, 177 m a.s.l., 24. May 2013, (TL).

Distribution. North Africa. Discovered in Morocco by Moradmand (2013).

Theraphosidae

Ischnocolus valentinus (Dufour, 1820)

Material. 1 ♂ [Mo–AThp.0001], N Ait Hammodo, 31.5783N, –6.9891E, 1934 m a.s.l., 28. May 2013, (TL).

Distribution. According to Korba et al. (2022), the distribution of this species is restricted to the Iberian Peninsula and northern Morocco.

Note. The specimen fits well to the diagnosis provided in Korba et al. (2022), with only one spine apically on pro-ventral tibia I, a straight embolus with a narrowing tip and elongated posterior lateral spinnerets.

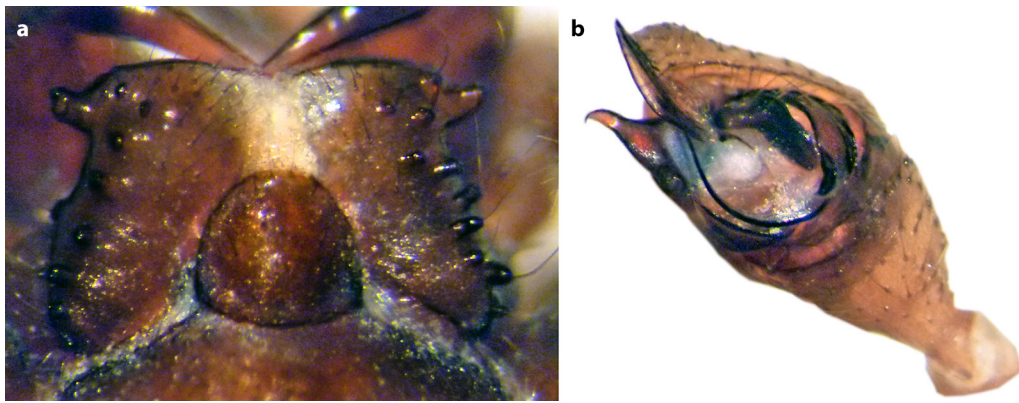


Fig. 6: *Steatoda incomposita*, male. **a.** endites and labium, ventral view; **b.** left palp, ventral view

Theridiidae

Steatoda incomposita (Denis, 1957) (Fig. 6)

Material. 1 ♂ [Mo–AThr.0001], Oukaimeden, 31.2013N, –7.8661E, 2695 m a.s.l., 21. May 2013, (TL).

Distribution. The species is known from Gibraltar, Portugal, Spain, France and Corsica (Branco et al. 2019, Gaymard & Lecigne 2018, Knoflach 1996). Morphologically it is very close to *Steatoda albomaculata* (De Geer, 1778), and was probably often misidentified (Knoflach 1996). This is the first record from Africa and from Morocco, respectively.

SCORPIONES

Buthidae

Androctonus amoreuxi amoreuxi (Audouin, 1826)

Material. 1 ♀ [Mo–ScB.0001], E Taghijit, 29.0558N, –9.3575E, 625 m a.s.l., 25. May 2013, (DCh), 1 ♂, Plage Blanche, 28.8700N, –10.7800E, 69 m a.s.l., 11. Jul. 2019, (KA); 1 ♀ [Mo–ScB.0002], Fask, 28.9525N, –9.8260E, 338 m a.s.l., 11. Jul. 2019, (NS).

Distribution. The nominal subspecies occurs from North Africa to Sudan, Senegal and Chad (Touloun et al. 2016).

Buthus albengai Lourenço, 2003

Material. 1 ♂ [Mo–ScB.0003], 2 ♀♀ [Mo–ScB.0004–5], N Ait Arefa, 33.6380N, –4.8180E, 1430 m a.s.l., 2. Jun. 2013, (TL); 1 ♂ [Mo–ScB.0006], N Ifrane, 33.5744N, –5.0991E, 1753 m a.s.l., 8. Jun. 2013, (TL); 1 ♂ [Mo–ScB.0007], 2 ♀♀ [Mo–ScB.0008–9], S Khazzouza, 33.3808N, –5.2247E, 1776 m a.s.l., 8. Jun. 2013, (TL); 1 ♂ [Mo–ScB.0010], N Ait Daoud Ou Moussa, 33.5966N, –4.9261E, 1686 m a.s.l., 8. Jun. 2013, (TL).

Distribution. Endemic to Morocco (Lourenço 2003).

Buthus boumalenii Touloun & Boumezzough, 2011

Material. 1 ♂ [Mo–ScB.0011], 1 ♀ [Mo–ScB.0012], E Bou Bib, 31.0577N, –4.6805E, 718 m a.s.l., 7. Jun. 2013, (TL).

Distribution. Endemic to Morocco (Touloun & Boumezzough 2011).

Buthus elmoutaouakili (Lourenço & Qi, 2006)

Material. 1 ♂ [Mo–ScB.0013], 1 ♀ [Mo–ScB.0014], NE Id Yahya, 29.5294N, –9.7502E, 427 m a.s.l., 24. May 2013, (TL).

Distribution. Endemic to Morocco (Lourenço & Qi 2006).

Buthus lienhardi Lourenço, 2003

Material. 1 j♂ [Mo–ScB.0015], Oukaimeden, 31.2013N, –7.8661E, 2695 m a.s.l., 21. May 2013, (TL); 2 ♀♀ [Mo–

ScB.0016–17], 1 j♂ [Mo–ScB.0018], SE Touftiht, 31.4730N, –7.4119E, 1504 m a.s.l., 27. May 2013, (TL); 1 ♂ [Mo–ScB.0019], NE Azrif, 31.5541N, –7.2438E, 1333 m a.s.l., 28. May 2013, (TL); 1 ♂ [Mo–ScB.0020], S Douar Abadou, 31.6380N, –7.1316E, 1461 m a.s.l., 28. May 2013, (TL).

Distribution. Endemic to Morocco (Lourenço 2003).

Buthus paris (C.L. Koch, 1839)

Material. 2 ♂♂ [Mo–ScB.0021–22], 1 ♀ [Mo–ScB.0023], SE Ifkirene, 34.3118N, –2.6216E, 1334 m a.s.l., 2. Jun. 2013, (TL).

Distribution. Algeria, Morocco and Tunisia (Kovářík 2006, Lourenço 2003).

Compsobuthus wiliamsi Lourenço, 1999

Material. 1 ♂ [Mo–ScB.0024], W Inerne, 28.3033N, –9.7308E, 1083 m a.s.l., 24. May 2013, (TL).

Distribution. Endemic to Morocco (Lourenço 1999).

Scorpionidae

Scorpio fuliginosus (Pallary, 1928)

Material. 1 ♀ [Mo–ScS.0001], SE Ifkirene, 34.3113N, –2.6216E, 1339 m a.s.l., 2. Jun. 2013, (TL).

Distribution. Endemic to Morocco (Lourenço 2009).

Scorpio weidholzi Werner, 1929

Material. 1 j♂ [Mo–ScS.0002], NW Sidi Bou Othmane, 31.8825N, –7.9530E, 614 m a.s.l., 21. May 2013, (TL).

Distribution. Endemic to Morocco (Lourenço 2009).

SOLIFUGAE

Galeodidae

Paragaleodes occidentalis (Simon, 1885)

Material. 1 ♀ [Mo–SoG.0001], S Ouauizeght, 32.1372N, –6.3369E, 900 m a.s.l., 9. Jun. 2013, (DCh).

Distribution. Algeria, Mauritania and Morocco (Harvey 2013, World Solifugae Catalog 2023).

Solpugidae

Oparba maroccana (Kraepelin, 1899)

Material. 1 ♀ [Mo–SoSp.0001], W Bou Soummoum, 29.9969N, –7.6986E, 1052 m a.s.l., 25. May 2013, (TL); 1 j [Mo–SoSp.0002], NW Sidi Bou Othmane, 31.8808N, –7.9502E, 586 m a.s.l., 21. May 2013 (TL).

Distribution. Morocco, Nigeria and Togo (Harvey 2013, World Solifugae Catalog 2023).

Zeria persephone Simon, 1879

Material. 1 ♂ [Mo–SoSp.0003], E Ouled Mehalhal, 34.9525N, –2.5997E, 119 m a.s.l., 3. Jun. 2013, (DCh).

Distribution. Known only from Algeria and Morocco (Harvey 2013, World Solifugae Catalog 2023).

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