

FIRST DETAILED RECORDS OF *CALATHOCRATUS* FROM THE IBERIAN PENINSULA, WITH DESCRIPTION OF TWO NEW SPECIES (OPILIONES: DYSPNOI: TROGULIDAE)

Carlos E. Prieto^{1*}, Hay Wijnhoven² & Jochen Martens³

¹ Departamento de Zoología, Universidad del País Vasco (UPV/EHU), Apdo.644 48080-Bilbao, Spain / C. Astarloa 5, 5^aA, 48001-Bilbao, Spain / carlos.prieto@ehu.eus

² Nijmegen, The Netherlands

³ Johannes Gutenberg-Universität, Institut für Organismische und Molekulare Evolutionsbiologie (iomE), D-55099 Mainz, Germany / Senckenberg Research Institute, Arachnology, D-60325 Frankfurt am Main, Germany

* Corresponding author

Abstract. The genus *Calathocratus* is reliably recorded from the Iberian Peninsula, encompassing two new species described herein. Both species are small, have a similar overall morphology, like a dorsal median area devoid of papillae, but they are very different in penial morphology. *Calathocratus zaragozai* sp. nov. from the Valencian-Alicante mountains in Spain has a unique subapical stylus and a glans with large setae, while *Calathocratus algarvensis* sp. nov. from the Algarve region in Portugal, has a stout apical stylus and a glans with short, robust setae. Descriptions are complemented with the first record of teratological anophthalmia in Trogulidae and several observations of citizen science. A discussion on related species is included.

Key words: Spain, Portugal, penial morphology, tarsal formula, teratological anophthalmia, citizen science.

Primeras citas detalladas de *Calathocratus* para la Península Ibérica, con descripción de dos nuevas especies (Opiliones: Dyspnoi: Trogulidae).

Resumen. Se cita de forma fiable el género *Calathocratus* para la Península Ibérica con la descripción de dos nuevas especies. Ambas especies son pequeñas, tienen una morfología general similar, peculiarmente un área dorsal mediana desprovista de papilas, pero son muy diferentes por la morfología penial. *Calathocratus zaragozai* sp. nov. de las montañas de Valencia-Alicante en España tiene un singular estilo subapical y un glande con grandes setas, mientras que *Calathocratus algarvensis* sp. nov. de la región del Algarve en Portugal, tiene un estilo apical robusto y un glande con setas cortas y robustas. Las descripciones se complementan con el primer registro de anofthalmia teratológica en la familia Trogulidae y varias observaciones de ciencia ciudadana. Se incluye una discusión sobre especies relacionadas.

Palabras claves. España, Portugal, morfología penial, fórmula tarsal, anofthalmia teratológica, ciencia ciudadana.

Introduction

The family Trogulidae Sundevall, 1833, erected for the genus *Trogulus* Latreille, 1798 (and *Caeculus* Dufour, 1832, now a trombidiform mite) and named for the presence of a frontal head cap that covers and protects the pedipalps and chelicerae (Sundevall 1833), was further characterized by Simon (1879), who added the genera *Anelasmacephalus* Simon, 1879 and *Calathocratus* Simon, 1879 and separated the current Dicranolasmatidae Simon, 1879 into their own subfamily. Roewer (1940), in his style, based the Trogulidae systematics on the segment numbers of leg tarsi, allowing him to erect the genera *Platybessobius* Roewer, 1940 (tarsal articles legs I to IV: 1-1-2-2), *Trogulocratus* Roewer, 1940 (2-1-3-3) and *Kofiniotis* Roewer, 1940 (3-6-3-3). Šilhavý (1967) added the genus *Anarthrotarsus* Šilhavý, 1967 (with 1-1-1-1; see also Kontos & Martens 2022), although the taxonomic significance of the tarsal formula was questioned both by Starega (1966), who synonymized *Platybessobius* with *Calathocratus*, and by Martens & Chemini (1988), who accepted up to four tarsal formulas in the genus *Anelasmacephalus*. The generic systematics of the family was molecularly analyzed by Schönhofe & Martens (2010), demonstrating that *Platybessobius* and *Trogulocratus* are polyphyletic, passing them to the synonymy of *Calathocratus*.

The genus *Calathocratus*, erected for *Trogulus africanus* Lucas, 1846 from Algiers (Algeria) and later cited from Sicily (Marcellino 1965) and Tunisia (Roewer 1950 as *Trogulocratus tunetanus* Roewer, 1950), presently includes further eight species (Table I, Figure 1): *C. sinuosus* (Sørensen,

1873) from the surroundings of Rome (Italy) and the whole Italian Peninsula (Schönhofe & Martens 2010); *C. singularis* (Roewer, 1940) from Crete Island (Greece) and reported, as *Platybessobius cf. singularis*, from Greece and Anatolia by Schönhofe & Martens (2010); *C. intermedius* (Roewer, 1940), also from Crete Island although Schönhofe (2013) states that its type locality is “likely erroneous” because it was never collected again on Crete; *C. rhodiensis* (Gruber, 1963) from the island of Rhodes, *C. caucasicus* (Šilhavý, 1966) from the Russian Southwest Caucasus, and *C. beieri* Gruber, 1968 from Southeast Anatolia (Gruber 1963, 1968; Šilhavý 1966); *C. hirsutus* Snegovaya, 2011 and *C. minutus* Snegovaya, 2011, both from Krasnodar Krai in the Russian Caucasus (Snegovaya & Chumachenko 2011). Chemeris (2013) described *Trogulocratus kyrgyzicus* Chemeris, 2013 from Kyrgyzstan, which Kury et al. (2020) placed under *Calathocratus*. This presently is the easternmost published record of the genus.

On the Iberian Peninsula, the family Trogulidae includes six species of *Trogulus* and six of *Anelasmacephalus* (Schönhofe & Martens 2008; Prieto & Las Heras 2020). Additionally, Prieto (2008) mentioned the presence in Valencia [lapsus calami; in reality, province of Alicante] of an unnamed species of *Trogulocratus*. Based on a molecular analysis by Schönhofe & Martens (2010) the mentioned sample was revealed by Schönhofe et al. (2013) as a well separated lineage within the newly defined *Calathocratus*. We describe this new Spanish species, dedicating it to the



Figure 1. Geographic distribution of the *Calathocratus* species, indicated by the initial of the specific epithet (see it in Table 1, except g= *C. singularis*); moreover z= *C. zaragozai* sp. nov. and α= *C. algarvensis* sp. nov. The locality of *C. kyrghyzicus* is located 2000 km east of the specified symbol and the record of *C. africanus* for Corsica (Simon 1879) is cited by Delfosse (2018) as *Calathocratus* sp. We add the first record of *Calathocratus* sp. (+) for Morocco. / **Figura 1.** Distribución geográfica de las especies de *Calathocratus*, indicada por la inicial del epíteto específico (ver en la Tabla 1, excepto g= *C. singularis*); además z= *C. zaragozai* sp. nov. y α= *C. algarvensis* sp. nov. La localidad de *C. kyrghyzicus* se ubica 2000 km al este del símbolo especificado y el registro de *C. africanus* para Córcega (Simon 1879) es citado por Delfosse (2018) como *Calathocratus* sp. Añadimos la primera cita de *Calathocratus* sp. (+) para Marruecos.

Table I. Specific diversity and geographical distribution of the genus *Calathocratus* according to the tarsal formula FT (formerly, 1122 in *Platybessobius*, 2133 in *Trogulocratus*). Body size (mm) is given for males/females. SMA refers to the presence of a smooth dorsal median area, devoid of papillae. / **Tabla I.** Diversidad específica y distribución geográfica del género *Calathocratus* según la fórmula tarsal (1122 y 2133 es la de los antiguos géneros *Platybessobius* y *Trogulocratus*). El tamaño del cuerpo (mm) se da para machos/hembras. SMA se refiere a la presencia de un área media dorsal lisa, desprovista de papilas.

FT	Species	Geographical distribution	Body size: M/F	SMA
1122	<i>C. singularis</i> (Roewer, 1940)	Greece, Crete I., Anatolia	3	-
1122	<i>C. caucasicus</i> (Silhavy, 1966)	S-Russia: Kuban	4.5	-
2122	<i>C. africanus</i> (Lucas, 1846)	Algeria, Tunisia, Sicily	6.2 / 6.8	+
2122	<i>C. beieri</i> Gruber, 1968	Anatolia: Vilayet	4.7	-
2122	<i>C. hirsutus</i> Snegovaya, 2011	S-Russia: Krasnodar	6.4-7.2 / 7.3-8.2	-
2122	<i>C. minutus</i> Snegovaya, 2011	S-Russia: Krasnodar	4.1-5 / 4.7-5.2	-
2133	<i>C. sinuosus</i> (Sørensen, 1873)	Italian Peninsula	4.8 / 5.3	+
2133	<i>C. intermedius</i> (Roewer, 1940)	Crete Island?	5	-
2133	<i>C. rhodiensis</i> (Gruber, 1963)	Rhodes Island	6.1 / 7.2	-
2133	<i>C. kyrghyzicus</i> (Chemeric, 2013)	Kyrgyzstan	5.2	-

memory of a friend, Juan Antonio Zaragoza Miralles, recently deceased. Amazingly, a sample of *Calathocratus* from the southern Portuguese Algarve region, collected in 2019, proved to belong to a morphologically different and new species, which is also described herein. Both species clearly differ in genital morphology and are geographically isolated from their assumed closest relatives *Calathocratus africanus* and *C. sinuosus*, with which they share a defined median area largely devoid of papillation.

Material & methods

The specimens of *C. zaragozai* were studied, measured and photographed by a SMZ1500 Nikon stereomicroscope and attached hardware Digital Sight DS-L1 Nikon; serial photographs were stacked, and backgrounds edited with the Helicon Focus (v.7.1.1) software. The photographs of *T. algarvensis* were taken with a video camera attached to a Zeiss SV 6 stereomicroscope and stacked with the Automontage©System. Original drawings were based on sketches directly drawn from an Olympus stereo light microscope and a Euromex dissecting microscope, with the aid of a calibrated drawing mirror.

The studied material has been or will be deposited in: **AXLS** = Collection Axel Schönhofer, Mainz, Germany.

CHW = Collection Hay Wijnhoven, Nijmegen, The Netherlands. **CJM** = Collection Jochen Martens, deposited in the Senckenberg Research Institute, Arachnology, Frankfurt am Main, Germany. **MNCN** = Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain. **SMF** = Senckenberg Research Institute and Natural History Museum, Frankfurt am Main, Germany. **ZUPV** = Departamento de Zoología y Biología Celular Animal, University of the Basque Country (UPV / EHU), Leioa, Bizkaia, Spain.

Measurements in mm.

Abbreviations: M = male(s), F = female(s), J = juvenile(s), EMS = underground sampling station, gr. MSS = Mesovoid Shallow Substratum group.

Additional specimens studied:

Calathocratus africanus, two males (5.95, 6.03 mm) and one female (7.06 mm) from Fienzza, Sicily, Italy [SMF·1389].

Calathocratus africanus, a juvenile (2.95 mm) from Albano, Rom, Italy [SMF·1390], referred to *C. sinuosus* by A. Schönhofer (pers.comm.).

Calathocratus africanus, a female (6.9 mm) from Algiers, Algeria [SMF·1391].

Trogulocratus tunetanus Roewer, 1950, holotype (female, 7.07 mm) from Sfax, Tunisia [SMF·9101].

Calathocratus sp., 1 adult, 2 juveniles from Béja, Teboursouk

Pass, Tunesia, 820 m, 36.4861 9.1514 (TF 1-1-2-2), H. Meybohm leg. 1.3.2011 [CJM-7132].

Calathocratus sp., 2 adults, 1 juvenile, from Tafoughalt, Morocco, 560 m, 34.82397 2.42985, H. Wijnhoven leg. 30.9.2010 [CJM-7019].

Systematics

Family TROGULIDAE Sundevall, 1833

Genus *Calathocratus* Simon, 1879

Calathocratus zaragozai sp. nov.

Trogulocratus sp. nov.? – Prieto, 2008: 62; fig. 17 (Valencia = *lapsus calami*: Alicante).

Trogulocratus sp. – Schönhofe & Martens, 2010: 62 (Alicante, Alcoy, Santuario Font Rotja).

Calathocratus sp. – Schönhofe et al., 2013: 309 (Spain).

TYPE LOCALITY. Serra del Menejador, Parque Natural de la Font Roja, Alcoi (Alicante, Spain; 30SYH131818, 1265 m asl)

Holotype: male [MNCN 20.02/38432, ex-coll. ZUPV-5654]

Paratypes: 1M, 3F, 4J [ZUPV-3753]: Alcoi: P.N. Font Rotja: Santuario (Alicante; 30SYH144826, 960 m), J. Zaragoza & V. Ripoll leg. 13-05-2006 [+ sequences in GenBank for 28S rRNA: GQ466314 and cytb: GQ466239] • 1M, 1F, 1J [ZUPV-5654]: Alcoi: P.N. Font Roja: Serra del Menejador (Alicante; 30SYH131818, 1265 m), V. Ortuño & gr. MSS leg. 10-05-2013 (EMS-1) • 3M, 1F [ZUPV-5752] + 2M [CHW-496, ex ZUPV-5752]: =, VII-2012 (EMS-1/3) • 2M, 3F [MNCN 20.02/38433-38437, ex-coll. ZUPV-5753]: =, X-2012 (EMS-1, 3, 4) • 3M [ZUPV-5755]: Agres: Sierra de Mariola (Alicante; 30SYH173945, 1170 m), V. Ortuño & gr. MSS leg., 16-01-2012 (EMS-1, 2) • 2M, 1F [ZUPV-5756]: =, X-2012 (EMS-1, 2) • 1F [ZUPV-5655]: =, 09-05-2013 (pitfall) • 2F [ZUPV-5652]: Barxeta: Rio Barxeta (Valencia; 30SYJ268210, 187 m), V. Ortuño & gr. MSS leg., 08-03-2012 (EMS-1) • 2F [ZUPV-5651]: Cocentaina: Mas de Llopis (Alicante; 30SYH187927, 1220 m), V. Ortuño & gr. MSS leg., 09-05-2013 (EMS-2) • 2M, 3F [ZUPV-5750]: =, X-2012 (EMS-1, 2) • 2F [ZUPV-5653]: Confrides: Sierra de Aitana (Alicante; 30SYH350822, 1330 m), V. Ortuño & gr. MSS leg., 16-05-2013 (pitfall) • 1M [ZUPV-5751]: =, VII-2012 (EMS-7) • 1M, 4F [ZUPV-5656]: Denia: P.N. Montgó (Alicante; 31SBD495000, 322 m), V. Ortuño & gr. MSS leg., 14-05-2013 (EMS-2, pitfall) • 5F [ZUPV-5757]: =, 27-01-2012 (EMS-3, 4) • 2M, 2F [ZUPV-5758]: =, X-XI-2012 (EMS-3, 4) • 1F [ZUPV-5657]: Quatretondeta: La Serrella (Alicante; 30SYH351887, 1000 m), V. Ortuño & gr. MSS leg., 14-05-2013 (pitfall) • 2M, 2F [CJM-9642, ex ZUPV-5759]: =, X-XI-2012 (EMS-1, 2) • 1F [ZUPV-5728]: Tibi: Sierra del Maigmo (Alicante; 30SYH060646 1080 m), V. Ortuño & gr. MSS leg., X-2012 (EMS-1) • 1F [ZUPV-5754]: =, X-2012 (pitfall) • 1M [ZUPV-5650]: Xaló: Serra de Bèrnia (Alicante; 30SYH564836, 900 m), V. Ortuño & gr. MSS leg., 14-05-2013 (EMS-3) • 1M, 2F, 1J [ZUPV-5749]: =, X-XI-2012 (EMS-3, 4). 1F, 1J [AXLS-878]: Bicorp, road to Casas Benalí, Cueva de los Moros (Valencia; 39.11716, -0.77613, 266 m), S. Huber & A. Schönhofe leg., 01-06-2010 • 1M [AXLS-879]: Pego/Val de Ebo (Alicante; 38.81772, -0.12256, 405 m), S. Huber & A. Schönhofe leg., 02-06-2010 • 3F, 2J [AXLS-892]: Pego/Val de Ebo, cavities (Alicante; 38.82610, -0.10824, 256 m), NE facing Pinus for-

est on slope, in dead wood, S. Huber & A. Schönhofe leg., 03-06-2010 • 1J [AXLS-895]: W Alcoy, road to Santuario de la Font Roja (Alicante; 38.66504, -0.53734, 1142 m), leaf litter in dense evergreen *Quercus* forest, S. Huber & A. Schönhofe leg., 05-06-2010.

Total: 26 males, 41 females, 10 juveniles. Adult sex (male/female) ratio, 0.63.

DERIVATIO NOMINIS. The species name is dedicated to the memory of Juan Antonio Zaragoza Miralles (1953 - October 18, 2022), a friend and a Spanish arachnologist and biospeleologist from Alicante who, with his wife Vicen Ripoll, collected the first specimens of this species.

DIAGNOSIS. A medium sized species (males 5.1-5.9 mm, females 6.0-7.1 mm body length) with an elongated dorsal median area free of papillae, tarsal formula 2-1-3-3, glans with large, robust spines and subapical straight stylus, unique in the genus.

DESCRIPTION (Figures 2-6, 7 B). **Male** (holotype). Body (Figure 2), length 5.85, width 2.12, colour yellowish brown, partly due to soil incrustations. Body elongated (length/width ratio 2.75), abdomen slightly wider behind coxae IV. Body integument papillose, partly obscured by soil incrustations, dispersed papillae, each with an erect seta on top. Dorsal surface (Figure 2A) densely covered with papillae app. 40 µm in diameter; behind the eyes a median area almost devoid of papillae (only scattered single papillae, more abundant in the prosomal region), reaching almost to the posterior edge of the scutum, the band narrowing, then widening in the intersegmental areas, thus forming a sequence of six bare patches, bordered on both sides by closely placed, elevated papillae forming an irregular crest. Tergite VI with posterior median incision, and densely covered with slender papillae, especially on the ribbed medial area.

Eyes and head cap (Figure 2 A, B). Ocularium plus head cap length 0.68, head cap length (to the eyes) 0.44, head cap width 0.60, eye interdistance 0.28, interocular distance 0.10, eye diameter 0.13. Ocularium situated near front of prosoma, shallow and ill defined, covered by papillae smaller than those on dorsal surface. Eyes standing very close together, separated by less than one eye diameter. Head cap branches relatively short, diverging then converging, covered with cylindrical papillae, longer in the median area, some with a seta on top.

Ventral surface (Figure 2C) densely covered with papillae. Coxae covered with slender setose papillae.

Chelicera small (Figure 3A, 4A). Basal segment 0.57, second segment 0.39, chela 0.37. Basal segment long and cylindrical, with sparse setae. Chela almost as long as the second segment.

Pedipalp (Table II, Figure 3B, 4B) small and short, protruding from head cap. Trochanter cylindrical. Femur twice as long as the trochanter, slightly curved apically, with few setae, longer setae on the ventral side. Patella half as long as the femur, convex dorsally and with long dorsal setae. Tibia 3/4 as long as femur, slightly thickened distally and with longer dorsal setae. Tarsus shorter than trochanter, cone-shaped with long setae on distal half, no distal claw.

Legs (Table II) with papillation on all segments except tarsi, papillae with erect fine setae, setae length half of leg diameter, up to leg diameter on metatarsus III and IV. Coxa, femur, patella, tibia and metatarsus distally with grouped

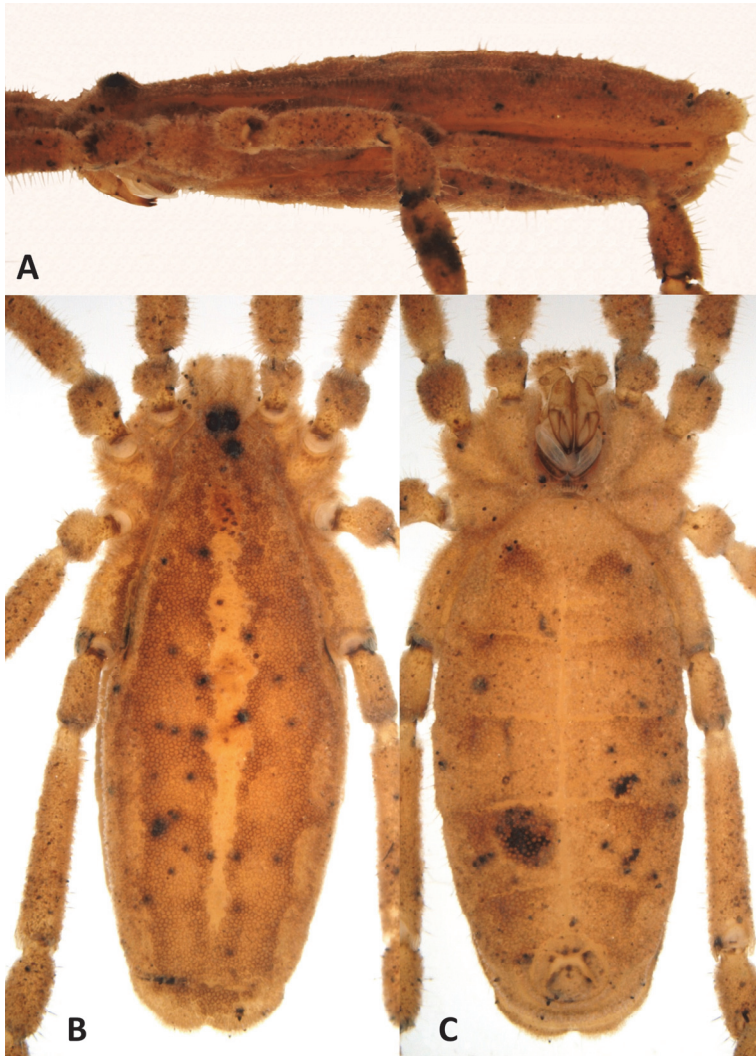


Figure 2. *Calathocratus zaragozai* sp. nov. Holotype, male 5.85 mm [ZUPV-5654, Alcoi: P.N. Font Rotja: Serra del Menejador]. Body. A, side view. B, dorsal view. C, ventral view. The specimen has been cleaned of adhering earth particles. Note that injured papillae leave scarred black dots and a large scarred area in third free sternite. Photo C. Prieto. / **Figura 2.** *Calathocratus zaragozai* sp. nov. Holotipo, macho 5.85 mm [ZUPV-5654, Alcoi: P.N. Font Rotja: Serra del Menejador]. Cuerpo. A, vista lateral. B, vista dorsal. C, vista ventral. El ejemplar se ha limpiado de las partículas de tierra adheridas. Nótese que las papilas lesionadas dejan puntos cicatrizados negros y una gran área cicatrizada en el tercer esternito libre. Fotos, C. Prieto.

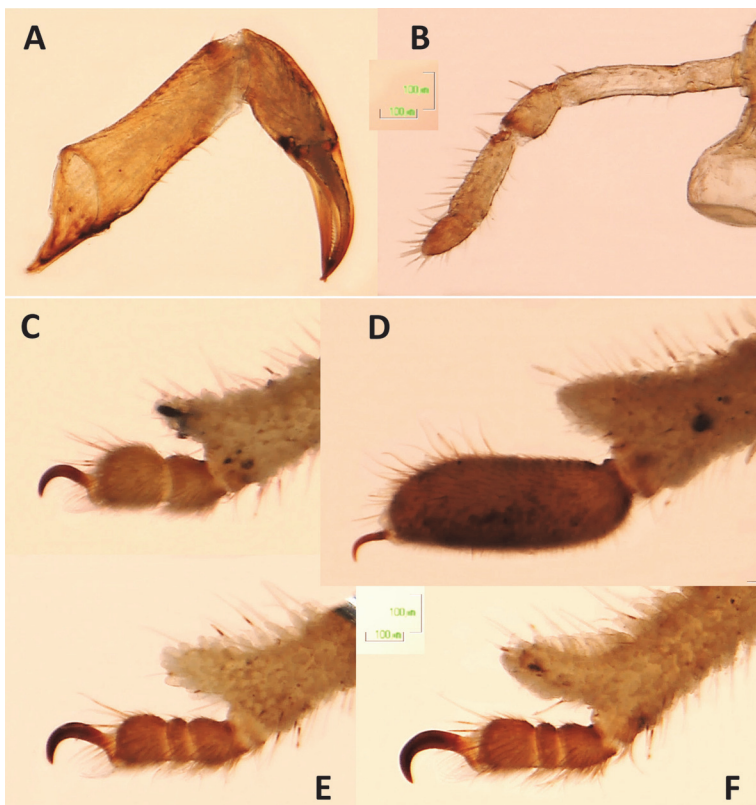


Figure 3. *Calathocratus zaragozai* sp. nov. Holotype [ZUPV-5654, Alcoi: P.N. Font Rotja: Serra del Menejador]. Appendices. A, right chelicera, lateral view. B, right pedipalp, medial view. C-F: tarsi of legs I-IV, prolateral view. Photo C. Prieto. / **Figura 3.** *Calathocratus zaragozai* sp. nov. Holotipo [ZUPV-5654, Alcoi: P.N. Font Rotja: Serra del Menejador]. Apéndices. A, quelícero derecho, vista lateral. B, pedipalpo derecho, vista medial. C-F, tarsos de las patas I-IV, vista prolateral. Fotos, C. Prieto.

Figure 4. *Calathocratus zaragozai* sp. nov. Paratype male [ZUPV-5752, Alcoi: P.N. Font Rotja: Serra del Menejador]. Appendices. A, right chelicera, lateral view. B, right pedipalp, lateral view. C-F, left tarsi of legs I-IV, prolateral view. Scale bar 0.5 mm. / **Figura 4.** *Calathocratus zaragozai* sp. nov. Macho paratipo [ZUPV-5752, Alcoi: P.N. Font Rotja: Serra del Menejador]. Apéndices. A, pedipalpo derecho, vista medial. B, quelícero, vista lateral. C-F, tarsos de las patas I-IV, vista prolateral. Escala, 0.5 mm.

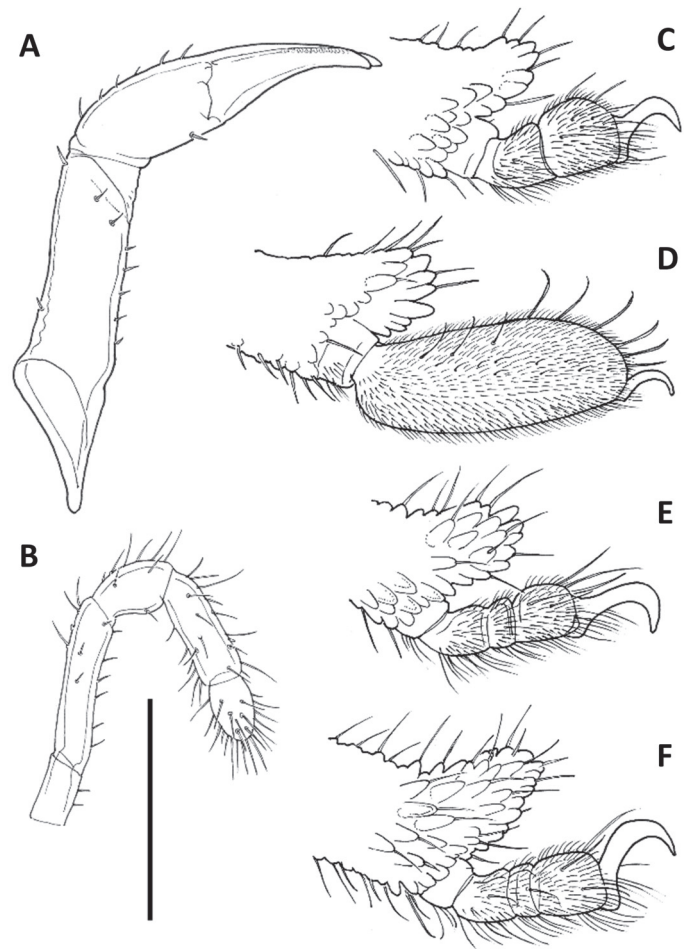


Table II. Measurements of palp and legs of the holotype of *Calathocratus zaragozai* sp. nov. / **Tabla II.** Medidas del palpo y las patas del holotipo de *Calathocratus zaragozai* sp. nov.

	Troch.	Femur	Patella	Tibia	Metat.	Tarsus	Length
Palp	0.15	0.35	0.20	0.27		0.13	1.10
Leg I	0.41	1.02	0.57	0.70	0.68	0.34	3.72
Leg II	0.61	2.01	0.75	1.23	1.36	0.64	6.60
Leg III	0.45	1.17	0.65	0.89	0.95	0.30	4.41
Leg IV	0.66	1.71	0.83	1.24	1.32	0.33	6.09

Table III. Measurements of the most relevant morphological parameters of *Calathocratus zaragozai* sp. nov. The coefficient of variation (CV, defined as the ratio of the standard deviation to the mean) is expressed as percentage. / **Tabla III.** Medidas de los parámetros morfológicos más relevantes de *Calathocratus zaragozai* sp. nov. El coeficiente de variación (CV, relación entre la desviación típica y la media) se expresa en porcentaje.

	Mean	MALES Range	(n=15) CV (%)		Mean	FEMALES Range	(n=20) CV (%)
Body (length)	5.59	5.17 – 5.88	3.48		6.46	6.00 – 7.08	4.12
Body (width)	2.12	1.96 – 2.29	4.38		2.50	2.29 – 2.74	4.56
Leg II (length)	6.49	6.15 – 6.86	2.82		6.85	6.36 – 7.34	3.46
Tarsus II (length)	0.63	0.59 – 0.70	4.88		0.60	0.56 – 0.65	3.90
Tarsus II (ratio l/w)	2.66	2.44 – 2.83	4.64		2.65	2.46 – 2.91	4.95
Ocularium + hood	0.71	0.62 – 0.79	6.11		0.78	0.66 – 0.85	23.04
Hood branches	0.44	0.37 – 0.50	7.35		0.51	0.42 – 0.60	8.97
Ocularium (width)	0.30	0.28 – 0.33	4.80		0.33	0.29 – 0.37	22.69
B/w eyes distance	0.11	0.07 – 0.13	16.12		0.13	0.10 – 0.17	15.72
Eye (diameter)	0.13	0.11 – 0.15	11.00		0.12	0.10 – 0.15	10.04

long papillae shielding the corresponding articulation joints. Dorso-distal metatarsus margin is protruding, especially in metatarsi III and IV (Fig. 3 E-F) and covered with long papillae (Fig. 3 C-D for legs I-II). Leg tarsi I-IV with tarsal formula 2-1-3-3. Tarsus II large and cylindrical, 2.65 times (range for 15 males 2.44-2.91) its width.

Penis (Figure 5 A-B). Length 1.35. Penis truncus slender, 1.25 mm long, its base drawn out in two short indistinct

roots, dorsoventrally flattened, more distally cylindrical. Glans penis (Figure 5 C-E) covered with large and robust setae (25 µm) evenly distributed (dorsal, lateral and ventral side each with about 14 setae), ventrobasal glans area without setae. Stylus attached subapically (50 µm long) at an angle of approximately 50°, almost straight and parallel-sided, in lateral view with a rectangular tip.

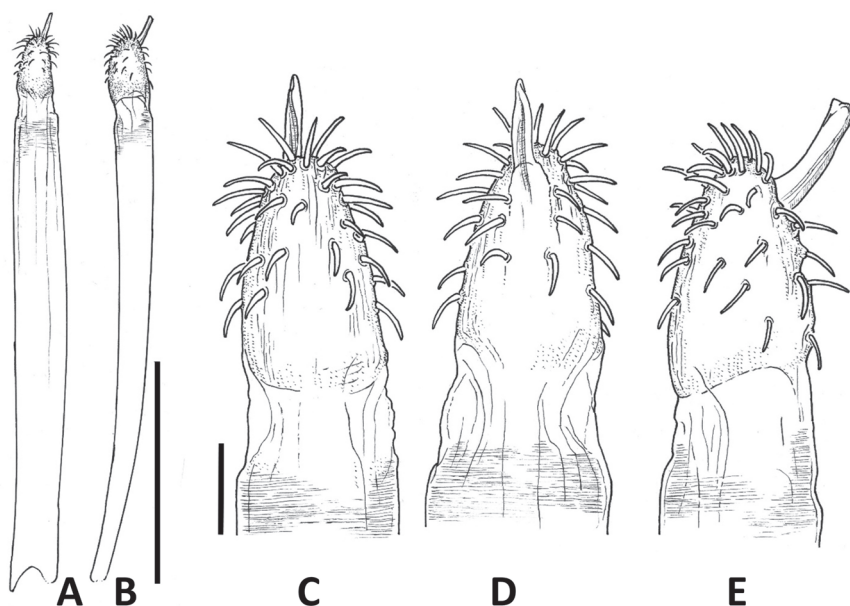


Figure 5. *Calathocratus zaragozai* sp. nov. Paratype [ZUPV-5752, Alcoi: P.N. Font Rotja: Serra del Menejador]. Penis. A-B, ventral and lateral view. C-E: glans penis in ventral, dorsal and lateral view. Scale bar: A-B 0.5 mm, C-E 0.05 mm. / **Figura 5.** *Calathocratus zaragozai* sp. nov. Paratipo [ZUPV-5752, Alcoi: P.N. Font Rotja: Serra del Menejador]. Pene. A-B, vista ventral y lateral. C-E: glande en vistas ventral, dorsal y lateral. Escalas: A-B, 0.5 mm; C-E, 0.05 mm.

Female. As in the male, but larger (6.0-7.1 mm) and wider (mean 2.5 mm), longer leg II (mean 6.85 mm), but proportionally longer in males (1.16 times the body length vs 1.06 in females); the head cap and eye dimensions seem quite variable compared to males (Table III). Ovipositor (Figure 6A) as a frustoconical and pleated trunk, distally with two lateral lobes flanking two internal lips. Surface covered with sensillar papillae, more sclerotized distally.

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY. This Iberian endemic is known from the northern mountainous part of the province of Alicante (12 localities) and the southern part of the province of Valencia (Barxeta and Bicorp), an area limited to the north by the Serpis River and to the south by the Vinalopó River (Figure 8). The species has been found both in the summit areas of the Alicante calcareous mountains, between 900 and 1330 m asl, as well as at lower altitudes (P.N. of Montgó at 322 m, Barxeta at 187 m), suggesting a more extensive geographical distribution than currently known.

Most samples of *C. zaragozai* sp. nov. were obtained by the entomologist Vicente Ortuño and his team in the calcareous mountains north of Alicante, by means of MSS samplings (Milieu Souterrain Superficial, currently Mesovoid Shallow Substratum, traps buried up to 1 m deep in pebbled slopes), and pitfall traps, sampling invertebrates active on soil surface. Pit falls contained only 6 females, the MSS traps 24 males, 26 females and 2 juveniles. Samples from Barxeta (in alluvial shallow substratum, as described by Ortuño et al. 2013) provided two females. Thus, *C. zaragozai* sp. nov. likely favours endogean habitats.

This harvestman species was found year-round: summer 2012 (12 %: 6M, 1F), autumn 2012 (45 %: 11M, 15F, 1J), winter 2013 (17 %: 3M, 7F) and spring 2013 (27 %: 4M, 11F, 1J). In spring and autumn, they are more active, due to the Mediterranean climate, with dry and hot summers and precipitation predominant in spring and autumn. At higher altitudes this effect is less distinct (Chatzaki et al. 2009). Juveniles occurring in spring and autumn suggest an eurychronous reproduction strategy with adults surviving more than one year and overlapping generations (Belozarov, 2012), as in other trogludids.

Calathocratus algarvensis sp. nov.

TYPE LOCALITY: São Marcos da Serra (Algarve, Portugal; 29SNB55253263, 97m asl), H. Wijnhoven leg. 3.5.2019.

Holotype: male [CJM 8153].

Paratypes: 1M, 2F, 2J [CJM 9643]; same data as holotype.

DERIVATIO NOMINIS. The species name is derived from the Portuguese Algarve district.

DIAGNOSIS: A small and slender trogludid species (5.15-5.27 body length, 2.13-2.15 body width; $n = 2$) with slender legs; elongated dorsal median area devoid of papillae, tarsal formula 2-1-3-3, penis nearly parallel-sided, robust glans with many massive setae.

DESCRIPTION (Figures 9-11). **Male** (holotype). Measurements in Table IV.

Body male body length 5.27, width 2.15; yellowish brown, partly due to soil incrustations. Body small and elongated (length/width ratio 2.45), with the abdomen slightly wider behind leg coxae IV. Dorsal surface (Figure 9 B) densely covered with papillae app. 50 μ m in diameter; behind the eyes a median area devoid of papillae, ranging almost to the posterior edge of the scutum, the area bordered on both sides by closely placed, elevated papillae forming an irregular crest. Tergite VI with posterior median cleft, covered with similar papillae as the posterior scutum region (Fig. 9).

Eyes and head cap (Figure 9). Eyes plus head cap length 0.53; head cap length (to the eyes) 0.42; head cap width 0.60 mm; eye interdistance 0.30; interocular distance 0.08; eye diameter 0.11. Eyes situated at front of prosoma, ocularium shallow and ill defined, covered by papillae smaller than those on dorsal surface. Eyes standing close together, separated by approximately one eye diameter. Head cap branches relatively short, covered with long and slender papillae, each with a seta on top, surface morphology obscured by soil incrustations.

Ventral surface densely covered with papillae. Few soil incrustations, more along the ventral side. Coxae covered with thin setose papillae.

Chelicera small (Figure 10 C). Chelicera: basal segment 0.86, second segment 0.35, chela 0.38. Basal segment long and cylindrical, with sparse setae. Chela almost as long as the second segment.

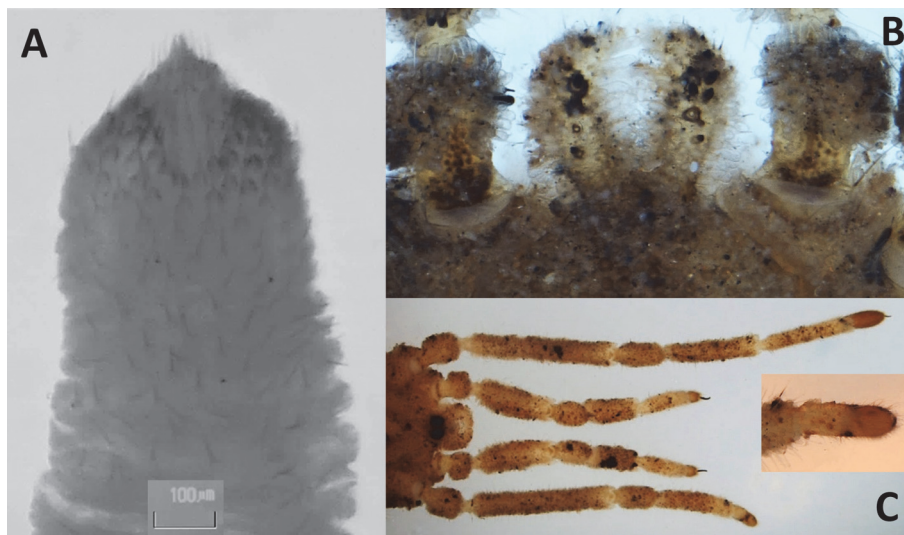


Figure 6. *Calathocratus zaragozai* sp. nov. A, ovipositor of a paratype female 6.6 mm long [ZUPV-5753, Serra del Menejador]. B, eyeless ocularium and head cap branches of a teratological female 6.47 mm long [ZUPV-5749, Serra de Bèrnia]. C, leg pairs I-II of a teratological female 6.33 mm long [ZUPV-5759]. Photo C. Prieto. / **Figura 6.** *Calathocratus zaragozai* sp. nov. A, ovipositor de una hembra paratípica de 6.6 mm [ZUPV-5753, Serra del Menejador]. B, oculario sin ojos y ramas del capuchón de una hembra teratológica de 6.47 mm [ZUPV-5749, Serra de Bèrnia]. C, patas I-II de una hembra teratológica de 6.33 mm [ZUPV-5759]. Fotos, C. Prieto.

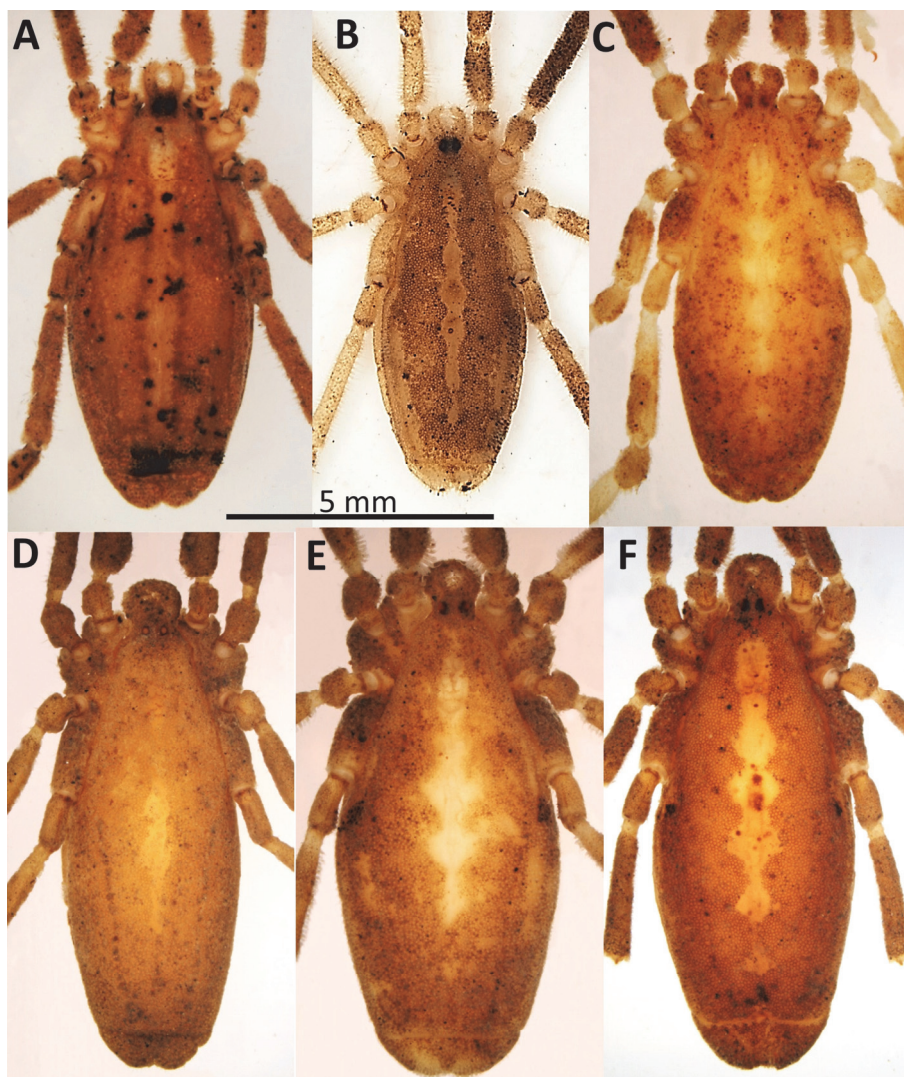


Figure 7. A, *Calathocratus* sp., female 6.18 mm [ZUPV-5597, Gràndola]. B, *Calathocratus zaragozai* sp. nov. male paratype 5.31 mm [ZUPV-5752, Serra del Menejador]. C-F, *Calathocratus africanus* (Lucas, 1846). C, male 6.03 mm [SMF-1389, Fienzza, Sicily]. D, female 6.7 mm [SMF-1391, Algiers, Algeria]. E, female 7.07 mm, holotype of *Trogulocratus tunetanus* Roewer, 1950 [SMF-9101, Sfax, Tunisia]. F, female (7.06 mm) [SMF-1389, Fienzza, Sicily]. Photo C. Prieto. / **Figura 7.** A, *Calathocratus* sp., hembra 6.18 mm [ZUPV-5597, Gràndola]. B, *Calathocratus zaragozai* sp. nov., paratipo macho 5.31 mm [ZUPV-5752, Serra del Menejador]. C-F, *Calathocratus africanus* (Lucas, 1846). C, macho 6.03 mm [SMF-1389, Fienzza, Sicilia]. D, hembra 6.7 mm [SMF-1391, Argel, Argelia]. E, hembra 7.07 mm, holotipo de *Trogulocratus tunetanus* Roewer, 1950 [SMF-9101, Sfax, Túnez]. F, hembra (7.06 mm) [SMF-1389, Fienzza, Sicilia]. Fotos, C. Prieto.

Table IV. Measurements of pedipalp and legs of *Calathocratus algarvensis* sp. nov. Male holotype (in brackets female paratype). / **Tabla IV.** Medidas del pedipalpo y las patas de *Calathocratus algarvensis* sp. nov. Macho holotipo (en paréntesis, paratipo hembra)

	Troch.	Femur	Patella	Tibia	Metat.	Tarsus	Length
Palp	0.15 (0.15)	0.3 (0.35)	0.15 (0.2)	0.25 (0.25)		0.15 (0.12)	1.00 (1.07)
Leg I	0.5 (0.4)	1.10 (1.1)	0.5 (0.4)	0.8 (0.8)	0.75 (0.8)	0.35 (0.3)	4.00 (3.80)
Leg II	0.7 (0.65)	2.0 (2.05)	0.6 (0.65)	1.3 (1.3)	1.4 (1.4)	0.6 (0.6)	6.60 (6.65)
Leg III	0.5 (0.5)	1.2 (1.2)	0.5 (0.6)	0.9 (0.9)	1.0 (0.95)	0.3 (0.3)	4.40 (4.45)
Leg IV	0.7 (0.6)	1.9 (1.85)	0.65 (0.7)	1.4 (1.35)	1.4 (1.35)	0.4 (0.4)	6.45 (6.25)



Figure 8. Geographical distribution of *Calathocratus zaragozai* sp. nov. in the Comunidad Valenciana. Red dots, specimen-based records; white squares, photographic records (BV, Biodiversidad Virtual; iN, iNaturalist). A few sites are cited and the type locality is underlined. The inset shows the mapped area for *C. zaragozai* and the sites of the other Iberian species of *Calathocratus*. / **Figura 8.** Distribución geográfica de *Calathocratus zaragozai* sp. nov. en la Comunidad Valenciana. Círculos rojos, registros basados en especímenes; cuadrados blancos, registros fotográficos (BV, Biodiversidad Virtual; iN, iNaturalist). Se citan algunas localidades y se subraya la localidad tipo. El recuadro muestra el área cartografiada para *C. zaragozai* y las localidades de las otras especies ibéricas de *Calathocratus*.

Pedipalp (Figure 10 A, Table IV) small and robust. Trochanter cylindrical, unarmed. Femur slightly enlarged distally, twice as long as the trochanter, with few setae, longer setae on the ventral side. Patella half as long as the femur, with long dorsal setae. Tibia slightly shorter than femur, slightly enlarged distally, with setae that are longer on dorsal side. Tarsus as long as trochanter, cone-shaped with long setae on distal half, no distal claw.

Legs (Table IV). Papillation on all segments except tarsi, papillae with erect fine and long setae, setae length half of leg diameter, and up to leg diameter. Coxa, femur, patella, tibia and metatarsus distally with grouped long papillae shielding the corresponding articulation joints. Dorso-distal metatarsus margin is protruding, especially in metatarsi III and IV (Figure 11 C-D) and covered with long papillae. Leg tarsi I-IV with tarsal formula 2-1-3-3 (Figure 11 A-D). Tarsus II large and cylindrical, 2.70 times its width. Claws hook-shaped, claw on leg I, III and IV most robust, in leg I almost as large as last article, larger in legs III and IV; smooth setae on all tarsi, including single long setae dorsally and distally.

Penis (Figure 10 H-I). Penis length 1.40. Truncus slender, almost parallel-sided, its base drawn out in two short indistinct roots, dorsoventrally flattened, more distally cylindrical, only slightly broadening below the glans. Glans penis (Figure 10 E-G) elongated and robust, covered with short, robust and curved setae on dorsal, ventral and lateral side. Glans contin-

uously tapering into the stylus. Stylus slightly curved dorsally, with blunt top.

Female (Figure 9, 10 B, D, 11 E-H). As in the male, but slightly larger (5.49) and wider (2.32), with longer legs (Table IV).

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY. All specimens were collected from under a decomposing tree trunk (Figure 12) on a hill side close to a watercourse, linked with the Odelouca river, a tributary of the Arade river, with typical Mediterranean vegetation characterized by holly oak (*Quercus ilex*), common gorse (*Ulex europaeus*) and rockrose (*Cistus* sp.). The location is part of the Monchique Range, so probably this species is more wide-spread in the calcareous mountainous regions of the Algarve.

Calathocratus sp.

MATERIAL: 1M, 1F [ZUPV-5597]: Grândola: Herdade Ribeira Abaxo (Setúbal, Portugal; 29SNC363171, 241 m), R. Plăiașu leg., 05-11-2016. The removed penis was missing. These two specimens differ in certain aspects from *C. algarvensis* sp. nov. They are larger (male is 5.57 vs 5.15-5.27; female (Figure 7 A) is 6.18 vs 5.49). In addition, these specimens from Grândola have longer, thinner hood branches, eyes larger and set closer together, a tuft of longer papillae behind eyes, and slenderer tarsus II (3+ times its width) than *C. algarvensis*. Possibly, a third Iberian species is involved; additional material is needed for a sound decision.

Discussion

Variability in *C. zaragozai* sp. nov. Samples of *C. zaragozai* (Table III) show no significant morphological variability (variation coefficient is less than 10%). The two specimens from the lowest altitude (Barxeta) are the largest and specimens from Montgó have slightly smaller eyes with larger interocular distance (ratio 0.6-0.85) than the other measured specimens (ratio 0.9-1.3).

Male/female ratio is 0.63, increasing with altitude, being 0.24 (4M, 17F) at lower altitudes, 0.50 (5M, 10F) around 1000 m asl, and 1.21 (17M, 14F) at altitudes above 1170 m. An increasing sex ratio at higher altitudes has been found for Odonata (Crowley & Johansson 2002). Generally, males move around more than females, resulting in a biased sex ratio for pitfall traps. Body size tends to decrease with altitude (not significant): mean for males / females is 5.79 / 6.6 mm at lower altitudes, 5.66 / 6.35 mm around 1000 m asl and 5.53 / 6.33 mm at higher altitudes.

The juvenile ratio (no. of immatures / total number = 0.13), agrees with figures for other taxa from Alicante mountains such as *Dicranolasma soerensenii* (0.092, 119 juveniles, 1176 adults), but differs significantly from *Trogulus* cf. *lusitanicus* (0.43, 183 juveniles, 244 adults) (unpublished results based on the collection ZUPV). This different pattern could be related to the large size of *T. lusitanicus*, with males larger than 10 mm and females reaching 15 mm long, whose proportionately larger juveniles are probably more active than smaller immature stages of *Dicranolasma* or *Calathocratus*.

Teratologies in *C. zaragozai* sp. nov. A female specimen from Serra de Bèrnia [ZUPV5749] presents teratological anophthalmia (Figure 5B); the lack of the eyes makes the hood branches appear thinner at the base. Blindness is rarely reported in Opiliones; it was not reported by Mitov (1995) in

Figure 9. *Calathocratus algarvensis* sp. nov. Female paratype, 5.49 mm [CJM 8153]. Body. A, side view. B, dorsal view. C, ventral view. D, head cap and prosomal region. Photo P. Schwendinger. / **Figura 9.** *Calathocratus algarvensis* sp. nov. Paratipo hembra, 5.49 mm [CJM 8153]. Cuerpo. A, vista lateral. B, vista dorsal. C: vista ventral. D, capuchón y región prosómica. Fotos, P. Schwendinger.



Table V. Photographic records of *Calathocratus* spp. from citizen science in two repositories (BV, www.biodiversidadvirtual.org; iN, www.inaturalist.org) are identified by their observation number. . Only records from Alicante and Valencia can be assigned with certainty to *C. zaragozai* sp. nov. They are ordered chronologically by the observation date. Decimal geographic coordinates of iNaturalist records have been converted to MGRS coordinates with hectare precision. / **Tabla V.** Registros fotográficos de *Calathocratus* spp. procedentes de ciencia ciudadana en dos repositorios (BV, www.biodiversidadvirtual.org; iN, www.inaturalist.org) identificados por su nº de observación. Sólo los registros de Alicante y Valencia pueden asignarse con certeza a *C. zaragozai* sp. nov. Están ordenados cronológicamente por su fecha de observación. Las coordenadas geográficas decimales de los registros de iNaturalist se han transformado en coordenadas MGRS con precisión hectométrica.

Record Nº	Locality, Province	coord. MGRS	Photographer	Observed	Uploaded
BV-310435	Villajoyosa, Alicante	30SYH 380684	Daniel García	18-02-2012	18-02-2012
BV-454462	Xàtiva, Valencia	30SYJ 151179	Francisco Rodríguez	29-04-2013	02-05-2013
iN-138469635	[Xàtiva,] Valencia	30SYJ 152177	faluke	29-04-2013	12-10-2022
iN-107212534	Arenas de San Pedro, Ávila	30TUK 201522	jmsandicor18	20-02-2022	21-02-2022
iN-111201258	Sta. Margarida da Serra, Grândola, Setúbal	29SNC 372168	joaodpontos	29-03-2022	12-04-2022
iN-117050416	Teulada, Alicante	31SBC 481905	eva_b_s	24-04-2022	15-05-2022

his extensive search for teratologies in Bulgarian harvestmen. Only two records are known, both belonging to Phalangioidea, *Togwoteus biceps* (Thorell, 1877) by Holmberg & Kokko (1983), and two specimens of *Lophopilio palpinalis* (Herbst, 1977) by Noordijk et al. (2016). Thus, this report is the first observation for the suborder Dyspnoi and the family Trogulidae.

The other observed teratology is the shortened right leg II of a female (body length 6.33 mm, Figure 5C) from La Serrella [ZUPV-5759]; right leg is 4.93 mm long (left leg 6.69 mm), with a normal femur, a little shorter patella and tibia, and much shorter metatarsus and tarsus, which, being fused, barely reach a quarter of the corresponding parts on the left leg.

Citizen Science records of *Calathocratus* spp. First citizen science record for the Iberian Peninsula was uploaded in 2012 at the **Biodiversidad Virtual** repository, while most recent records were uploaded in 2022 at **iNaturalist** repository (Table V; Figure 13). All photographic records show the large and undivided tarsus II, a diagnostic character for *Calathocratus*, and the smooth median dorsal area delimited laterally by a sinuous crest formed by longer papillae, which is an exclusive character of Western *Calathocratus* taxa. Three of the five records (note that ones by Francisco Rodríguez and “faluke”, his nickname, are the same) come from the provinces of Valencia and Alicante and match the distribution area of *C. zaragozai* sp. nov. Although identification of trogulids

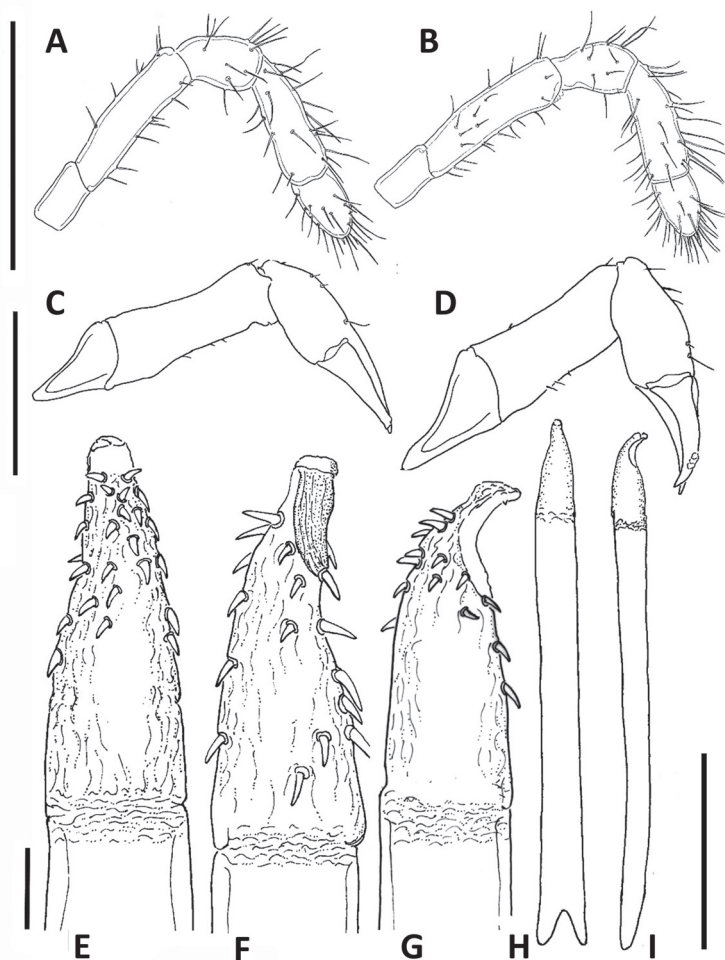


Figure 10. *Calathocratus algarvensis* sp. nov. A, C, E-I: holotype male [CJM-8153], B, D: paratype female [CJM-9643]. A-B, right pedipalp, retrolateral view. C-D, right chelicera, retrolateral view. E-G, glans penis in ventral, dorsal and lateral view. H-I, penis in ventral and lateral view. Scale bar: A-D, H-I 0.5 mm; E-G 0.05 mm. / **Figura 10.** *Calathocratus algarvensis* sp. nov. A, C, E-I: macho holotipo [CJM-8153], B, D: hembra paratipo [CJM-9643]. A-B, pedipalpo derecho, vista retrolateral. C-D, quelícero derecho, vista retrolateral. E-G, glande del pene en vistas ventral, dorsal y lateral. H-I, pene en vistas ventral y lateral. Escalas: A-D, H-I, 0.5 mm; E-G, 0.05 mm).

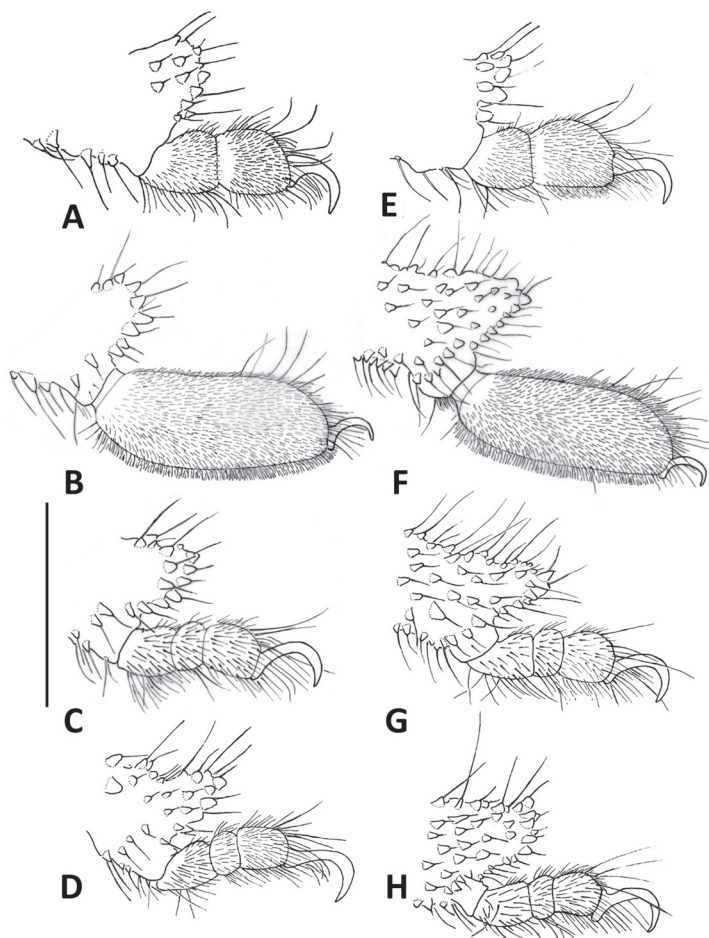


Figure 11. *Calathocratus algarvensis* sp. nov. A-D: left tarsi of legs I-IV of the holotype male [CJM-8153], prolateral view. E-H, left tarsi of legs I-IV of the paratype female [CJM-9643]. Scale bar 0.5 mm. / **Figura 11.** *Calathocratus algarvensis* sp. nov. Tarsos izquierdos de las patas I-IV, vista prolateral. A-D: macho holotipo [CJM-8153]. E-H, hembra paratipo [CJM-9643]. Escala, 0.5 mm.

Figure 12. Habitat of *Calathocratus algarvensis* sp. nov. at the type locality, São Marcos da Serra (Algarve, Portugal), with holly oak (*Quercus ilex*), common gorse (*Ulex europaeus*) and rockrose (*Cistus* sp.). The specimens were found under the tree trunk in the bottom right. Photo H. Wijnhoven, 3.5.2019. / **Figura 12.** Hábitat de *Calathocratus algarvensis* sp. nov. en la localidad tipo, São Marcos da Serra (Algarve, Portugal), con encina (*Quercus ilex*), aulaga (*Ulex europaeus*) y jara (*Cistus* sp.). Los especímenes fueron encontrados debajo del tronco de la parte inferior derecha. Foto H. Wijnhoven, 3.5.2019.



Figure 13. Iberian photographic records in two citizen science repositories (Table 5), **Biodiversidad Virtual** (top image, the first photographic record) and **iNaturalist** (bottom images connected by an Iberian map with their provenances). Note in each photo the smooth median area delimited by two undulating crests and the diagnostic undivided tarsus II, and that the specimen iN-138469635 seems to be eating a small land snail. / **Figura 13.** Registros fotográficos ibéricos en dos repositorios de ciencia ciudadana (Tabla 5), **Biodiversidad Virtual** (imagen superior, el primer registro fotográfico) e **iNaturalist** (imágenes inferiores conectadas por un mapa de la península con sus procedencias). Nótese en cada fotografía el área mediana lisa delimitada por dos crestas ondulantes y el diagnóstico tarso II indiviso, y que el espécimen iN-138469635 parece estar comiendo un pequeño caracol terrestre.



from field photographs is not reliable, we consider that those three records likely represent *C. zaragozai* sp. nov.

There is a record from Santa Margarida da Serra, less than one km apart the site of *Calathocratus* sp. from Herdade Ribeira Abaxo [ZUPV-5597], both from Grândola (Setúbal, Portugal). Although the distance to the type locality of *C. algarvensis* sp. nov. is barely 90 km, the above-mentioned

morphological differences suggest it is a different species.

The latest record is from Arenas de San Pedro (Ávila, Spain), a site separated by more than 400 km from Alicante/Valencia and Algarve regions. Taking in account that the habitat of the Ávila population is not Mediterranean (it was found among lichens and mosses in a humid gorge of a granitic mountain range), it could belong to a fourth species.

Systematics. Schönhofer & Martens (2010) synonymized *Trogulocratus* and *Platybessobius* with *Calathocratus*, based on polyphyly by molecular analysis, and, as a consequence, the genus now contains ten species (Table I).

Beyond the generic systematics, species delimitation of these small trogulids was a challenge ever since. Though only few species have been described to date, a revision of the classical material of Lucas, Simon and Sørensen was never achieved. Thus, it is unproven how many species actually occur in North Africa and, even more strange, if an African species, *C. africanus*, actually occurs in southern Italy as suggested by determinations by Roewer (see above) and indication by Marcellino (1965). Being aware that the much larger species of the genus *Trogulus* put difficult problems to taxonomists, which up to now could only partly be solved by means of molecular genetics, the taxonomic situation in *Calathocratus* seems to be even harder. Fairly rich and geographically widely scattered material from Turkey was attributed to highly distinct clades resulting from molecular genetic studies, apparently indicating species status (Schönhofer & Martens 2010). But a species characterization by (genital) morphological data was hardly possible and thus was not further followed. Enormous cryptic diversity of *Calathocratus* in the Near East, and, in addition, in the Caucasus range in Russia, Georgia, Azerbaijan and Armenia is to be expected (Snegovaya & Chumachenko 2011, J.M. unpublished data).

Species from North Africa and the two new ones from Iberian Peninsula represent the westernmost localities of the genus. These populations including such from Sicily apparently form a group of closely related species. *C. sinuosus* and *C. africanus* have to be involved in a comparison with both new species described here, since only these species share a characteristic feature with the new species: the mid dorsal scutal area of opisthosoma being devoid of papillae.

C. zaragozai sp. nov. was first mentioned as *Trogulocratus* sp. nov. by Prieto (2008; a sample of 1M, 3F and 4J) based on the tarsal formula 2-1-3-3, and tarsus II with dimensions intermediate between those of *C. intermedius* and *C. tunetanus*. A genetical analysis of a sample of the Valencia-Alicante population of *Calathocratus* (*Trogulocratus* sp.) confirmed its status as at least a species-level lineage (Schönhofer & Martens 2010, Figure 6); six *Calathocratus* species were analyzed by them: *C. africanus*, *C. beieri*, *Platybessobius caucasicus*, *P. singularis*, *Trogulocratus sinuosus* and *Trogulocratus* sp. from Spain, showing (i.e. Schönhofer & Martens 2010, Figure 6) that the three samples of *Trogulocratus sinuosus*, two of them from mainland Italy and coded as “species awaiting formal description” did form a clade with *C. africanus*, while ‘*Trogulocratus* sp.’ from Spain did not cluster with them.

Calathocratus africanus (Lucas, 1846) was described from Algeria and reported later from Tunisia as its synonym *Trogulocratus tunetanus* Roewer, 1950 and Sicily (Marcellino 1965) (Figure 7 C-F). Body size (M 6.0 mm, F 6.7-7.1 mm) and leg lengths (7.5 and 7.9 mm for leg II) and similar dorsal habitus demonstrate that *C. africanus* is closely related to *C. zaragozai* sp. nov. A similar general habitus is found for the specimens from Tafoughalt [CJM-7019], representing the first record of *Calathocratus* for Morocco and the most western record for Northern Africa. Figure 7 C-F shows specimens from Algeria, Tunisia and Sicily where the sinuous line that borders the smooth median dorsal area seems not raised into a crest of elongate papillae as in *C. zaragozai* sp. nov.

The glans penis in *C. africanus* is provided with spines, more robust and numerous and with the apex incised (Marcellino 1965), and the stylus is curved and placed on top of the glans, while in *C. zaragozai* sp. nov. the stylus is straight and inserted subapically on the glans. Also, *C. algarvensis* sp. nov. seems to be closely related to *Calathocratus africanus*, but the blunt stylus top and small body size of *C. algarvensis* sp. nov. point to a different relationship.

Calathocratus sinuosus (Sørensen, 1873) was described from Gennazano (Italy), its status was resolved by Schönhofer & Martens (2010). Morphometric data and description of Marcellino (1965 sub *Trogulocratus apenninicus*) indicate that this species has a small body size (4.8 and 5.3) and a smooth median dorsal area; the penis has a glans with few spines and an apical, tapering stylus; the tarsus II is three times its width (two times in *C. africanus*). Our specimens of *C. zaragozai* sp. nov. have an intermediate tarsus II ratio of 2.65 in mean (range 2.44-2.91).

Although there have been considerable taxonomical achievements in recent decades on Trogulidae of the Iberian Peninsula (i.e. Prieto & Las Heras 2020, Schönhofer 2009, Schönhofer & Martens 2008, 2010), studies on trogulid species on this large and mountainous subcontinent continue to offer fascinating opportunities. ‘Still far from understanding species boundaries within the CPT complex [*Calathocratus* Simon, 1879, *Platybessobius* Roewer, 1940 and *Trogulocratus* Roewer, 1940] we glance at the amount of cryptic diversity, far beyond expectation for the European and Near East fauna’ (Schönhofer & Martens 2010). In most parts of the Caucasus range, *Calathocratus* species are widely distributed and locally rather common. Also, this fauna with three species documented (Table 1) is largely unexplored (J.M. personal observation). Obviously, *Calathocratus* represents an ancient group for which the western distributional range and its species radiation is still poorly understood.

Acknowledgements

To Vicente Ortuño (Universidad de Alcalá, Madrid, Spain) for putting at CP’s disposal the rich collection of Opiliones collected by his team by trapping in the MSS of the calcareous mountains of Alicante. To Rodica Plăiașu (Institute of Speleology “Emil Racovița”, Romania) by the donation of the *Calathocratus* sample from Grândola. To Daniel García, Francisco Rodríguez -faluke, Juan Manuel Sánchez Díaz-Corralejo -jmsandicor18, -joaodpontes, and -eva_b_s for allowing the use of the photographs that support the citizen science records cited in the text. To Bernard Bal (bbinsecte) by its first determination at iNaturalist as a *Calathocratus* population outside Valencia and Alicante provinces. To Axel Schönhofer (Johannes Gutenberg Universität Mainz, Mainz, Germany) for his molecular analysis of the new Spanish species, the authorization to include the material of *C. zaragozai* from his collection and for the improvements suggested after reviewing the final version of the manuscript. To Peter Schwendinger at the MHNG (Geneva, Switzerland), who kindly provided the automontage images of *C. algarvensis* sp. nov. To the Feldbausch Foundation and the Wagner Foundation at the Fachbereich Biologie of Mainz University (Germany) which continuously sponsored J.M. for fieldwork and lab work in Europe and Asia. We cordially thank all friends, colleagues and institutions.

References

- BELOZEROV, V. N. 2012. Dormant stages and their participation in adjustment and regulation of life cycles of harvestmen (Arachnida, Opiliones). *Entomological review*, **92** (6): 688–713.

- BRIGNOLI, P.M. & E. RAFAELLI 1978. Nuovi dati e problemi aperti su alcuni Opilioni Italiani (Arachnida Opiliones) [New data and open problems on some Italian Opiliones (Arachnida Opiliones)]. *Bollettino della Società Entomologica Italiana*, **110** (4–6): 86–99.
- CHATZAKI, M., P. LYMBERAKIS, P. MITOV & M. MYLONAS 2009. Phenology of Opiliones on an altitudinal gradient on Lefka Ori Mountains, Crete, Greece. *The Journal of Arachnology*, **37** (2): 139–146.
- CHEMERIS, A.N. 2013. Two new harvestman species (Arachnida: Opiliones) from the collection of Siberian Zoological Museum. *Arthropoda Selecta*, **22** (1): 41–46.
- CHEMINI, C. & J. GRUBER 1976. Aracnidi opilionidi della Riserva naturale di Torricchio, (nota faunistica preliminare). Opiliones (Arachnida) of Torricchio nature reserve. *La Riserva Naturale di Torricchio*, **1** (7): 131–144.
- CROWLEY, P. H. & F. JOHANSSON 2002. Sexual dimorphism in Odonata: age, size, and sex ratio at emergence. *Oikos*, **96**: 364–378.
- DELFOSE, E. 2018. Addenda et corrigenda du catalogue des Opilions de France (Arachnida: Opiliones) – Métropole et Outremer. *Revue arachnologique* (série 2) **5**: 36–37.
- GILGADO, J. D., H. ENGHOF, A. TINAUT & V. M. ORTUÑO 2015. Hidden biodiversity in the Iberian Mesovoid Shallow Substratum (MSS): New and poorly known species of the millipede genus *Archipolydesmus* Attems, 1898 (Diplopoda, Polydesmidae). *Zoologischer Anzeiger*, **258**: 13–38.
- GRUBER, J. 1963. Ergebnisse der von Dr. O. Paget und Dr. E. Kritscher auf Rhodos durchgeführten zoologischen Exkursionen. VII. Scorpiones und Opiliones. *Annalen des Naturhistorischen Museums in Wien*, **66**: 307–316.
- GRUBER, J. 1968. Ergebnisse zoologischer Sammelreisen in der Türkei: *Calathocratus beieri*, ein neuer Troglidae aus Anatolien (Opiliones, Arachnida). *Annalen des Naturhistorischen Museums in Wien*, **72**: 435–441 + 1 pl.
- HOLMBERG, R. G. & E. G. KOKKO 1983. A blind *Homolophus biceps* (Arachnida: Opiliones). *Entomological News*, **94**: 49–52.
- KONTOS, P. & J. MARTENS 2022. The description of a new species of *Anarthrotarsus* Šilhavý from Greece and a discussion about the genus (Arachnida: Opiliones: Troglidae). *Revue suisse de Zoologie*, **129**(1), 221–227.
- KURY, A.B., A.C. MENDES, L. CARDOSO, M.S. KURY & A.DE A. GRANADO 2020. *WCO-Lite: online world catalogue of harvestmen (Arachnida, Opiliones). Version 1.0— Checklist of all valid nomina in Opiliones with authors and dates of publication up to 2018*. Self-published, Rio de Janeiro. ii + 237 pp. ISBN 978-65-00-06706-4. <https://doi.org/10.5281/zenodo.4025288>
- LUCAS, P.H. 1846. Deuxième classe. Arachnides [pp. 89–320 + 22 pl.]. In: J.A.N. Périer & A. Berbrugger (Eds.), *Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842*. Sciences physiques. Zoologie III (“1849”). Impr. royale, Paris
- MARCELLINO, I. 1965. Su alcuni Troglidae (Arachnida, Opiliones) della Sicilia e dell' Appennino centrale. *Bollettino delle sedute dell'Accademia Gioenia di Scienze Naturali in Catania* (s.4), **8** (5): 323–340.
- MARTENS, J. & C. CHEMINI 1988. Die Gattung *Anelasmacephalus* Simon, 1879. Biogeographie, Artgrenzen und Biospezies-Konzept (Opiliones: Troglidae). *Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere*, **115**: 1–48.
- MITOV, P. 1995. Teratological data about Opiliones (Arachnida) from Bulgaria (pp. 147–161). In: *Proceedings of the 15th European Colloquium of Arachnology, Institute of Entomology*.
- NOORDIJK, J., T. HEIJERMAN & R. MORSSINKHOF 2016. A rare teratology in the harvestman *Lophopilio palpalis* (Opiliones: Phalangidae). *Arachnology*, **17**(2): 100–102.
- NOVAK, T., A. ALATIČ, J. POTERČ, B. BERTONCELJ & F. JANŽEKOVIC 2006. Regenerational leg asymmetry in damaged *Trogulus nepaeformis* (Scopoli 1763) (Opiliones, Troglidae). *The Journal of Arachnology*, **34** (3): 524–531.
- ORTUÑO, V.M., J.D. GILGADO, A. JIMÉNEZ-VALVERDE, A. SENDRA, G. PÉREZ-SUÁREZ & J.J. HERRERO-BORGOÑÓN 2013. The “Alluvial Mesovoid Shallow Substratum”, a New Subterranean Habitat. *PLoS ONE*, **8** (10), e76311.
- PRIETO, C.E. 2008. Updating the checklist of the Iberian opiliofauna: corrections, suppressions and additions. *Revista Ibérica de Aracnología*, **16** [2007]: 49–65. *
- PRIETO, C.E. & L. LAS HERAS 2020. Revisión y distribución geográfica de los *Anelasmacephalus* Simon, 1879 (Opiliones: Troglidae) de la península IBÉRICA. *Revista Ibérica de Aracnología*, **37**: 165–183. *
- ROEWER, C.F. 1940. Neue Assamiidae und Troglidae. Weitere Weberknechte X. *Veröffentlichungen aus dem Deutschen Kolonial- und Übersee-Museum in Bremen*, **3** (1): 1–31 + pl. 1–2.
- ROEWER, C.F. 1950. Über Ischyropsalididae und Troglidae. Weitere Weberknechte XV. *Senckenbergiana*, **31** (1/2): 11–56 + pl. 1–10.
- SCHÖNHOFER, A.L. 2009. Revision of Troglidae Sundevall, 1833 (Arachnida: Opiliones) (Doctoral dissertation, Mainz, Univ., Diss., 2009). [dn-b.info/995761779/34](https://nbn-resolving.org/urn:nbn:de:hbz:5:1-63888-p0011-7)
- SCHÖNHOFER A.L. 2013. A taxonomic catalogue of the Dyspnoi Hansen and Sørensen, 1904 (Arachnida: Opiliones). *Zootaxa*, **3679** (1): 1–68.
- SCHÖNHOFER, A. L., & MARTENS, J. (2008). Revision of the genus *Trogulus* Latreille: the *Trogulus coriziformis* species-group of the western Mediterranean (Opiliones: Troglidae). *Invertebrate Systematics*, **22**(5), 523–554.
- SCHÖNHOFER, A.L. & J. MARTENS 2010. Hidden Mediterranean diversity: Assessing species taxa by molecular phylogeny within the opilionid family Troglidae (Arachnida, Opiliones). *Molecular Phylogenetics and Evolution*, **54** (1): 59–75.
- SCHÖNHOFER, A.L., L. MCCORMACK, N. TSURUSAKI, J. MARTENS & M. HEDIN 2013. Molecular phylogeny of the harvestmen genus *Sabacon* (Arachnida: Opiliones: Dyspnoi) reveals multiple Eocene-Oligocene intercontinental dispersal events in the Holarctic. *Molecular Phylogenetics and Evolution*, **66** (1): 303–315.
- ŠILHAVÝ, V. 1966. Neue Trogliden aus dem Kuban-Gebiet und dem Kaukasus (Arach., Opiliones). *Senckenbergiana biologica*, **47** (2): 151–154.
- ŠILHAVÝ, V. 1967. *Anarthrotarsus martensi*, ein neuer Weberknecht aus Griechenland (Arach., Opiliones). *Senckenbergiana biologica*, **48** (3): 175–178.
- SIMON, E. 1879. *Les Arachnides de France*. Tome 7. Contenant les ordres des Chernetes, Scorpiones et Opiliones [Opiliones: 116–332 + pl. 21–24]. Librairie Encyclopédique de Roret, Paris, pp. 1–332 + pl. 17–24.
- SNEGOVAYA, N.Y. & Y.A. CHUMACHENKO 2011. Harvestmen (Arachnida: Opiliones) from the yew and box-tree grove of the Caucasian State Natural Biospheric Reserve, Russia. *Caucasian Entomological Bulletin*, **7** (2): 115–124.
- SØRENSEN, W.E. 1873. Bidrag til Phalangidernes Morphologi og Systematik samt Beskrivelse af nogle nye, herhen hørende Former [Contributions to phalangid morphology and systematics and description of some new, hitherto associated species]. *Naturhistorisk Tidsskrift*, (3) **8**: 489–525 + pl. 15 (In Danish)
- STARĘGA, W. 1966. Beitrag zur Kenntnis der Weberknecht-Fauna (Opiliones) der Kaukasusländer. *Annales Zoologici*, **23** (13): 387–411.
- SUNDEVALL, C.J. 1833. *Conspectus Arachnidum*. C.F. Berling, Londini Gothorum [Lund (Sweden)], 39 pp.

* Reference available at www.sea-entomologia.org

