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Redescription of *Dysdera sultani* (Araneae: Dysderidae) with the first description of the female

Recep Sulhi Özkütük, Rahşen S. Kaya, Ersen Aydın Yağmur, Tarık Danışman, Salih Gücel & Kadir Boğaç Kunt

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Abstract. During field trips made to investigate the dysderid fauna of Turkey, specimens of *Dysdera sultani* Deeleman-Reinhold, 1988, previously known from males only, were collected. Detailed descriptions and photographs of the copulatory organs of both sexes are given. In addition, photographs of some closely related Anatolian species are included.

Keywords: Anatolia, new record, spider, Turkey, woodlouse hunter

Zusammenfassung. Wiederbeschreibung von *Dysdera sultani* (Araneae: Dysderidae) mit Erstbeschreibung des Weibchens. Bei Exkursionen zur Untersuchung der Dysderiden-Fauna der Türkei wurden Exemplare von *Dysdera sultani* Deeleman-Reinhold, 1988 gefangen, von der bisher nur Männchen bekannt waren. Es werden Beschreibungen und Fotos der Kopulationsorgane beider Geschlechter der Art präsentiert. Ergänzt wird dies durch Fotos nahe verwandter anatolischer Arten.

Members of the spider genus *Dysdera* Latreille, 1804 are nocturnal ground foragers that are commonly found in leaf litter and primarily feed on terrestrial woodlice (Jocqué & Dippenaar-Schoeman 2006). The genus is represented by 260 extant species, mainly distributed in the West Palaearctic, with the exception of the Cosmopolitan *Dysdera crocata* C. L. Koch, 1838.

The Italian arachnologist Pietro Pavesi firstly recorded the genus *Dysdera* from the Istanbul Province of Turkey (Pavesi 1876). The first significant contribution on the genus, however, was given by Nosek (1905), and included the descriptions of *D. argaeica* Nosek, 1905, *D. asiatica* Nosek, 1905 and *D. longimandibularis* Nosek, 1905. Until the work of Deeleman-Reinhold & Deeleman (1988), in which eight new species of *Dysdera* were described from Turkey, there were only scattered records. Today, the genus *Dysdera* is represented by 24 species in Turkey, most of which are local endemics (Demir & Seyyar 2017, Varol & Danışman 2018).

Here we provide the first description of the female of *D. sultani* Deeleman-Reinhold, 1988, a species previously known only from males, and only from two localities in Turkey and Greece (Deeleman-Reinhold & Deeleman 1988). Additionally, we provide morphological information on the species.

Material and methods

Specimens were collected in the western central Anatolian region of Turkey using a litter reducer (sifter), pitfall traps and hand collection. Specimens were preserved in 70% ethanol and deposited in the Zoology Museum of the Eskişehir Technical University. Digital images of the copulatory organs were obtained using a Leica DFC295 digital camera attached to a Leica S8AP0 stereomicroscope. Five to fifteen photographs were taken in different focal planes and combined using "CombineZP" image stacking software. All measurements are given in mm. Terminology for measurements follows Chatzaki & Arnedo (2006). Terminology for the copulatory organs was adapted from Deeleman-Reinhold & Deeleman (1988).

Abbreviations

Prosoma and opisthosoma: OL – opisthosomal length, PL – prosoma length, PWmax – maximum prosoma width, PWmin – minimum prosoma width

Eyes: AME – anterior median eyes, PLE – posterior lateral eyes, PME – posterior median eyes, AMEd – diameter of anterior median eye, PLEd – diameter of posterior lateral eye, PMEd – diameter of posterior median eye

Chelicera: ChF – length of cheliceral fang, ChG – length of cheliceral groove, ChL – total length of chelicera (lateral external view)

Legs and palps: Ta – tarsus, Me – metatarsus, Ti – tibia, Pa – patella, Fe – femur, C – coxa, D – dorsal, Pl – prolateral, Rl – retrolateral, Pv – proventral, Rv – retroventral, V – ventral.

Results

Family Dysderidae C. L. Koch, 1837

Genus *Dysdera* Latreille, 1804

***Dysdera sultani* Deeleman-Reinhold, 1988** (Figs 1–4, 7–12, 13–14)

D. sultani Deeleman-Reinhold, in Deeleman-Reinhold & Deeleman, 1988: 214, Figs 236–238.

Material examined. TURKEY. 5 ♀♀, Konya Province, Akşehir District, Cankurtaran Village (38.26667°N, 31.40000°E), 1530 m a.s.l., 12 May 2009, leg. R. S. Kaya; 1 ♀, Konya Province, Akşehir District, Sultan Mountains (38.28075°N, 31.42944°E), 1566 m a.s.l., 15 May 2012, leg. E. A. Yağmur & R. S. Kaya; 1 ♂, 1 ♀, Eskişehir Province, Odunpazarı District, Yukarı Kalabak Village (39.50917°N, 30.41306°E), 1135 m a.s.l., 2 May 2013, leg. R. S. Özkütük; 2 ♂♂, 1 ♀, İzmir Province, Menderes District, Özdere (38.02122°N, 27.10119°E), 30 m a.s.l., 03 February 2013, leg. T. Danışman; 1 ♂, Uşak Province, Eşme District, c. 2 km east of Hardallı Vilage (38.33694°N,

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28.82028°E), 935 m a.s.l., 20 January–20 May 2014, leg. E. A. Yağmur & S. Örgel; 4 ♀♀, Uşak Province, Altıntaş Village (38.71778°N, 29.50750°E), 970 m a.s.l., 26 March 2015, leg. E. A. Yağmur, S. Örgel; 1 ♂, 2 ♀♀, Uşak Province, İlyaslı Village (38.60472°N, 29.20556° E), 780 m a.s.l., 25 April 2017, leg. S. Gücel & K.B. Kunt.

Other material examined. ***Dysdera argaeica*** **Nosek, 1905:** TURKEY. 3 ♂♂, 2 ♀♀, Kayseri Province, Mount Lifos (38.58666°N, 35.48638°E), 2200 m a.s.l., 19 May 2011, leg. T. Danışman; 2 ♂♂, 2 ♀♀, Kayseri Province, Hisarcık District, Mount Erciyes (38.60808°N, 35.51361°E), 1820 m a.s.l., 18 August–27 October 2012, leg. E. A. Yağmur & H. Koç (Figs 5, 15).

Dysdera enguriensis **Deeleman-Reinhold, 1988:** TURKEY. 1 ♂, Ankara Province, Çankaya District, Dodurga Village (39.82025°N, 32.66791°E), 1090 m a.s.l., 29 May 2012, leg. K. B. Kunt (Fig. 6).

Diagnosis. *Dysdera sultani* is closely related to the Turkish endemic species *D. argaeica*, according to the basic characteristics of the male copulatory organs, such as the cylindrical shape of the bulbus, the massive structure of the posterior apophysis, and the development of the internal and external sclerites on the bulb. The most obvious difference between the males of these two species is the angle and shape of the structures towards the distal part of the bulb. The vulvae of *D. sultani* and *D. argaeica* are similar, but the midline of the transverse bar is more flattened in *D. argaeica* as opposed to crescent shaped in *D. sultani*. Additionally, the posterior diverticulum is membranous and well-developed in *D. argaeica.*

Measurements (♂/♀). OL 4.80/7.60; PL 4.30/4.50; PWmax 3.40/3.40; PWmin 2.20/2.50; AMEd 0.10/0.23; PLEd 0.10/0.19; PMEd 0.10/0.16; ChF 0.71/0.88; ChG 0.73/0.82; ChL 1.30/1.65.

Description. Medium-sized dysderid spiders. Male specimens are slightly darker than females.

Prosoma reddish brown. The cephalic region is lighter than the thoracic region and is angular laterally. The eyes are closely grouped; anterior-median eyes are more distant from each other (Fig. 1). Chelicerae brown. Cheliceral groove with three small teeth. Distance between basal and medial teeth is half of the distance between distal and medial teeth (Fig. 2).

Labium, gnathocoxae and sternum reddish brown and margins blackish brown. Labium reddish brown from the adjacent edge of the sternum to approximately the tip of the sternum; the tip much lighter, orange and concave. The surface of the sternum bright with nearly uniform weak black hairs and brown margins. Setae longer in males.

Pedicel strongly developed, sclerotized and brown dorsally and ventrally. Legs yellowish to light brown, with the first three segments of the anterior legs darker than the other segments. Front legs spineless. Femora of all legs with dorsal spines in both sexes. Leg measurements and spination are given in Tab. 1 and Tab. 2.

Scopulae present on tarsi and metatarsi of all legs. However, the scopulae of the 3rd and 4th legs are well developed and more distinct than the other legs.

Opisthosoma greyish; cylindrical and more swollen in females. The surface covered with short blackish hairs on both the dorsal and ventral sides. Distinct colour difference between the spinnerets and opisthosoma in both sexes. Spinnerets darker brown than opisthosoma and almost the same colour as the legs. Epigastral scutum is present and weakly developed. Tracheal spiracles are sclerotized.

The female palp is the same colour as the legs; palpal tarsus with a single-claw, and almost the entire surface is densely covered with thick hairs.

Tab. 1: Leg measurements of *Dysdera sultani* (in mm). C – coxa, FE – femur, PA – patella, TI – tibia, ME – metatarsus, TA – tarsus

(♂/♀)	I	II	III	IV
C	1.68 / 1.70	1.40 / 1.50	0.96 / 1.10	1.18 / 1.50
Fe	2.73 / 3.30	2.30 / 3.00	2.25 / 2.50	2.92 / 3.50
Pa	2.19 / 2.20	2.00 / 2.00	1.39 / 1.40	1.73 / 1.75
Ti	2.78 / 2.80	2.64 / 2.70	1.33 / 1.55	2.08 / 2.45
Me	2.89 / 2.80	2.53 / 2.82	1.97 / 2.25	2.47 / 3.00
Ta	0.50 / 0.60	0.60 / 0.60	0.50 / 0.60	0.60 / 0.60

Tab. 2: Leg spination of legs III and IV of *Dysdera sultani*

	III	**IV**
♂		
Fe	0	1-2 D
Pa	0	0
Ti	1-1-1Rl 1-1 Pl 1Rv 1V 1Pv	1-1 Rl 1-1Pl 1Rv 1V 1Pv
Me	1-1-1Rl 1-1 Pl 1-1 Rv 1Pv	1-1-1 Rl 1-1 Pl 1-1-1 Rv 1-1-1Pv
♀		
Fe	0	2-2 D
Pa	0	0
Ti	1-1-1Rl 1-1 Pl 1Rv 1V 1Pv	1-1-1 Rl 1-1Pl 1Rv 1V 1Pv
Me	1-1-1-1 Rl 1-1 Pl 1-1 Rv 1Pv	1-1-1 Rl 1-1 Pl 1-1-1 Rv 1-1-1Pv



Fig. 1: *Dysdera sultani*. Female, prosoma, arrows indicate the front margins of the head region

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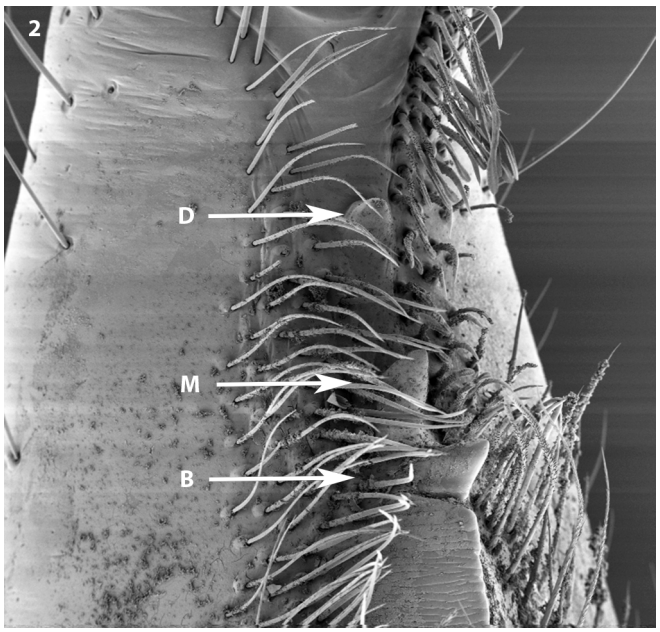
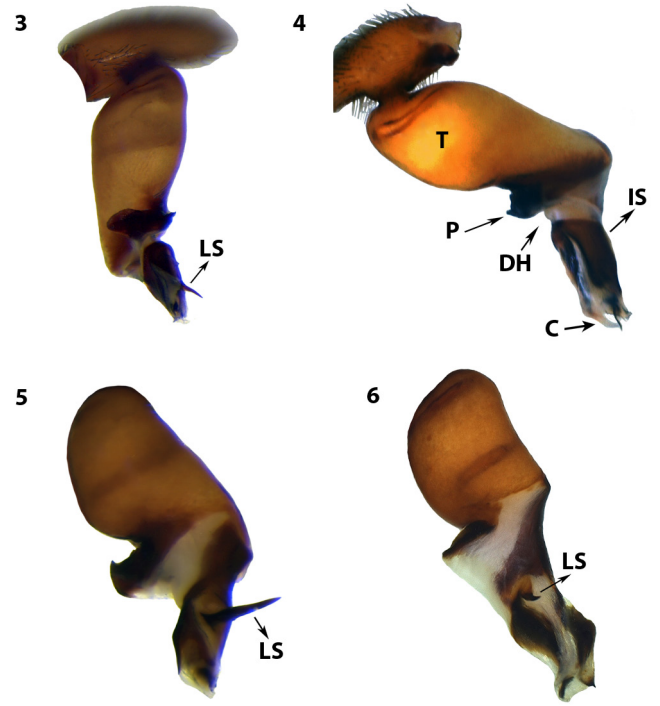
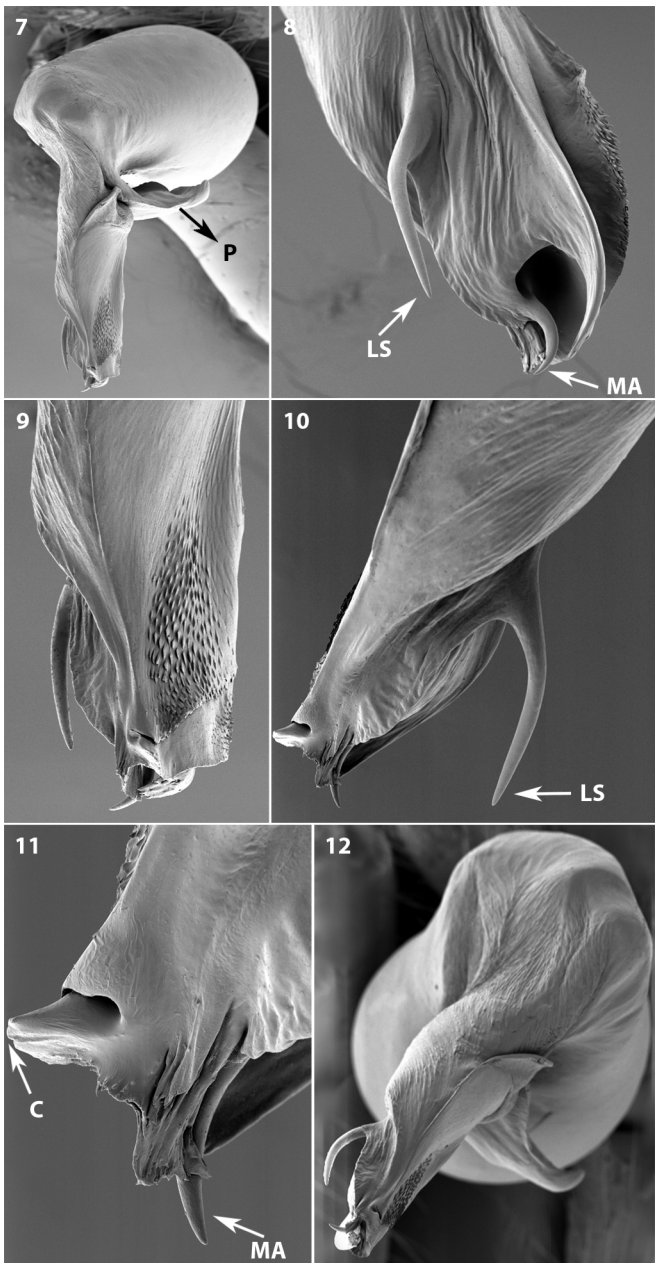


Fig. 2: *Dysdera sultani*. Cheliceral teeth



Figs 3-6: *Dysdera sultani*. **3.** Bulbus, nearly prolateral view; **4.** Ditto, retrolateral view; **5.** *Dysdera argaeica*, bulbus, prolateral view; **6.** *Dysdera enguriensis*, bulbus, prolateral view. B, basal; C, crest; D, distal; DH, distal haematodocha; IS, internal sclerite; LS, lateral sheet; M, medial; P, posterior apophysis; T, tegulum



Figs 7–12: *Dysdera sultani*, bulbus. **7.** Prolateral view; **8.** Nearly prolateral view; **9.** Nearly, retrolateral view; **10.** Retrolateral view; **11.** nearly distal view; **12.** nearly posterior view. C, crest; LS, lateral sheet; MA, median apophysis; P, posterior apophysis

In males, palpal segments are brown and darker than in females; dorsal surface of all patellae, tibiae and tarsi covered with dense, relatively long hairs.

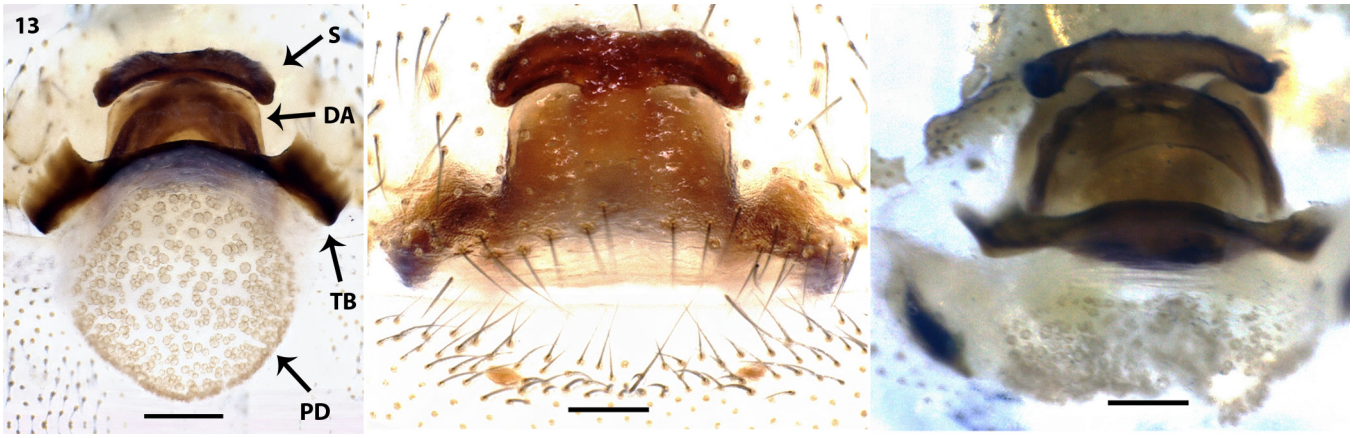
Tegulum cylindrical, and sperm ducts distinct (Figs 3–4). The posterior apophysis long, strongly sclerotized and hook-shaped (Figs 3–4, 7, 12). Distal haematodocha clear; triangular from anterior to posterior in retrolateral view (Fig. 4).

The internal sclerite dark brown, broad, rectangular and extending along the distal division (Fig. 4). In SEM photographs, triangular, spiny protrusions arranged like fish-scales are present from the midline to the distal border of the internal sclerite. The lateral sheet long and spine shaped. Crest membranous and comma shaped. Median apophysis short and spine-like (Figs 7–12).

Vulva strongly sclerotized. Spermathecae slightly concave posteriorly. The dorsal arch is the same width as the spermathecae. The midline is sclerotized and membranous on the margins. Transverse bar strongly convex and about twice as long as spermathecae. Except for the parts that are adjacent to the dorsal arch, the transverse bar is rectangular. Posterior diverticulum wide and membranous. A cartilaginous transition zone is present between the posterior diverticulum and transverse bar (Figs 13–14).

Distribution. *Dysdera sultani* was described by Deeleman-Reinhold (in Deeleman-Reinhold & Deeleman 1988) from Turkey and Greece based on male specimens only. The species was previously known from the type locality in the Akşehir

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Figs 13–15: *Dysdera sultani*. **13.** Vulva, dorsal view (DA – dorsal arch, PD – posterior diverticulum, S – spermathecal, TB – transverse bar), scale bar 0.2 mm; **14.** Ditto, ventral view, scale bar 0.1 mm; **15.** *Dysdera argaeica*, vulva, dorsal view, scale bar 0.1 mm

District of Konya Province in Turkey and from the Samos Island in Greece. Here we have provided newly collected material from central Anatolian and Aegean regions of Turkey (Fig. 16).

Such broad range from the central Anatolian high mountainous region to the coastal Aegean region and a distribution pattern from warmer areas to more hot-dry areas in *D. sultani* may be related to drying that occurred in Anatolia at the end of the Pleistocene, 15000 years ago. As a result of this drying, many species moved to higher altitudes and humid places, whereas drought-tolerant species could remain or disperse to newly dry areas (see Çıplak 2008, Korkmaz et al. 2014). Additionally, the presence of *D. sultani* on Samos Island is likely due to land bridges that appeared in the Pleistocene during the expansion of this species.

Notes. According to the classification of Deeleman-Reinhold & Deeleman (1988), *D. sultani* belongs to the *asiatica* species group which is characterized by following features:

1. The anterior margins of the prosoma are parallel to each other and the thoracic part is slightly narrowed behind the eyes.
2. Chelicerae are shorter than half the length of the prosoma.
3. Variable leg spination.

Dysdera sultani has all characteristics of the *asiatica* species group mentioned above. The presence of a lateral sheet on the male palp (lateral sheet is well developed in *D. sultani* and *D. argaeica* while not well developed in *D. enguriensis*) indicates both relationships between the species and similar features of the *asiatica* species group (see Figs 5–6, 15).

Deeleman-Reinhold & Deeleman (1988) compared the holotype and paratype samples of *D. sultani* and emphasized that "the palps are uniform despite the geographical distance of 420 km between the samples". The authors, however, indicated that the cheliceral sizes and leg spination are slightly different between the samples.



Figs 16: Map of the records of *Dysdera sultani*

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Cheliceral size could be related to the particular isopod species *Dysdera* preys upon (see Pollard 1986), but we found no significant differences in cheliceral size among specimens from different localities. Additionally, as Deeleman-Reinhold & Deeleman (1988) mentioned, the number of spines on the legs may show small variations even within the same population.

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