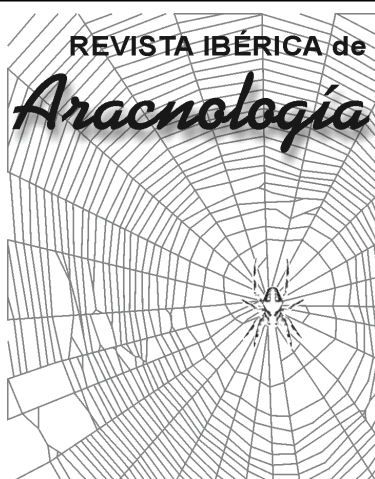




ARTÍCULO:

***Chthonius (Ehippiochthonius) cardosoi*, a new hypogean species from Portugal (Pseudoscorpiones: Chthoniidae)**

Juan A. Zaragoza

Departamento de Ecología
Facultad de Ciencias
Universidad de Alicante
E-03080 Alicante,

Revista Ibérica de Aracnología

ISSN: 1576 - 9518.

Dep. Legal: Z-2656-2000.

Vol. 20

Sección: Artículos y Notas.

Pp: 25-30.

Fecha de publicación: 31-Enero-2012

Edita:

Grupo Ibérico de Aracnología (GIA)

Grupo de trabajo en Aracnología
de la Sociedad Entomológica
Aragonesa (SEA)

Avda. Radio Juventud, 37

50012 Zaragoza (ESPAÑA)

Tel. 976 324415

Fax. 976 535697

C-elect.: amelic@telefonica.net

Director: Carles Ribera

C-elect.: cribera@ub.edu

Índice, resúmenes, abstracts, vols.
publicados:

<http://gia.sea-entomologia.org>

Página web GIA:

<http://gia.sea-entomologia.org>

Página web SEA:

<http://www.sea-entomologia.org>

ARTÍCULO:

***Chthonius (Ehippiochthonius) cardosoi*,
a new hypogean species from Portugal
(Pseudoscorpiones: Chthoniidae)**

Juan A. Zaragoza

Abstract:

The new species *Chthonius (Ehippiochthonius) cardosoi* is described from a hypogean location. This is the sixth species of the subgenus recorded from mainland Portugal.

Keywords. Pseudoscorpiones, Chthoniidae, *Chthonius*, *Ehippiochthonius*, hypogean, Portugal.

Taxonomy. *Chthonius (Ehippiochthonius) cardosoi* sp. nov.

***Chthonius (Ehippiochthonius) cardosoi*, nueva especie hipogea de
Portugal (Pseudoscorpiones: Chthoniidae)**

Resumen:

Se describe la nueva especie *Chthonius (Ehippiochthonius) cardosoi* de una localización hipogea. Representa la sexta especie del subgénero citada para Portugal continental.

Palabras clave. Pseudoscorpiones, Chthoniidae, *Chthonius*, *Ehippiochthonius*, hipogeo, Portugal.

Taxonomía. *Chthonius (Ehippiochthonius) cardosoi* sp. nov.

Introduction

Five species of the subgenus *Chthonius (Ehippiochthonius)* have been recorded from mainland Portugal (Zaragoza, 2007). Three of these are epigean: *C. (E.) gibbus* Beier, 1952, *C. (E.) machadoi* Vachon, 1940 and *C. (E.) tetrachelatus* (Preyssler, 1790). *Chthonius (E.) hispanus* Beier, 1930, although mentioned chiefly from caves, still retains the anterior eyes and is considered of epigean or troglomorphic condition (Zaragoza, 2007). *Chthonius (E.) minutus* Vachon, 1940, was, up to now, the only eyeless species of the subgenus in Portugal; it was thought that this species had been found in an artificial mine gallery and consequently it has been considered endogean (Mahnert, 1978) or simply humidophilic (Bellés, 1987), but its *locus typicus*: Mina dos Mouros, Mexilhoeira Grande, is a small natural cave (15 meters long), after consulting the Catalogue of the limestone caves from Portugal by Machado & Machado (1948). In a small sample of pseudoscorpions from caves of mainland Portugal, sent by Dr. Pedro Cardoso, were found two *Ehippiochthonius* specimens representing a new undescribed species with modifications to a hypogean life. *C. (E.) minutus* and the new species present a moderate degree of adaptations to the subterranean environment, similar to those observed in the recently discovered species of the MSS (mesovoid shallow substratum) from the Canary Islands (Mahnert, 2011). The MSS is defined as empty ventilated spaces within the rocky debris accumulated on the bedrock and covered by a layer of soil; it is connected with the fissure

network of the bedrock, whether it be calcareous or not (e.g. lava). From the biological point of view, the MSS and fissure network is considered a particular habitat for a fauna that requires constant humidity and temperatures values. The existence of this fauna, with different degrees of adaptation, also is quite frequent and best known in natural (caves) or artificial (mines) cavities, when these interrupt the substratum (Giachino & Vailati, 2010). The term “hypogean” is adopted here in the sense defined by Ortuño & Gilgado (2010) for the fauna of the MSS and the MSP (deep subterranean environment), instead of the term “subterranean” that, for both these authors, also includes the endogean fauna.

Material and methods

The specimens were dissected and then examined as temporary glycerine mounts in cavity slides, after which they were preserved in 70% ethanol inside glass vials, with the dissected appendages in glass microvials. Microscopical examination, measurements taking and preparation of illustrations were carried out with a trinocular Zeiss Axiolab light microscope. The Measurements are based on Chamberlin's (1931) reference points; depth and width of the pedipalpal chela and hand are both given. The ratios given are the length/width or (for legs) the length/depth index of an article; when two articles are compared the ratio is the length/length index. The terminology follows Chamberlin (1931), including trichobothriotaxy, with modifications or additions proposed by Harvey (1992) for the segments of the pedipalps and legs and by Judson (2007) for the faces of the appendages, the chelal spot-sensilla and the cheliceral rallum (“flagellum”). The formulae of the setal rows of the carapace, pedipalpal femur and chelal hand follow Gabbutt & Vachon (1963).

Abbreviations

DEUA: Departamento de Ecología, Universidad de Alicante. MNCNM: Museo Nacional de Ciencias Naturales, Madrid. ZMUC: Zoological Museum, Natural History Museum of Denmark.

Taxonomy

Family Chthoniidae Daday, 1888

Chthonius (Ephippiochthonius) cardosoi sp. nov.
(Figs 1–9)

TYPE MATERIAL. Female holotype: Portugal, district of Setúbal, Sesimbra, Gruta do Fumo, coordinates N38°26.050 W009°08.650, altitude 210 m, 23 December 2007, collected by P. Cardoso, S. Henriques & F.L. Rasteiro, deposited in ZMUC. Female paratype, same data (DEUA). Both specimens collected by hand from under stones on wet clayey floor, 10–30 meters inside cave from the cave's entrance.

ETYMOLOGY. The species is named after Dr Pedro Cardoso (Universidade dos Açores), who, together with two colleagues, collected the type specimens and to honour his important contribution to the knowledge of the ar-

achnology in Portugal.

DIAGNOSIS. Cheliceral movable finger without isolated subdistal tooth; posterior margin of carapace with four long setae; epistome moderately prominent and dentate; no eyes or eye-spots; trichobothria *eb-esb-ist* placed in a straight line, *ist* distinctly distal to *esb*; movable chelal finger with 12 acute teeth (each with canal) and 7–9 rounded teeth (without canal); pedipalps moderately long and slender, femur $5.78\text{--}6.0 \times$ longer than broad (length $0.63\text{--}0.66$), chela $5.23\text{--}5.52 \times$ longer than deep (length $0.85\text{--}0.89$).

DESCRIPTION. The data correspond to the female holotype, followed by the paratype female in parentheses. Body and appendages colour yellowish, some tiny cuticular hispid granulation on carapace and cheliceral palm.

Carapace (Fig. 1) $1.19\text{--}1.17 \times$ longer than broad, constricted posteriorly; anterior margin moderately prominent, medially dentate and with rudimentary epistome (Fig. 2); eyes or eye-spots are absent; chaetotaxy: 20 setae and 2 microsetae, formula: 4(plus 1 preocular microsetae on each side):6:4:2:4, lateral setae of the posterior margin slightly shorter than the medial ones; some tiny pores over entire carapace; 5 lyrifissures in the ocular zone and 2 in the posterior row.

Chaetotaxy of tergites I–XI: 4: 4: 4: 4: 6: 6: 6: 6: 4: 6(2 sublateral tactile setae). Manducatory process: 2 setae, pedipalpal coxa: 3, coxa I: 3(plus 3 apical microsetae), coxa II: 3–4(4)+10(6) bipinnate coxal spines, coxa III: 5+4 bipinnate coxal spines, coxa IV: 6; intercoxal tubercle bisetose. Anterior genital operculum with 8 setae. Chaetotaxy of sternites III–XI: 7+2 $\times$ 3 suprastigmal setae: 9(8)+2 $\times$ 2 suprastigmal setae: 9(7): 6: 6: 6: 6: 7(2 submedial tactile setae): 0. Anal cone 0+2 setae. *Chelicera* (Figs 3–4) with 6 setae on the palm and 1 lateral microseta, *gl* ratio: 0.52; fixed finger with 13 (11) teeth, two distal teeth distinctly larger than the rest, decreasing in size towards the base; movable finger with 10 teeth, the distal one larger than the rest which decrease towards the base, one isolated subdistal tooth is absent, spinneret low and rounded; rallum 11 setae, serrula exterior and interior with 14 and 15 (13) lamellae respectively.

Pedipalps (Figs 6–9): femur $6.0\text{--}5.78$ times longer than broad, $1.38\text{--}1.47 \times$ longer than the carapace, $2.43\text{--}2.32 \times$ longer than the patella and $1.25\text{--}1.27 \times$ longer than the fixed finger, chaetotaxy: 3-6-3-5-1, four lyrifissures: 1 dorsal medial-antiaxial and 3 paraxial; patella $2.20\text{--}2.27 \times$ longer than broad, with 5 dorsal and one ventral lyrifissures; hand $2.18\text{--}2.31 \times$ longer than deep and $2.24\text{--}2.31 \times$ longer than broad; chela $5.23\text{--}5.52 \times$ longer than deep and $5.39\text{--}5.52 \times$ longer than broad; fixed finger $1.43\text{--}1.39 \times$ longer than the hand, movable finger $1.41\text{--}1.37 \times$ longer than the hand. Hand with a low hump distal to trichobothria *ib/isb*; chaetotaxy: 4–4–4 (4–5–4). Fixed finger with a row of 16 acute teeth with dental canals and 6 (9) tiny and sclerotized, basal, granular teeth; two first distal teeth distinctly smaller than the rest; the third distal tooth with a different shape

to rest, a little wider and with more pronounced curved sides, as described by Gardini (2009) for *Chthonius (Ephippiochthonius) thaleri* Gardini, 2009; tip of finger with an accessory tooth (*td*) on antiaxial face and a low hollow on paraxial face (Fig. 9). Movable finger with a row of 19 (18) teeth, from distal to basal: 12 acute teeth with dental canals and followed, from little distal to trichobothria *sb* to the level of sensilla *pc*, by 7 (6) rounded rudimentary teeth without dental canals and 7 (9) tiny and sclerotized, basal, granular teeth; first distal tooth (first and second distal teeth) very small; apodeme well developed; sensilla *pc* halfway between trichobothria *sb* and *b*. Trichobothriotaxy: *eb*–*esb*–*ist* placed in a straight line, *ist* distinctly distal to *esb*, distance *ist*–*esb* 1.91 (1.78) $\times$ longer than distance *esb*–*eb*; distance *st*–*sb* 1.57 (1.55) $\times$ longer than distance *sb*–*b*. Chelal lyrifissures and diminutive pores as shown in Figs 7–8.

Legs. Leg I: femur 5.31 (5.12) $\times$ longer than deep and 2.02 (2.06) $\times$ longer than the patella, patella 3.11 (2.92) $\times$ longer than deep, tibia 4.03 (4.11) $\times$, tarsus 9.15 (8.45) $\times$. Leg IV (Fig. 5): femur+patella 2.76 (2.79) $\times$ longer than deep, tibia 4.06 (4.07) $\times$, metatarsus 3.09 (3.32) $\times$, tarsus 9.93 (10.0) $\times$, tarsus 1.83 (1.78) $\times$ longer than the metatarsus; tactile seta ratios: tibia 0.52, metatarsus 0.43 (0.44) and tarsus 0.32 (0.31).

Measurements: body length 1.50 (1.44); carapace 0.48/0.40 (0.43/0.37); cheliceral palm 0.42/0.20 (0.40/0.18), movable finger length 0.22 (0.21). Pedipalps: femur 0.66/0.11 (0.63/0.11); patella 0.27/0.12; hand length 0.37 (0.36), depth 0.17 (0.15), width 0.16 (0.15); fixed finger length 0.53 (0.50), movable finger length 0.52 (0.49); chela length 0.89 (0.85), chela depth 0.17 (0.15), chela width 0.16 (0.15). Leg I: femur 0.35/0.07 (0.32/0.06), patella 0.17/0.06 (0.16/0.05), tibia 0.20/0.05 (0.19/0.05), tarsus 0.36/0.04 (0.31/0.04). Leg IV: femur+patella 0.51/0.19 (0.47/0.17), tibia 0.33/0.08 (0.31/0.08), metatarsus 0.19/0.06 (0.18/0.06), tarsus 0.35/0.04 (0.33/0.03).

Discussion

Within the Portuguese species of the subgenus *Ephippiochthonius*, *C. (E.) cardosoi* sp. nov., represents the second species (the first being *Chthonius C. (E.) minutus* Vachon, 1940) lacking eyes and showing moderate troglomorphic adaptation. The new species can be distinguished from *C. (E.) minutus* by the absence of an isolated subdistal tooth on the movable cheliceral finger and the presence of 4 setae on the posterior margin of the carapace in the new species, on the contrary that in *C. (E.) minutus* where the subdistal tooth is present and the posterior margin bears 2 setae (Vachon, 1940). The species *Chthonius (E.) hispanus* Beier, 1930, has been reported from Lapa do Médico cave (Vachon, 1940), in the same district of Setúbal, as the new species; Vachon (1940) did not provide description of the single female specimen, and mentioning only that it showed a different pattern of trichobothria *ist*–*eb* with respect to the type. In addition to the presence of developed anterior eyes, *C. (E.) hispanus* differs from the new species in

bearing only 2 setae on the posterior margin of the carapace, and in having the anterior margin of the carapace not prominent (pers. obs. of female holotype from Cueva de la Loja, El Mazo, Asturias, Spain, deposited in MNCNM; a redescription of this species is going to be given in a different paper). The new species also differs from *C. (E.) machadoi* Vachon, 1940 and the other members of the *machadoi*-group, as recently described by Mahnert (2011) on new species from the Canary Islands, in lacking the isolated subdistal tooth on the movable finger of the chelicera.

There are three of the Spanish *Ephippiochthonius* species that bear 4 setae on the posterior margin of the carapace: *C. (E.) catalonicus* Beier, 1939 (Beier, 1939), *C. (E.) cabrerensis* Mahnert, 1993 (Mahnert, 1993) and *C. (E.) aguilaorum* Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2000 (Carabajal *et al.*, 2000). The new species is quite different from the latter two in terms of the pedipalpal measurements and ratios: e.g. femur 1.35 mm long and chela 6.68 $\times$ longer than deep in *C. (E.) aguilaorum*, femur 0.34 long and chela 4.60 $\times$ in *C. (E.) cabrerensis* versus femur 0.66 long and chela 5.23 $\times$ in *C. (E.) cardosoi* sp. nov. It is similar to *C. (E.) catalonicus*, with which it shares some of the chelal means, but it differs in the finger/hand length ratio: about 1.40 in *C. (E.) cardosoi* sp. nov. as opposed to 1.70 in *C. (E.) catalonicus*, as well as in having a different pattern of trichobothria *eb*–*esb*–*ist*.

In the Callaini's key (1984) for the subgenus *Ephippiochthonius*, the new species will run to the Moroccan species *C. (E.) atlantis* Mahnert, 1980 (couplet 27), but the latter differs in having a subdistal isolated tooth on the movable cheliceral finger (Mahnert, 1980). Due to the frequent ambiguity in species descriptions concerning the definition of the character "raised lamella on the basal half of the movable chelal finger", the new species could also run to *C. (E.) ventalloi* Beier, 1939, (Valencia, Spain) (couplet 59), but the latter differs in having only 2 setae on the posterior margin of the carapace (Beier, 1939; Zaragoza, 1985).

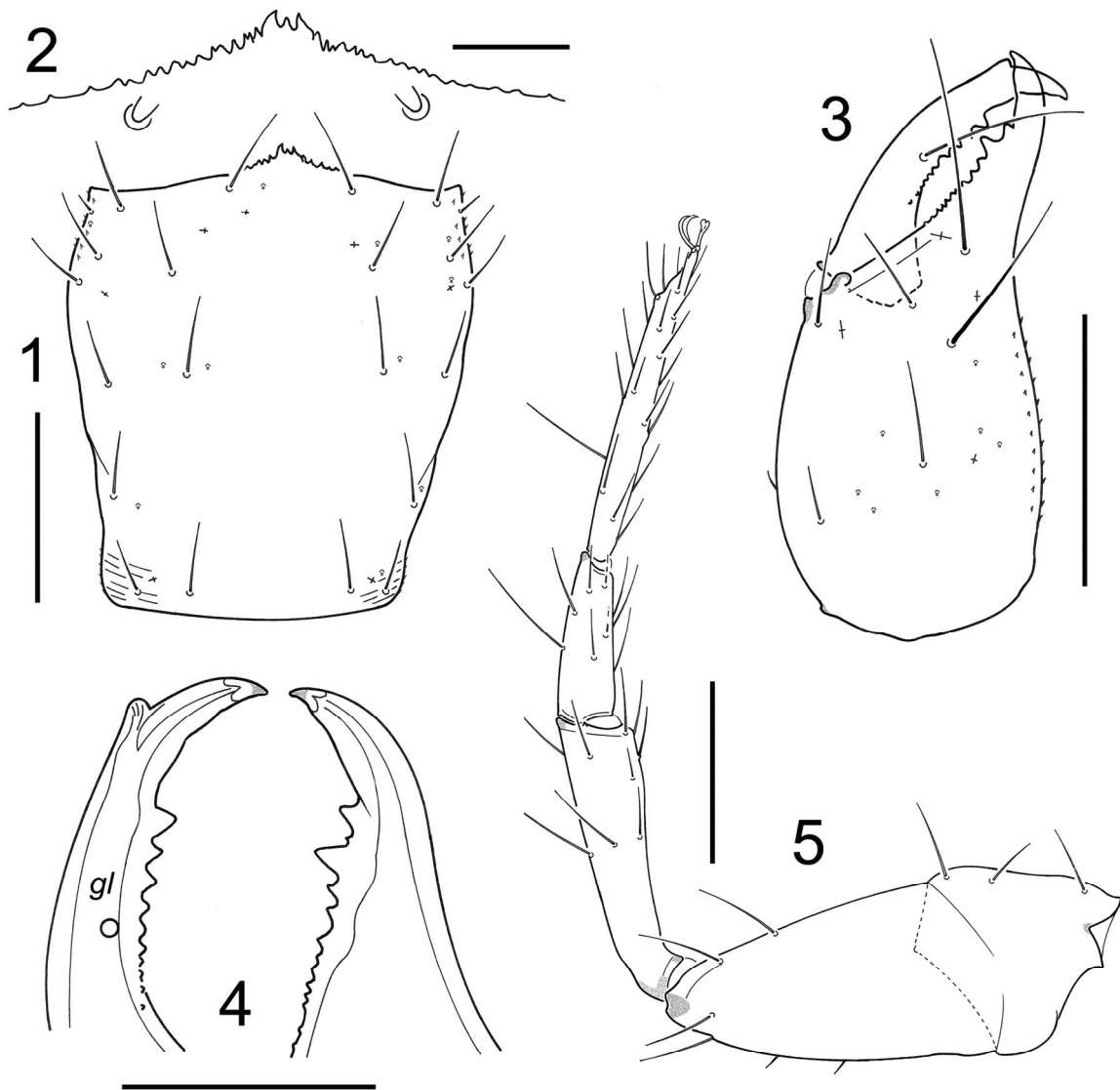
Posteriorly described species to the Callaini's key up to 2011 are also distinct in comparison with the new species.

Acknowledgments.

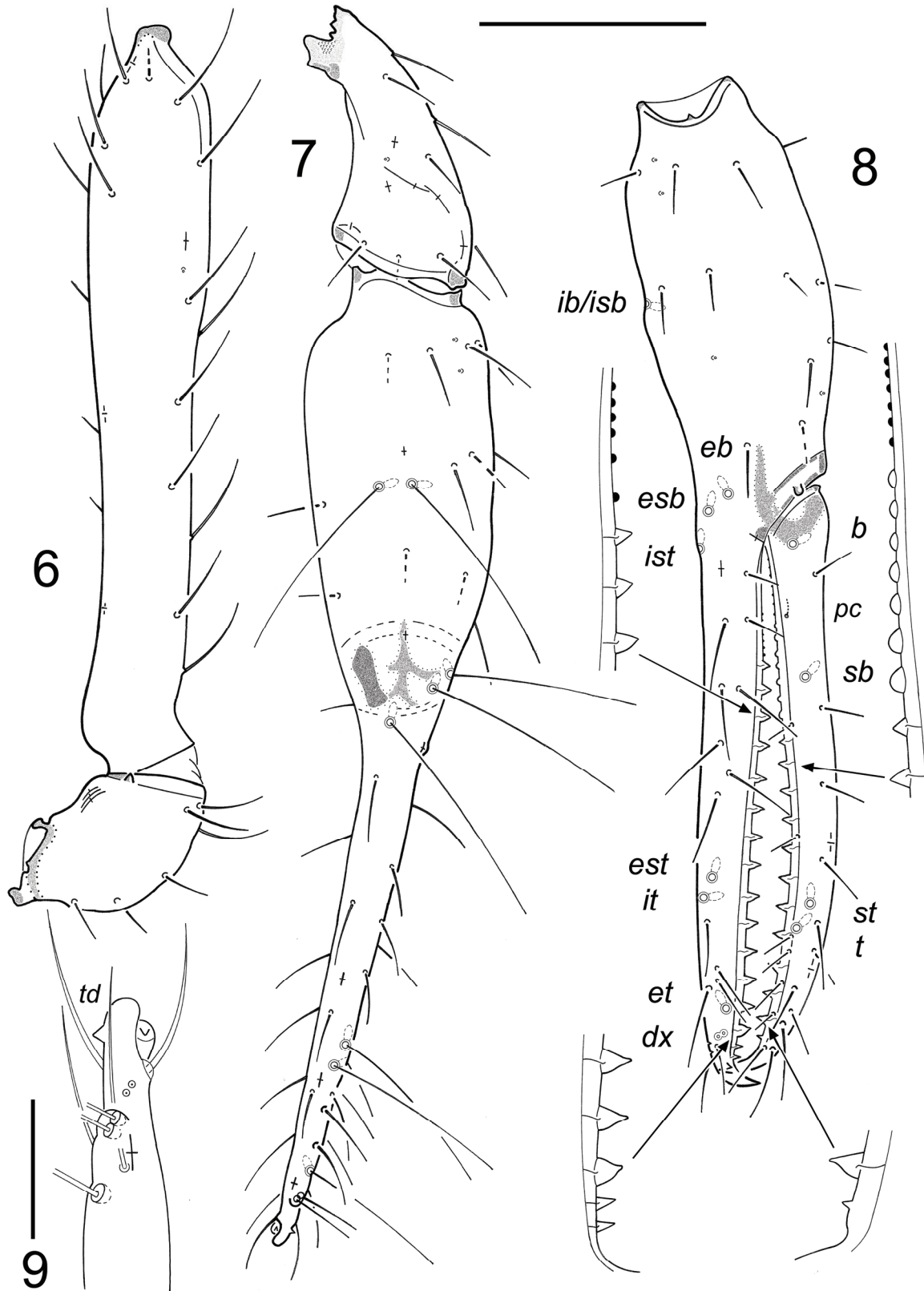
I am indebted to Dr Volker Mahnert (Muséum d'histoire naturelle de la Ville de Genève) and a second anonymous reviewer for their helpful comments to improve the manuscript. I am very grateful to the colleagues Pedro Cardoso (Universidade dos Açores), Sérgio Henriques (Museu Nacional de História Natural, Lisboa) and Francisco Luis Rasteiro (Núcleo de Espeleologia da Costa Azul) for providing material of the new species. Thanks are also due to Javier Sánchez Almazán (MNCNM) for the loan of the type of *Chthonius (E.) hispanus* and to Sofia P.S. Reboleira (Departamento de Biologia da Universidade de Aveiro) for providing data about the Mina dos Mouros cave and copy of Machado & Machado bibliographic reference.

References

- BEIER, M. 1939. Die Pseudoscorpioniden-Fauna der iberischen Halbinsel. *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere*, **72**: 157–202.
- BELLÉS, X. 1987. *Fauna cavernícola i intersticial de la península Ibèrica i les illes Balears*. C.S.I.C.: Mallorca.
- CALLAINI, G. 1984. Osservazioni su alcune specie di *Chthonius* del sottogenere *Ephippiochthonius* Beier (Arachnida, Pseudoscorpionida, Chthoniidae). *Notulae Chernetologicae XVII. Annali del Museo Civico di Storia Naturale di Genova*, **85**: 125–159.
- CARABAJAL MÁRQUEZ, E., GARCÍA CARRILLO, J. & RODRÍGUEZ FERNÁNDEZ, F. 2000. Descripción de dos nuevas especies de Pseudoscorpiones cavernícolas de la provincia de Cádiz (Arachnida, Pseudoscorpionida, Chthoniidae, Neobisiidae). *Graellsia*, **56**: 27–33.
- CHAMBERLIN, J.C. 1931. The arachnid order Chelonethida. *Stanford University Publications, Biological Sciences*, **7**(1): 1–284.
- GABBUTT, P.D. & VACHON, M. 1963. The external morphology and life history of the pseudoscorpion *Chthonius ischnocheles* (Hermann). *Proceedings of the Zoological Society of London*, **140**: 75–98.
- GARDINI, G. 2009. *Chthonius thaleri*, a new endogeic species from Venetia, Italy (Pseudoscorpiones: Chthoniidae). *Contributions to Natural History*, **12**: 545–550.
- GIACHINO, P.M. & VAILATI, D. 2010. The Subterranean Environment. Hypogean life, concepts and collecting techniques. WBA Handbooks, 3, Verona: 1–132.
- HARVEY, M.S. 1992. The phylogeny and classification of the Pseudoscorpionida (Chelicerata: Arachnida). *Invertebrate Taxonomy*, **6**: 1373–1435.
- JUDSON, M.L.I. 2007. A new and endangered pseudoscorpion of the genus *Lagynochthonius* (Arachnida, Chelonethi, Chthoniidae) from a cave in Vietnam, with notes on chelonethini. *Zootaxa*, **1627**: 53–68.
- MACHADO, A.B. & MACHADO, B.B. 1948. Inventário das cavernas calcárias de Portugal. *Publicações do Instituto de Zoologia do Porto*, **36**: 444–473.
- MAHNERT, V. 1978. Zur Verbreitung höhlenbewohnender Pseudoscorpione der iberischen Halbinsel. *Communications del 6è. Simposium d'Espeleologia, Terrassa*: 21–23.
- MAHNERT, V. 1980. Zwei neue *Chthonius*-Arten (Pseudoscorpiones) aus Höhlen Marokkos. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, **53**: 215–219.
- MAHNERT, V. 1993. Pseudoscorpione (Arachnida: Pseudoscorpiones) von Inseln des Mittelmeers und des Atlantiks (Balearen, Kanarische Inseln, Madeira, Ascension), mit vorwiegend subterranean Lebensweise. *Revue suisse de Zoologie*, **100**: 971–992.
- MAHNERT, V. 2011. A nature's treasury: pseudoscorpion diversity of the Canary Islands, with the description of nine new species (Pseudoscorpiones, Chthoniidae, Cheiridiidae) and new records. *Revista Ibérica de Aracnología*, **19**: 27–45.
- ORTUÑO, V. & GILGADO, J.D. 2010. Update of the knowledge of the Ibero-Balearic hypogean Carabidae (Coleoptera): faunistics, biology and distribution. *Entomologische Blätter*, **106**: 233–264.
- VACHON, M. 1940. Éléments de la faune portugaise des Pseudoscorpions (Arachnides) avec description de quatre espèces nouvelles. *Anais da Faculdade de Ciencias do Porto Academia Polytechnica do Porto*, **25**: 141–164.
- ZARAGOZA, J.A. 1985. Nuevos o interesantes Chthoniidae cavernícolas del País Valenciano (Arachnida, Pseudoscorpiones). *Miscelánea Zoologica*, **9**: 145–158.
- ZARAGOZA, J.A. 2007. Catálogo de los Pseudoscorpiones de la Península Ibérica e Islas Baleares (Arachnida: Pseudoscorpiones). *Revista Ibérica de Aracnología*, **13**: 3–91.



Figures 1–5. *Chthonius (Ephippiochthonius) cardosoi* sp. nov., female holotype. **1.** carapace; **2.** partial anterior margin of carapace; **3.** left chelicera; **4.** partial view of fingers of left chelicera; **5.** left leg IV, lateral view. Abbreviations: *gl* subgaleal seta. Scale bars (mm): 0.05 (Fig. 2), 0.10 (Fig. 4), 0.20 (Figs 1, 3, 5).



Figures 6–9. *Chthonius* (*Ephippiochthonius*) *cardosoi* sp. nov., female holotype. **6.** left pedipalpal trochanter and femur, dorsal view; **7.** left pedipalpal patella and chela, dorsal view; **8.** left pedipalpal chela, antiaxial view, with details of dentition; **9.** tip of fixed finger of left pedipalpal chela, dorsal view. Abbreviations: *pc* doubled pore sensillum, *td* accessory tooth (other abbreviations correspond to trichobothria). Scale bars (mm): 0.05 (Fig. 9), 0.10 (Figs 6–8).