

CHTHONIUS (CHTHONIUS) CAMPANETI, A NEW PSEUDOSCORPION SPECIES FROM COVES DE CAMPANET, MALLORCA (SPAIN)

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Abstract: Intensive sampling over a period of a year has been carried out in Coves de Campanet, Mallorca, Balearic Islands, producing three pseudoscorpion species. Two of these are epigeal species *Chthonius (Chthonius) ischnocheles* and *Chthonius (Ephippiochthonius) tetrachelatus*. The third is a previously undescribed species, *Chthonius (Chthonius) campaneti* sp. n., which represents the second hypogean species of the subgenus *Chthonius* known for Spain. A key for the Iberian species of the subgenus *Chthonius* is provided.

Key words: Hypogean, taxonomy, Pseudoscorpiones, Chthoniidae, Spain, Balearic Islands.

Chthonius (Chthonius) campaneti, nueva especie de pseudoscorpión de las Coves de Campanet, Mallorca (España)

Resumen: Se ha realizado un muestreo intensivo durante un año en las Coves de Campanet, Mallorca, Islas Baleares. Tres especies de pseudoescorpiones han sido identificadas, las especies epigeas *Chthonius (Chthonius) ischnocheles* y *Chthonius (Ephippiochthonius) tetrachelatus*; también una nueva especie no previamente descrita, *Chthonius (Chthonius) campaneti* sp. n., que representa la segunda especie hipogea del subgénero *Chthonius* para España. Se aporta una clave para las especies ibéricas del subgénero *Chthonius*.

Palabras clave: Hipogeo, taxonomía, Pseudoscorpiones, Chthoniidae, España, Islas Baleares.

Taxonomy / Taxonomía: *Chthonius (Chthonius) campaneti* sp. n.

Introduction

Coves de Campanet is a cave located on the southwestern slope of Sant Miquel hill, Serra de Tramuntana, municipality of Campanet, in the northeast of Mallorca Island (Fig. 1). The cave is developed in dolomitic limestone rock of Upper Triassic Age, occupying a surface area about 3.200 m², to a maximum depth of 50 m, comprised of various passages and chambers, the latter including Sala del Llac, Sala de la Palmera, Sala Romàntica, etc., some of which contain small water pools (<http://www.covesdecampanet.com/home.php?lang=en>).

The first known access to the cave by man in recent history occurred in 1945, after hard deobstruction work (Cañigueral, 1949; Saz, 1946; Vives, 1996). Before imminent work to turn the caves into a tourist attraction, some scientists were invited to study the cave. The expedition was carried out by catalan and mallorcan specialists: the biologist Francesc Español and the geologists Noel Llopis-Lladó, José M^a Thomas Casajuana, Guillem Colom and Joan Bauzá (Español, 1945; Llopis-Lladó & Thomas-Casajuana, 1948). As a result of their collecting, the endogean carabid beetle *Henrotius jordai* (Reitter, 1914) was rediscovered in Mallorca after 30 years, a new location record was obtained for the troglomorphic carabid *Laemostenus (Pristonychus) algerinus* (Gory, 1833) (Español, 1966) and a new dipluran species, *Megajapyx (Homojapyx) espanoli* Pagès, 1950, was described (Pagès, 1950).

A new expedition for sampling the stygobian fauna was carried out in 1976 by Nicole Goubault (Muséum national d'Histoire naturelle, Paris) and François Lescher-Moutué (Laboratoire Souterrain CNRS, Moulis) (Goubault & Lescher-Moutué, 1976). The list of their faunistic discoveries includes *Eucyclops serrulatus* (Fischer, 1851), *Paracyclops fimbriatus* (Fischer, 1853), *Diacyclops clandestinus* (Kiefer,

1926), *Pleuroxus aduncus* (Jurine, 1820) and *Iberobathynella fagei* (Delamare & Angelier 1950).

For a better knowledge of the terrestrial fauna of the cave, a collaboration agreement was made between the cave's owner, Maria Antònia Siquier, and the second author, which has allowed intensive sampling for a year, starting in October 2012. As a result, three pseudoscorpion species have been identified, the epigeal species *Chthonius (Chthonius) ischnocheles* (Hermann, 1804) and *Chthonius (Ephippiochthonius) tetrachelatus* (Preyßler, 1790), and a new previously undescribed troglomorphic species, *Chthonius (Chthonius) campaneti* sp. n.

Material and methods

Up to 18 pitfall traps were installed in five chambers of the cave and baited with beer, cheese, jam and sobrassada. Traps were emptied every two weeks. Some specimens were captured by hand when they were observed walking near the traps.

Measurements of the air temperature (AT), surface temperature (ST) and relative humidity (RH) were taken at every two weeks visit and around each trap. For AT and RH the measurements were taken with a thermo-hygrometer, Oregon Scientific model EMR812HGN, and those for ST were taken with a laser thermometer, Würth model 08536007.

The specimens were dissected and examined as temporary mounts in cavity slides with glycerine. After study, the specimens were preserved in 70% ethanol inside glass vials, with the dissected appendages in a glass microvial. When necessary, some specimens were previously cleared by immersion in 60% lactic acid at room temperature for a few days.



Fig. 1. Situation of Coves de Campanet (arrowed) in the northeastern part of Mallorca.

The specimens were studied under a trinocular Zeiss Axiolab light microscope, measurements were taken with an ocular micrometer and the reference points used were those proposed by Chamberlin (1931); both the depth and width of the pedipalpal chela are given, when different. Measurements are expressed in millimetres, followed by standard ratios in parentheses. The ratios given are length/width for carapace, chelicerae and pedipalps, and length/depth for legs; for chela and chelal hand, the length/depth is also given, when different of the length/width; when two articles are compared, the ratio is the length/length index. The general terminology follows Chamberlin (1931), including trichobothriotaxy, with modifications or additions proposed by Harvey (1992) and Judson (2007).

Institutional abbreviations. DEUA: Departamento de Ecología, Universidad de Alicante, Spain. MBCN: Museu Balear de Ciències Naturals, Mallorca, Spain. *Other abbreviations used in text.* AT: air temperature, ST: surface temperature, RH: relative humidity.

Results

Family CHTHONIIDAE Daday, 1889

Genus *CHTHONIUS* C.L. Koch, 1843

Subgenus *Chthonius* C.L. Koch, 1843

Chthonius (Chthonius) campaneti Zaragoza & Vadell sp. n.
Fig. 2, 5-10.

TYPE MATERIAL. Holotype female, Spain, Balearic Islands, Mallorca, Campanet, Coves de Campanet, Sala de la Capella (39°47'37"N, 2°58'10"E; 54 m a.s.l.), 2.II.2013, lgt. M. Vadell (DEUA: 24011). Paratype female, same location (except in Sala de les Arrels) and collector as holotype, 16.II.2013 (MBCN: 19501).

ETYMOLOGY. The species is named in reference to its type locality, Coves de Campanet.

DIAGNOSIS. Weakly troglomorphic facies. No eyes or eye-spots. Chelicera with six setae on palm, without microsetae; movable cheliceral finger with isolated subapical tooth, spin-

neret low but distinct. Carapace with two macrosetae on posterior margin, without preocular microsetae. Tergite I with four macrosetae. Pedipalp: femur length 0.61–0.64 mm (5.1–5.4); chela length 0.91–0.93 (5.5–5.6); fixed finger with 80–91 teeth, movable finger with 57–66 teeth; trichobothrium *ist* distinctly distad of *eb/esb*.

DESCRIPTION. Female holotype, followed (when different) by female paratype in parentheses. Small hypogean species with moderate troglomorphic adaptations; integument desclerotized, whole body and appendages pale brown, except chelicerae, which are reddish-brown; weak hispid granulation on lateral surface of ocular and posterior areas of carapace, on cheliceral palm, on base of paraxial face of pedipalpal femur, on base of movable chelal finger and on dorsal and ventral surfaces of pedipalpal hand.

Carapace (Fig. 5-6) subquadrate, as broad as long, markedly constricted posteriorly; anterior margin prominent, medially dentate and with well developed epistome; without eyes or eye-spots; 18 setae, without preocular microsetae, formula: 4:6:4:2:2, anteromedial seta 0.11 mm long, ocular seta 0.07 mm. Four lyrifissures in anterior and ocular areas, two in posterior area.

Pedipalpal coxa with 5 setae (including 2 on manducatory process), coxa I 3 + 3 marginal microsetae, II 4 + 8–9 (7) bipinnate coxal spines, III 5 + 4–5 (4) bipinnate coxal spines and IV 7 (6); intercoxal tubercle bisetose.

Chaetotaxy of tergites I–XI: 4:4:4:4:6:6:6:6:4:1T2T1. Genital area with 8 (9) setae on sternite II. Chaetotaxy of sternites III–XI: (3)11(3):(2)6(2):8:6:6:6:6:2T1T2:0 (paratype: III 8). Anal cone 0+2 setae.

Chelicera (Fig. 9-10) with 6 setae on palm, without microsetae laterally, seta *vb* very short (0.03 mm long); seta *gl* 0.59 (0.63) from base of movable finger. Fixed finger with 13 (11) teeth, two distal teeth distinctly larger than others, proximally decreasing in size. Movable finger with an isolated subapical tooth (*di*), a large distal tooth and 10 contiguous teeth decreasing in size proximally; spinneret low and apically rounded. Rallum with 11 blades, serrulae exterior and interior with 16 (15) and 13 blades, respectively.



Fig. 2-4. Habitus of living specimens. 2, *Chthonius (C.) campaneti* sp. n.; 3, *Chthonius (C.) ischnocheles* (Hermann, 1804); 4, *Chthonius (E.) tetrachelatus* (Preysslner, 1790).

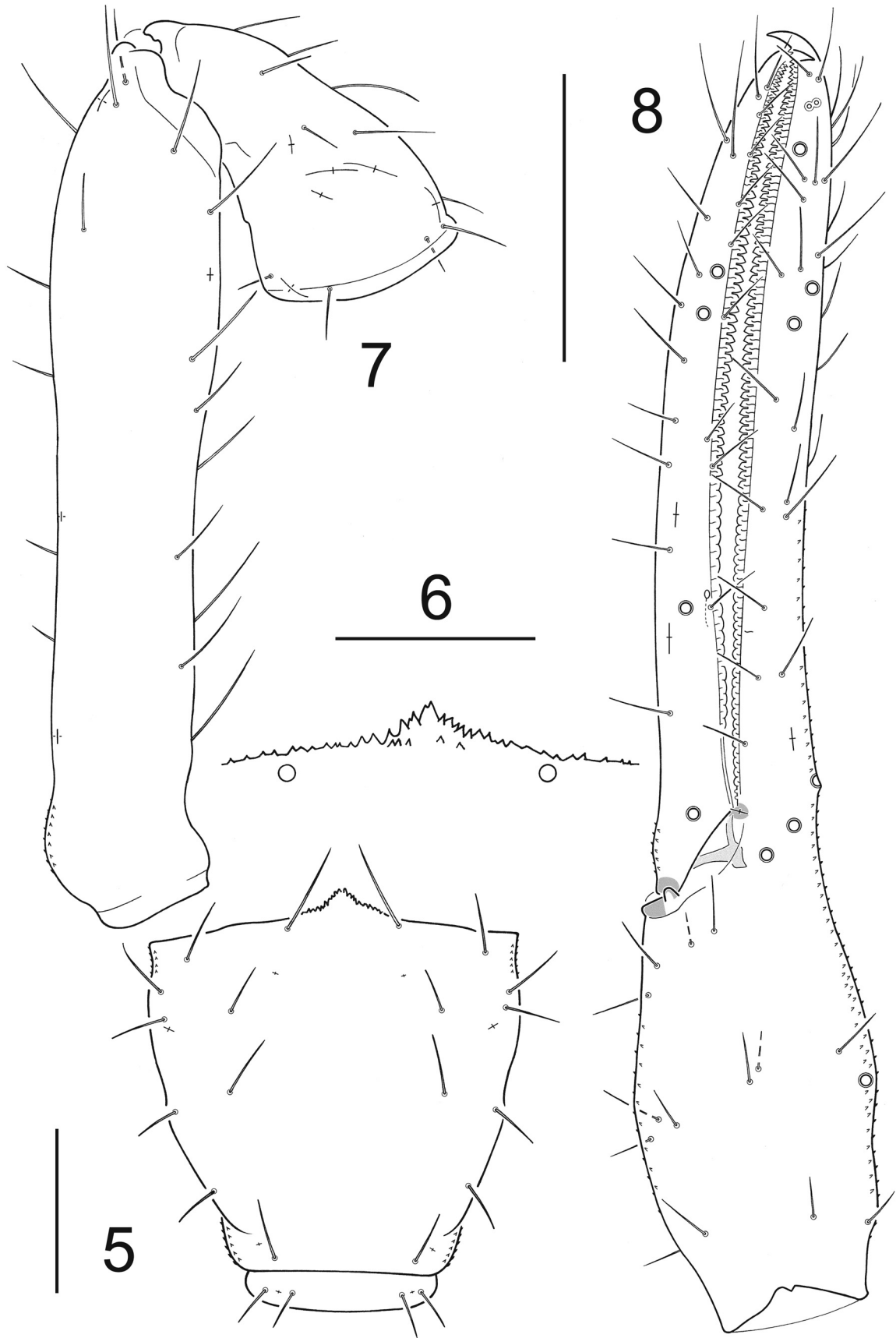


Fig. 5–8. *Chthonius (Chthonius) campaneti* sp. n., female holotype. **5**, carapace and tergite I; **6**, median part of anterior margin of carapace, showing epistome; **7**, femur and patella of left pedipalp, dorsal view; **8**, left chela, lateral view. Scale bars (in mm): 0.1 (Fig. 6), 0.2 (Fig. 5, 7, 8).

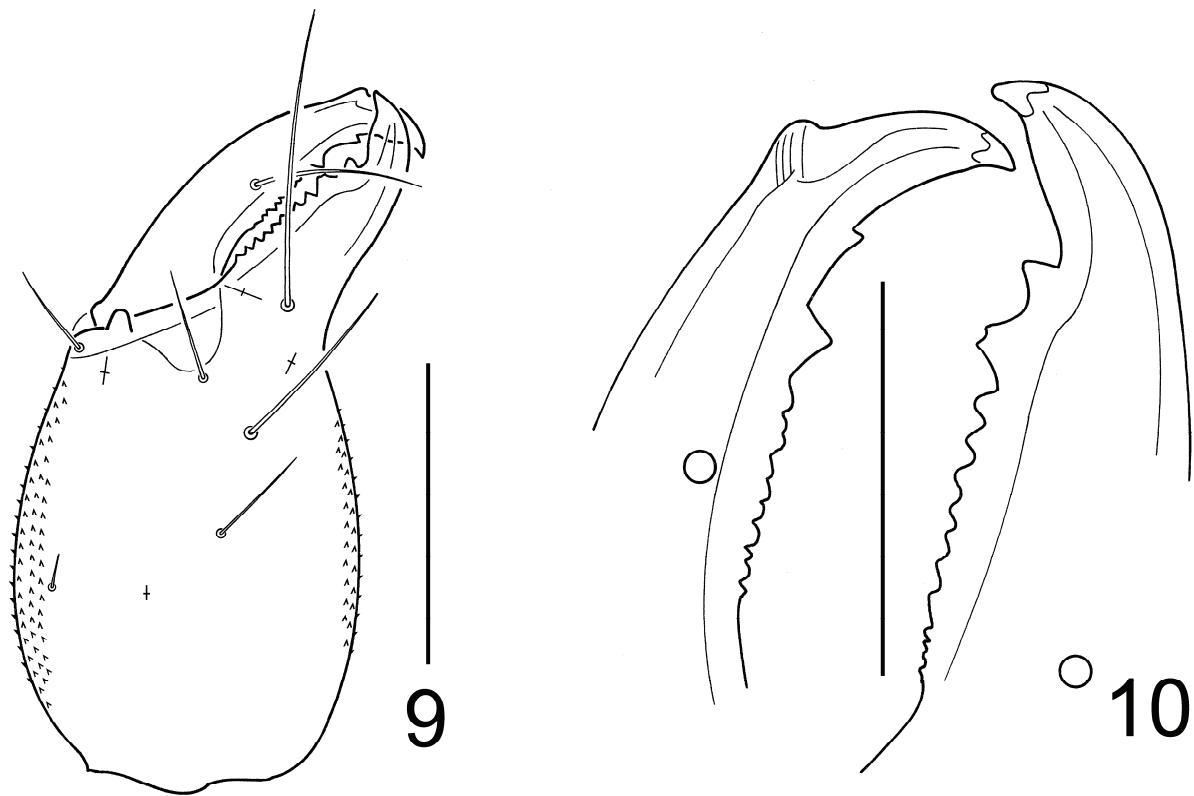


Fig. 9–10. *Chthonius (Chthonius) campaneti* sp. n., female holotype. **9**, left chelicera; **10**, partial view of fingers of left chelicera. Scale bars (in mm): 0.1 (Fig. 10), 0.2 (Fig. 9).

Pedipalp (Fig. 7-8) with femoral chaetotaxy 3:6:2:5:1, four lyrifissures: one antiaxial and three paraxial. Chelal hand continuously depressed from trichobothria *ib-isb* to base of fixed finger, proximad of *ib-isb* with a weak, broad depression; chaetotaxy 4:6:4. Fixed finger with 91 (80) close-set teeth, pointed and slightly inclined backwards in distal half of finger and rounded in proximal half, dental row reaching to base, all teeth with dental canals, two microtubercles at base. Movable finger with 66 (57) close-set teeth, pointed and slightly inclined backwards in distal half of finger and rounded in proximal half, dental row reaching between trichobothria *sb* and *b* (slightly closer to *b*), all teeth with dental canals; coupled sensilla *pc* slightly distad of *sb*; basal apodeme very short and apically indented. Trichobothria as in fig. 8; *ist* distinctly distad of *esb*; distance *st-sb* 1.4 (1.6) longer than distance *sb-b*.

Leg IV tactile seta ratios: tibia 0.54 (0.52), basitarsus 0.38 (0.39), telotarsus 0.33 (0.31).

Measurements and ratios. Female paratype (when different) in square brackets. Body 1.46. Carapace 0.48/0.46 (1.0) [0.46/0.44 (1.0)]. Chelicera: palm 0.46/0.23 (2.0) [0.45/0.23 (2.0)], movable finger 0.25 [0.24]. Pedipalp: femur 0.64/0.12 (5.4) [0.61/0.12 (5.1)]; patella 0.27/0.14 (1.9) [0.26/0.14 (1.9)]; chela 0.93/0.17 (5.6) [0.90/0.17 (5.5), depth 0.16 (5.6)]; hand 0.30 (1.8) [0.29 (1.8)]; movable finger 0.62 [0.61]; ratio movable finger/hand 2.0 [2.1]; ratio femur/movable finger 1.0; ratio femur/carapace 1.3; ratio chela/carapace 1.9 [2.0]. Leg I: femur 0.34/0.06 (5.7); patella 0.16/0.05 (3.0) [0.15/0.06 (2.7)]; tibia 0.19/0.05 (4.2) [(4.1)]; tarsus 0.36/0.04 (10.0) [(9.7)]; ratio femur/patella 2.2 [2.3]. Leg IV: femur+patella 0.47/0.17 (2.7) [0.46/0.18 (2.6)]; tibia 0.33/0.08 (4.2)

[0.31/0.08 (4.1)]; basitarsus 0.17/0.06 (3.0); telotarsus 0.34/0.03 (9.9) [0.34/0.04 (9.6)]; ratio telotarsus/basitarsus 2.0.

REMARKS. *Chthonius campaneti* sp. n. resembles some hypogean species from the western Mediterranean area in having the chelal fixed finger with 60 or more close-set teeth. It differs from *Chthonius mayi* Heurtault-Rossi, 1968 (from mainland France) (Heurtault-Rossi, 1968) in having an isolated subapical tooth on the movable cheliceral finger. *Chthonius mazaurici* Leclerc, 1981, *Chthonius balazuci* Vachon, 1963 (both from mainland France) (Leclerc, 1981; Vachon, 1963), *Chthonius italicus* Beier, 1930, *Chthonius caoduroi* Callaini, 1987 (both from mainland Italy) (Beier, 1930; Callaini, 1987) and *Chthonius multidentatus* Beier, 1963 (from Sicily) (Beier, 1963b) all bear 4 or more setae on the posterior margin of the carapace, versus 2 in *C. campaneti* sp. n. *Chthonius cephalotes* (Simon, 1875) (from mainland France) shares with *C. campaneti* the presence of only 2 setae on the posterior margin of the carapace, but it differs from the latter by the absence of a carapacial epistome, the presence of cheliceral microsetae (Heurtault-Rossi, 1968) and the pedipalpal measurements (femur length 1.05, chela length 1.52 mm in *C. cephalotes*, versus 0.61–0.64 and 0.90–0.93 mm, respectively, in *C. campaneti*). The new species is morphologically close to *Chthonius lucifugus* Mahnert, 1977 from Lleida province (Catalonia, mainland Spain) (Mahnert, 1977) [Leclerc (1983) identified some specimens from a cave in the French department of Hérault as *C. cf. lucifugus*, but their taxonomic status remains to be determined], with which it shares the absence of microsetae in the preocular area of the carapace and on the chelicera, along with the presence of only 2 setae on the pos-

terior margin of the carapace. However, they can be distinguished by the chaetotaxy of tergite I (2 setae in *C. lucifugus* and 4 in *C. campaneti*), the pedipalpal measurements and ratios (*C. lucifugus* with femur length 0.82 (ratio 6.7), chela length 1.15 (ratio 6.5), versus femur length 0.63 (ratio 5.3) and chela length 0.92 (ratio 5.6) in *C. campaneti*) and the position of trichobothrium *ist*, which is markedly distad of *esb* in the Catalanian species and closer in the Balearic species.

Chthonius campaneti represents the seventh species of the subgenus *Chthonius* known from the Iberian Peninsula (Zaragoza, 2007) and the second hypogean species for that region, after *C. lucifugus*.

DISTRIBUTION AND HABITAT. Only known from the type locality, where it is found in the chambers Sala de la Capella and Sala de les Arrels. Due to its scarcity in the cave and weak troglomorphic adaptations, the species might occur predominantly in the mesovoid shallow substratum. Mean measurements for the whole cave and year were AT 19.5°C, ST 17.7°C and RH 81.3%, with low variation in the different chambers; mean measures for the passage from Sala de les Arrels to Sala del Llac were AT 19.6°C, ST 18.4°C and RH 83.5%.

Chthonius (Chthonius) ischnocheles (Hermann, 1804)

Fig. 3.

MATERIAL. Spain, Balearic Islands, Mallorca, Campanet, Coves de Campanet, 16.II.2013, 1 female, 3 tritonymphs (DEUA); 06.IV.2013, 1 female (MBCN); 20.IV.2013, 1 female (DEUA); 04.V.2013, 1 male (DEUA); 06.VII.2013, 1 female (DEUA); 10.VIII.2013, 4 females, 1 male (2 females MBCN; 2 females, 1 male DEUA); 23.VIII.2013, 3 females (DEUA). All specimens lgt. M. Vadell.

DESCRIPTION. Males, followed (when different) by females in parentheses. Epigeic species, without troglomorphic adaptations; in general, integument pigmented, but some variation occurs in the studied sample: most of the specimens have opisthosoma and appendages reddish brown in colour and carapace with a darker colour tone, but in others the whole body and appendages are pale brown.

Carapace subquadrate, slightly longer (shorter) than broad; markedly constricted posteriorly; anterior margin medially dentate and with well developed epistome; four eyes with reflecting tapeta, anterior eyes with convex lens, posterior eyes with weak lens more or less flattened; diameter of anterior eyes 0.045–0.05 (0.045–0.06) mm, distance from anterior eyes to anterior margin of carapace 0.03–0.035 (0.04–0.05) mm, distance from anterior to posterior eyes 0.07–0.08 (0.075–0.095) mm; chaetotaxy: 20 macrosetae, formula: mm4mm:6:4:2:4 (1 female m4mm on anterior margin), anteromedial seta 0.12–0.13 (0.16) mm long, ocular seta 0.1 (0.1–0.12) mm; four lyrifissures in the anterior and ocular areas, two in posterior area.

Pedipalpal coxa with 5 setae (including 2 on manducatory process), coxa I 3–4 + 3 marginal microsetae, II 4 + 9–10 (8–11) bipinnate coxal spines, III 5 + 3–4 (5–6) bipinnate coxal spines, IV 6; intercoxal tubercle bisetose.

Chaetotaxy of tergites I–XI: 4:4:4:4:6:6:6:6:4:1T2T1. Genital area with 10 setae on sternite II in males and in females; sternite III with (3)8–9(3) setae in females; sternite III in males with genital opening flanked by 7–8 setae on each side, 4+4 internal glandular setae and (3)10(3) marginal setae.

Chaetotaxy of sternites IV–XI: (2)9–10(2):8–10:6:6:6:6:2T1 T2:0 (IV 6–8). Anal cone 0+2 setae.

Chelicera with 6 setae on palm and 3 microsetae laterally, seta *vb* 0.065 (0.07–0.08) mm long; seta *gl* 0.56–0.57 (0.62–0.66) from base of movable finger. Fixed finger with 7–8 (9–12) teeth, proximally decreasing in size, two distal teeth distinctly larger than others, 3–4 proximal microtubercles. Movable finger with an isolated subapical tooth (*di*), a large distal tooth, 5–10 small teeth and 1–4 proximal microtubercles; spinneret moderately prominent and apically rounded, slightly more developed in females. Rallum with 11 blades, serrulae exterior and interior with 15–16 (16–18) and 13–15 (15–16) blades, respectively.

Pedipalp with femoral chaetotaxy 3:6:2:5:1 (3:6:2:5–6:1); four lyrifissures: one antiaxial and three paraxial. Chelal hand continuously depressed from trichobothria *ib-ib* to base of fixed finger; chaetotaxy 4:5–6:4. Fixed finger with 36–42 (33–37) teeth, all with dental canals; 7–10 (6–7) distal teeth close-set, small and pointed; medial teeth spaced, with a large base, distally triangular, apically pointed and slightly inclined backwards; 10 (6–9) proximal teeth small and progressively rounded; dental row reaching to base, 2–4 microtubercles at base. Movable finger with 37–47 (38–40) teeth, all with dental canals, apically pointed and slightly inclined backward in distal half of finger; progressively flattened and proximally rounded in proximal half, dental row reaching to base or slightly distad of *b*; coupled sensilla *pc* distinctly distad of *sb*; basal apodeme very short and apically indented. Trichobothrium *ist* distinctly distad of *esb*; distance between *st-sb* 1.9 (1.8) longer than that between *sb-b*.

Leg IV. Tactile seta ratios: tibia 0.54–0.55 (0.52–0.56), basitarsus 0.39–0.41 (0.38) and telotarsus 0.31–0.34 (0.27–0.29).

Measurements and ratios. Males. Body 1.56–1.59. Carapace 0.50–0.56/0.48–0.55 (1.0). Chelicera: palm 0.47–0.53/0.23–0.26 (2.0), movable finger 0.25–0.27. Pedipalp: femur 0.63–0.77/0.13–0.15 (5.0–5.1); patella 0.28–0.33/0.14–0.17 (1.9–2.0); chela 0.94–1.13/0.17–0.20 (5.5–5.6); hand 0.33–0.42 (1.9–2.1); movable finger 0.60–0.70; ratio movable finger/hand 1.7–1.8; ratio femur/movable finger 1.1; ratio femur/carapace 1.3–1.4; ratio chela/carapace 1.9–2.0. Leg IV: femur+patella 0.52–0.69/0.24–0.31 (2.2); tibia 0.35–0.45/0.09–0.11 (3.8–4.0); basitarsus 0.19–0.22/0.07–0.08 (2.6); telotarsus 0.35–0.46/0.04–0.05 (8.8–10.2); ratio telotarsus/basitarsus 1.8–2.1.

Females. Body 2.10–2.19. Carapace 0.58–0.69/0.57–0.72 (1.0). Chelicera: palm 0.53–0.65/0.26–0.32 (2.0), movable finger 0.27–0.34. Pedipalp: femur 0.70–0.90/0.15–0.18 (4.7–4.9); patella 0.31–0.40/0.17–0.21 (1.9); chela 1.05–1.28/0.26–0.22 (4.8), depth 0.26–0.21 (4.9); hand 0.38–0.46 (1.7), depth (1.8); movable finger 0.67–0.80; ratio movable finger/hand 1.7–1.8; ratio femur/movable finger 1.0–1.1; ratio femur/carapace 1.2–1.3; ratio chela/carapace 1.8–1.9. Leg IV: femur+patella 0.59–0.78/0.26–0.35 (2.2–2.3); tibia 0.40–0.51/0.10–0.13 (4.0); basitarsus 0.21–0.27/0.08–0.10 (2.7–2.8); telotarsus 0.39–0.51/0.04–0.06 (9.3); ratio telotarsus/basitarsus 1.9.

REMARKS. Specimens from Coves de Campanet in general fit the description of *C. ischnocheles* given by Gabbutt & Vachon (1963). The pedipalps of the material from Mallorca are more robust than the specimens from Jaca (Huesca, Spain) studied by Mahner (1985), but still remain within the known

range of the species. The additional descriptive data for this species given by Mahnert (1985) and Zaragoza *et al.* (2007) are confirmed in this study.

Orghidan *et al.* (1975) recorded *Chthonius* (*C.*) *dacnodes* Navás, 1918, for the first time for Mallorca obtained by an intensive caving expedition, but did not collect any specimen of *C. ischnocheles*. The species *C. dacnodes* was collected at different localities of the island, including the cave Cova de Ca'n Sion, geographically very close to Coves de Campanet. These records might be based on quite frequent confusions with *C. ischnocheles* (Gardini, 2000; Zaragoza *et al.*, 2007), since clear differences between those species have been emphasized by Mahnert only from 1985.

DISTRIBUTION AND HABITAT. Present in most western and central European countries and the Macaronesian Islands. Introduced to Saint Helena Island and the U.S.A. Records for the Iberian Peninsula and the Balearic Islands are given in Zaragoza (2007) and Vadell *et al.* (2006). This species is not infrequent in caves, often being found at cave entrances, but in this case the artificial lighting in a tourist cave helps the specimens to penetrate into deeper chambers. The same occurs with *C. (E.) tetrachelatus*.

Key to the subgenus *Chthonius* for the Iberian Peninsula [modified from Beier (1963a), incorporating data from Muchmore (1968) and species described by Mahnert (1985) and this study]

- 1 Epigeal species, without troglomorphic facies; at least, anterior eyes always well developed 2
- Hypogean species, weak troglomorphic facies; without eyes or eye-spots 6
- 2 Teeth of the chelal fingers small and close-set; smaller species, movable chelal finger about 0.4 mm long or less 3
- Teeth of the chelal fingers large and interspaced; larger species, movable chelal finger about 0.7 mm or more.. 4
- 3 Chaetotaxy of tergites I–IV: 4–5:4–5:5–6:6–7 *Chthonius (C.) halberti*
- Chaetotaxy of tergites I–IV: 4:4:4:4 *Chthonius (C.) jonicus*
- 4 Anterior margin of carapace with distinct epistome *Chthonius (C.) ischnocheles*
- Anterior margin of carapace without epistome 5
- 5 Medial teeth of chelal fixed finger separated from each other by less than their basal diameter *Chthonius (C.) tenuis*
- Medial teeth of chelal fixed finger separated from each other by more than their basal diameter *Chthonius (C.) dacnodes*
- 6 Tergite I with 2 setae *Chthonius (C.) lucifugus*
- Tergite I with 4 setae *Chthonius (C.) campaneti*

Subgenus *Ephippiochthonius* Beier, 1930

Chthonius (E.) tetrachelatus (Preysler, 1790)

Fig. 4.

MATERIAL. Spain, Balearic Islands, Mallorca, Campanet, Coves de Campanet, 10.XI.2012, 1 male (MBCN); 24.XI.2012, 1 female (DEUA); 16.II.2013, 1 female, 1 male (DEUA); 02.III.2013, 3 females, 1 male (1 female MBCN, 2

females, 1 male DEUA); 06.VII.2013, 1 female (DEUA); 23.VIII.2013, 1 male (DEUA). All specimens lgt. M. Vadell.

DESCRIPTION. Males, followed (when different) by females in parentheses. Epigeal species, integument pigmented.

Carapace subquadrate, slightly longer than broad; anterior margin medially denticulate and weakly prominent; four eyes with reflecting tapeta, anterior eyes with convex lens, posterior eyes with weak or extremely flattened lens; diameter of anterior eyes 0.05–0.055 mm, distance from anterior eyes to anterior margin of carapace 0.03–0.035 mm, distance from anterior to posterior eyes 0.035–0.04 mm; chaetotaxy: 18 macrosetae, formula: m4m:6:4:2:2 (one male 1–2 microsetae on anterior margin), anteromedial seta 0.075 (0.085–0.09) mm long, ocular seta 0.055–0.065 (0.065–0.075) mm; Four lyrifissures in anterior and ocular areas, two in posterior area.

Pedipalpal coxa with 5 setae (including 2 on manducatory process), coxa I 3 + 3 marginal microsetae, II 4 + 9–11 bipinnate coxal spines, III 5 + 4–6 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Chaetotaxy of tergites I–XI: 4:4:4:4:6:6:6:6:4:1T2T1. Genital area with 9–10 setae on sternite II in males and 10 in females; sternite III with (3)8–11(3) setae in females; sternite III in males with genital opening flanked by 6–7 setae on each side, 4+4 internal glandular setae and (3)10(3) marginal setae. Chaetotaxy of sternites IV–XI: (2)7–8(2):8–10:6:6:6:6:2T1 T2:0. Anal cone 0+2 setae.

Chelicera with 6 setae on palm and 2 microsetae laterally; seta *gl* 0.58–0.60 from base of movable finger. Fixed finger with 10–11 teeth, proximally decreasing in size, second distal tooth distinctly larger than others. Movable finger without an isolated subapical tooth (*di*), with a large, simple or bicuspid distal tooth, 2–4 medium teeth and 1–3 proximal microtubercles; spinneret prominent and apically rounded, more developed in females. Rallum with 11 blades, serrulae exterior and interior with 16 and 13 blades respectively.

Pedipalp with femoral chaetotaxy 3:6:2:5:1; four lyrifissures: one antiaxial and three paraxial. Chelal hand very weakly depressed at level of *ib-ib*, weak hump distad of *ib-ib*. Fixed finger with 19–20 pointed teeth, distal one small, 9 proximal teeth progressively decreasing in size, all with dental canals, 4–7 microtubercles at base; tip of finger with an accessory tooth (*td*) on antiaxial face; tip of fixed chelal finger of males with a deep hollow on paraxial face, lacking in females; four teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.0275–0.030 mm. Distal half of movable finger with 6–7 pointed teeth with dental canals, distal one very small; proximal half without raised lamina, with 10–11 vestigial teeth without dental canals, very low and mostly undulate, basally decreasing in size, almost unrecognizable in some cases, reaching halfway between trichobothria *sb* and *b*, 1–4 microtubercles at base; coupled sensilla *pc* between *sb* and *b*, slightly closer to *sb*; basal apodeme long and apically indented. Trichobothrium *ist* slightly distad of *esb*; distance between *st-sb* 2.0–2.2 longer than that between *sb-b*.

Leg IV. Tactile seta ratios: tibia 0.56–0.59, basitarsus 0.38–0.40 and telotarsus 0.29–0.32.

Measurements and ratios. Males. Body 1.38–1.44. Carapace 0.40/0.37–0.40 (1.0–1.1). Chelicera: palm 0.33–0.35/0.16–0.17 (2.1), movable finger 0.17–0.18. Pedipalp: femur 0.54–0.59/0.09–0.10 (6.0–6.1); patella 0.22–0.23/0.10–0.11 (2.1–2.2); chela 0.72–0.79/0.13–0.14 (5.6–5.7), depth (5.5–5.6); hand 0.30–0.34 (2.3–2.5), depth (2.3–2.4); movable

finger 0.42–0.45; ratio movable finger/hand 1.3–1.4; ratio femur/movable finger 1.3; ratio femur/carapace 1.5; ratio chela/carapace 1.9–2.0. Leg IV: femur+patella 0.49–0.54/0.21–0.24 (2.3); tibia 0.30–0.32/0.07–0.08 (4.0–4.1); basitarsus 0.17–0.19/0.06 (2.8–3.2); telotarsus 0.34–0.37/0.03–0.04 (10.1–10.4); ratio telotarsus/basitarsus 2.0.

Females. Body 1.71–1.84. Carapace 0.44–0.46/0.42–0.45 (1.0). Chelicera: palm 0.37/0.19–0.18 (1.9–2.1), movable finger 0.18–0.19. Pedipalp: femur 0.60–0.65/0.11–0.12 (5.7); patella 0.23–0.25/0.13 (1.8–2.0); chela 0.83–0.87/0.17–0.18 (4.7–5.1); hand 0.34–0.39 (2.1); movable finger 0.45–0.46; ratio movable finger/hand 1.2–1.3; ratio femur/movable finger 1.2–1.3; ratio femur/carapace 1.4; ratio chela/carapace 1.9. Leg IV: femur+patella 0.55/0.22 (2.5); tibia 0.34–0.36/0.08 (4.2–4.5); basitarsus 0.20–0.21/0.06–0.07 (3.2–3.5); telotarsus 0.37–0.38/0.03–0.04 (10.7–11.0); ratio telotarsus/basitarsus 1.8–1.9.

REMARKS. A wide range of morphological variation has been recorded between different populations of *Chthonius tetra-chelatus*. Recently, Zaragoza & Pérez (2013) described a population from Jaén province (mainland Spain) for which differences from the above described population from Mallorca are remarkable: presence versus absence of dental canals in the teeth at the proximal half of the chelal movable finger, 1 versus 2 lateral microsetae on cheliceral palm and different pedipalpal ratios. However, all these characteristics still fall within the diagnosis of the species given by Gardini (2009, 2013).

DISTRIBUTION. Western Palaearctic Region, chiefly Mediterranean; introduced to eastern Canada, U.S.A. (including Hawaii), Cuba, Argentina, Seychelles and southwestern Australia (Gardini, 2013; Harvey, 2013). Records for the Iberian Peninsula and Balearic Islands are given in Zaragoza (2007) and Zaragoza & Pérez (2013).

Discussion

Species of the subgenus *Chthonius* are quite scarce in the Iberian Peninsula, as compared to the neighbouring countries of France and Italy. Currently, only five species are recorded from Spain and three from Portugal (Zaragoza, 2007; this study). This is in stark contrast to the large and continuously increasing number of species of the subgenus *Ephippiochthonius* known from the Iberian Peninsula (e.g. Carabajal *et al.*, 2011, 2012; Zaragoza, 2007; Zaragoza & Pérez, 2013). A lack of methodical sampling in endogean and leaf-litter environments for collecting pseudoscorpions could partly explain this, since only a small number of papers have been published (e.g. Da Gama *et al.*, 2000a, 2000b; Mahnert, 1985; Perera, 1989; Zaragoza *et al.*, 2007). However, there is not yet explanation for the relative absence of species of *Chthonius* (*s. str.*), in caves of the Iberian Peninsula, where the pseudoscorpion fauna is best known in comparison with other environments, since many hypogean species of the subgenus are recorded from France and Italy. The poor representation of *Chthonius* (*s. str.*) in the Iberian Peninsula is probably due to a combination of inadequate sampling and its biogeographical history, which is still unknown.

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