

Five new hypogean *Occidenchthonius* (Pseudoscorpiones: Chthoniidae) from Portugal

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Abstract. Five new species of the recently created genus *Occidenchthonius* Zaragoza, 2017 are described from caves of Portugal: *Occidenchthonius alandroalensis* sp. nov., *O. algharbicus* sp. nov., *O. duecensis* sp. nov., *O. gonalvesi* sp. nov. and *O. vachoni* sp. nov. The species *Occidenchthonius cardosoi* (Zaragoza, 2012) and *Chthonius ischnocheles* (Hermann, 1804) are reported from new localities in different karst units of Portugal. New morphological characters are proposed for use in the Chthoniidae taxonomy. An updated key to the genus *Occidenchthonius* is given.

Key words: Pseudoscorpions, taxonomy, caves, karst, Iberian Peninsula.

ZooBank publication: <http://zoobank.org/8080/References/A7261030-F4B4-4301-99F5-5C144C948245>.

The pseudoscorpion genus *Occidenchthonius* Zaragoza, 2017 was recently created to accommodate some species previously assigned to the subgenus *Ephippiochthonius* Beier, 1930. It shares the presence of coxal spines in coxae II and III with the other *Chthonius*-related genera: *Cantabrochthonius* Zaragoza, 2017, *Chthonius* C.L. Koch, 1843, *Ephippiochthonius*, *Globochthonius* Beier, 1931, *Hesperochthonius* Muchmore, 1968, *Microchthonius* Hadži, 1933, *Neochthonius* Chamberlin, 1929 and *Spelyngochthonius* Beier, 1955 (as termed by Zaragoza 2017). However, *Occidenchthonius* is distinguished by a combination of characters that include: i) ephippiochthonian chelal form; ii) marked ventral hollow (*vh*) with thicker cuticle before base of movable finger; iii) absence of a medial protuberance between chelal condyles; iv) four setae at the proximal portion of chelal hand in adults and tritonymphs, seta *ph*₃ present; v) absence of paraxial dorsal seta *ih*₅ in some species; vi) third tooth of normal row (*mt*) of fixed finger modified in shape and orientation; vii) absence of a subdistal protuberance (*sp*) in the fixed chelal finger of males and tritonymphs; viii) base of movable chelal finger with a distinct enlarged condyle (*bc*), proximally with a sclerotized and well developed apodeme (*ap*); ix) absence of lyrifissures *ma*₁ and *ma*₂; x) presence of a bisetose intercoxal tubercle between coxae III and IV; xi) distal marginal seta of pedipalpal coxa disk (*dps*) distinctly longer than that of coxa I (*dcs*), exceptionally of same length; xii) sternite III in male and female usually with eight marginal macrosetae, close to the stigmata without lateral short seta on each side; and xiii) male genitalia without a median hiatus dividing each row of the guard-setae (Zaragoza 2017).

Occidenchthonius is mainly distributed in the Canary Islands and Southern Iberian Peninsula, currently being the most diverse genus of Chthoniini in both areas (Zaragoza 2017).

Intense fieldwork in caves of Portugal over the last decade provided surprising new genera and species of cave-adapted pseudoscorpion fauna (Reboleira et al. 2010, 2011, 2012, 2013a, b), including five new species of *Occidenchthonius* which are here described, as well as new localities for several previously known species.

METHODS

Specimens were obtained in deep insulated parts of caves along Portugal, using a combination of active and passive standardized collecting methods (see Reboleira 2012).

For scanning electron microscopy (SEM) study, specimens were transferred to absolute ethanol, critical point-dried in a Tousimis Autosamdi 815, serie A, mounted on aluminium stubs, coated with platinum/palladium and studied using a JEOL JSM-6335F scanning electron microscope.

Specimens were examined as temporary glycerine mounts in cavity slides after dissection of one chelicera and one pedipalp, of which the chela was also separated. Posteriorly they were preserved in 70% ethanol inside glass vials, with the dissected articles placed in a glass microvial. When necessary, some specimens were previously cleared by immersion in 60% lactic acid at room temperature for a few days. A trinocular Zeiss Axiolab light microscope was used for detailed study and measurements were taken with an ocular micrometer, using the reference points proposed by Chamberlin (1931).

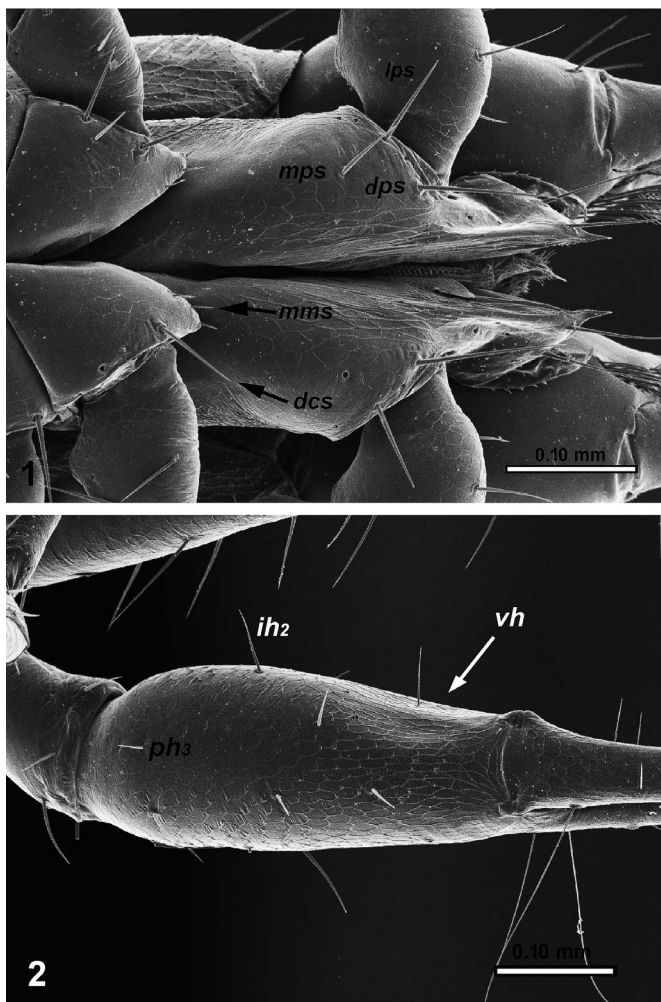
Measurements are expressed in millimetres, followed by standard ratios in parentheses. The ratios given are length/width for carapace, chelicerae and pedipalps, except in the case of the chela and its hand, for which the depth was used instead of width (Mahnert 2011b). When two different articles are compared, the ratio is the length/length index; if only one measurement is given for an article it corresponds to the length. The general terminology follows Chamberlin (1931), including trichobothriotaxy, with modifications or additions proposed by Harvey (1992) and Judson (2007). The chaetotactic formulae of the carapace and chelicera follow Gabbutt & Vachon (1963). Terminology of setae on carapace, pedipalpal coxa and chelal hand, follows Zaragoza (2017). Lyrifissures terminology for pedipalpal chela and chelicera is as in Zaragoza (2017). Following data are given: lengths and ratio of the anteromedial (*ame*) and sublateral ocular setae (*osl*) of the carapace, unless lost; value of the angle formed by setae *dps*-*mps*-*lps* in the pedipalpal coxa disk; ratio chelal hand depth/seta *ih*₂; length of tactile setae on tergites IX and XI and sternite X.

Abbreviations used in the text: *Repositories*. DEUA: Departamento de Ecología, Universidad de Alicante, Spain; MCNB: Museu de Ciències Naturals de Barcelona; MHNG: Muséum d'Histoire Naturelle, Geneva; MNCN: Museo Nacional de Ciencias Naturales, Madrid; MNHN: Muséum national d'Histoire naturelle, Paris; NHMW: Naturhistorisches Museum Wien; ZMUC: Zoological Museum, Natural History Museum of Denmark. *Other abbreviations used in text*: *A*: angle coxal setae *dps*-*mps*-*lps*; *al*: anterolateral seta of carapace; *ame*: anteromedial seta of carapace; *an*: anterior setae row of carapace; *ap*: apodeme; *as*: antiaxial sensory setae; *bc*: basal condyle; *dcs*: distal marginal seta of coxa I; *dh*₁, *dh*₂, *dh*₃, *dh*₄: distal setae row of chelal hand; *di*: isolated subapical tooth; *dps*: distal marginal seta of pedipalpal coxa; *fa*: antiaxial lyrifissure of fixed chelal finger; *fb*: basal lyrifissure of fixed chelal finger; *fd*₁, *fd*₂, *fd*₃: dorsal lyrifissures of the fixed chelal finger; *fp*: paraxial lyrifissure of fixed chelal finger; *hd*: distal lyrifissure of chelal hand; *hp*: proximal lyrifissure of chelal hand; *ih*₁, *ih*₂, *ih*₃, *ih*₄, *ih*₅: intermediate setae row of chelal hand; *il*: intermedian lateral seta of carapace; *in*: intermedian setae row of carapace; *ldb*, *ldst*, *ldt*, *lvb*, *lve*, *lvt*: lyrifissures associated with cheliceral setae *db*, *dst*, *dt*, *vb*, *ve* and *vt*, respectively; *lps*: lateral marginal seta of pedipalpal coxa; *m*: microseta; *ma*₁, *ma*₂: antiaxial lyrifissures of movable chelal finger; *me*: median setae row of carapace; *ml*: median lateral seta of carapace; *mm*: median medial seta of carapace; *mms*: marginal microsetae coxa I; *mps*: medial seta of pedipalpal coxa; *mt*: modified tooth; *mv*₁, *mv*₂: ventral lyrifissures of movable chelal finger; *oc*: ocular setae row of carapace; *ol*: lateral ocular seta of carapace; *om*: medial ocular seta of carapace; *osl*: sublateral ocular seta of carapace; *pc*: coupled sensilla; *ph*₁, *ph*₂, *ph*₃, *ph*₄: proximal setae row of chelal hand; *pl*: posterolateral seta of carapace; *pm*: postero-medial seta of carapace; *po*: posterior setae row of carapace; *sp*: subdistal protuberance; *T*: tactile seta; *td*: accessory tooth; *vh*: ventral hollow in chelal hand.

SYSTEMATICS

Discussion of characters and terminology.—*Carapacal chaetotaxy*: Gabbut & Vachon (1963) considered that the carapacal setae in *Chthonius ischnocheles* (Hermann, 1804) were lying in five rows: *anterior*, *ocular*, *median*, *intermedian* and *posterior*, which they represented by the formula: 4-6-4-2-4. Some of the carapacal setae have been named by Zaragoza (2017) and are included in this study (Fig. 3). Lengths of some carapacal setae have been given in Chthoniidae descriptions (e.g., Mahnert 2011a; Gardini 2013; Zaragoza 2017), usually the anteromedial ones (*ame*), whose measurements may differ among species (Zaragoza et al. 2007). A character that should be pointed out and mentioned in descriptions is the posterolateral setae which, when they occur, are usually very short, of microsetae size, but sometimes longer (e.g., Zaragoza 2012, 2017). Sublateral ocular setae of carapace (*osl*) are rarely considerably or even extremely reduced in length in a few species (e.g., Mahnert 1993; Zaragoza 2017; this study); then, it is considered an important interspecific difference and, for a better quantification, the ratio *ame*/*osl* is useful.

Chelal hand chaetotaxy: a designation system was proposed by Zaragoza (2017) for the chaetotaxy of the chelal hand in Chthoniidae (Fig. 7). Presence/absence of seta *ph*₃ at the



Figures 1–2.—*Occidenchthonius algharbicus* sp. nov., SEM pictures, female. (1) Pedipalpal coxae and coxae I, ventral view. (2) Left chelal hand, ventral view. See Methods for abbreviations.

proximal row is a very important character in the diagnosis of the *Chthonius*-related genera; also the absence of seta *ih*₅ characterizes the *machadoi*-group within the genus *Occidenchthonius* (Zaragoza 2017). Other hand setae may show variation in their length, particularly in the genera *Ephippiochthonius* and *Occidenchthonius*, as occurs with seta *ih*₂ (Fig. 2) that may be short or as long as the hand depth, which is considered an interspecific variation of taxonomic importance and, for an accurate measure, the ratio hand depth/*ih*₂ length is proposed.

Pedipalp coxal setae: pedipalpal coxa bears three setae in the disk of most chthoniid genera, usually 2 marginal and 1 discal setae, being here named *dps*, *mps* and *lps* (Fig. 1). The importance of the length of the distal marginal seta (*dps*) of the pedipalpal coxa compared with the length of distal marginal seta (*dcs*) on coxa I was stated by Zaragoza (2017) for the diagnosis of genus *Cantabrochthonius*. The position of seta *mps* is usually extremely discal in comparison with the other two marginal setae; however, the position of *mps* may rarely be moved close to the line *dps*-*lps* in some few species, forming an angle higher than 100° [Mahnert 2011a described 2

marginal and 1 submarginal setae for the species *O. lopezi* (Mahnert, 2011); other Canarian species have the same pattern: *O. canariensis* (Beier, 1965), *O. dubius* (Mahnert, 1993) and *O. setosus* (Mahnert, 1993), J.A. Zaragoza, pers. obs.; also in Portuguese species: *O. duecensis* sp. nov. and *O. vachoni* sp. nov., this study], which is considered an important interspecific character. The angle formed by the areolar insertions of disk setae *dps-mps-lps* is given in descriptions and illustrated (Figs. 6, 36, 43).

TAXONOMY

Family Chthoniidae Daday, 1888

Subfamily Chthoniinae Daday, 1888

Tribe Chthoniini Daday, 1888

Genus *Occidenchthonius* Zaragoza, 2017

Occidenchthonius Zaragoza 2017:126–127.

Type species.—*Chthonius* (*Ephippiochthonius*) *machadoi* Vachon, 1940, by original designation.

KEY TO ADULTS OF THE *OCCIDENCHTHONIUS* SPECIES

1. Chelal hand chaetotactic formula 4:4:4, seta *ih*₅ absent. Cheliceral hand lyrifissure *ldb* present (*O. machadoi*-group) 2
Chelal hand chaetotactic formula 4:5:4, seta *ih*₅ present. Cheliceral hand lyrifissure *ldb* present or absent..... 12
2. Epigeal species. Well developed eyes, anterior and posterior eyes with convex lens 3
Hypogean species. Eyeless or posterior eyes reduced to eye-spots..... 4
3. Fixed chelal finger with 12–16 teeth and movable with 7. Chela stouter: (♂) 4.5, (♀) 3.8–4.7 times longer than deep....
..... *O. machadoi* (Vachon, 1940)
Fixed chelal finger with 20–21 teeth, movable 9–10. Chela more slender: (♂) 5.1, (♀) 4.6–4.9 times longer than deep ...
..... *O. canariensis* (Beier, 1965)
4. Basal half of movable chelal finger with 5 or more rounded, partially fused, vestigial teeth, without canals, on raised lamina 5
Basal half of movable chelal finger with only 1 rounded, vestigial teeth, without canal, on weak lamina.....
..... *O. alandroalensis* sp. nov.
5. Carapace with a total of 2–8 preocular and ocular microsetae..... 6
Carapace with a total of 16 preocular and ocular microsetae..... *O. setosus* (Mahnert, 1993)
6. Posterior margin of carapace with 2 (exceptionally 3) setae..... 7
Posterior margin of carapace with 4 (very exceptionally 3 or 5) setae..... 11
7. Anophthalmic..... *O. oromii* Zaragoza, 2017
Eyes present, at least anterior eyes with weak lens, posterior eyes reduced to indistinct spots..... 8
8. Dorsal face of chelal hand without lyrifissure *hd* *O. gracilimanus* (Mahnert, 1997)
Dorsal face of chelal hand with lyrifissure *hd* 9
9. Distal half of movable chelal finger with 9–10 pointed teeth up to slightly proximad of trichobothrium *st*, basal half with 8–12 rounded and fused vestigial teeth up to level slightly proximad of trichobothrium *sb* 10
Distal half of movable chelal finger with 12–15 pointed teeth up to halfway between trichobothria *st* and *sb*, basal half with 10–12 rounded and fused vestigial teeth up to halfway between trichobothria *sb* and *b*.....
..... *O. mahnerti* Zaragoza, 2017
10. Anterior medial margin of carapace prominent; cheliceral spinneret absent in male; stouter and smaller pedipalp: femur (♂) 6.0–6.1, (♀) 5.9 times longer than broad, length (♂) 0.53 mm, (♀) 0.53–0.58 mm; hand (♂) 2.2–2.3, (♀) 2.1 times longer than deep; chela (♂) 5.7–5.8, (♀) 5.0–5.2 times longer than deep, length (♂) 0.71–0.72 mm, (♀) 0.75–0.76 mm
..... *O. beieri* Zaragoza, 2017
Anterior medial margin of carapace nearly straight; cheliceral spinneret present in male, hump like; pedipalp femur (♂) 6.8–7.2, (♀) 6.0–6.9 times longer than broad, length (♂) 0.62–0.65 mm, (♀) 0.63–0.72 mm, hand (♂) 2.4–2.6, (♀) 2.2–2.5 times longer than deep, chela (♂) 5.9–6.5, (♀) 5.5–6.2 times longer than deep, length (♂) 0.79–0.88 mm, (♀) 0.84–0.95 mm *O. tamaran* (Mahnert, 2011)
11. Smaller, chela length (♀) 0.69 mm, 5.0–5.5 times longer than deep; trichobothrium *ist* slightly distad to *esb*.....
..... *O. lopezi* (Mahnert, 2011)
Larger, chela length (♀) 1.08 mm, 6.1 times longer than deep; trichobothrium *ist* distinctly distad of *esb*.....
..... *O. tenerifae* (Mahnert, 2011)
12. Movable cheliceral finger with isolated subapical tooth (*di*)..... 13
Movable cheliceral finger without isolated subapical tooth (*di*) 25
13. Posterior margin of carapace with 4 macrosetae..... 14
Posterior margin of carapace with 2 macrosetae..... 16
14. Epigeal species with normal eyes; carapace with 2 preocular microsetae on each side; fixed chelal finger with 12–16 triangular teeth (not including proximal rounded teeth); smaller: chela length (♂) 0.45–0.57 mm, (♀) 0.50–0.66 mm... 15
Endogean or hypogean species, eyes reduced or absent; carapace with 1 preocular microseta on each side; fixed chelal finger with 17–21 triangular teeth (not including proximal rounded teeth); larger: chela length (♂) 0.89–1.12 mm, (♀) 0.84–1.37 mm *O. cassolai* (Beier, 1973)

15. Proximal half of fixed chelal finger with 2–5 rounded teeth merging into an evident high bulge of marginal lamina... *O. parmensis* (Beier, 1963)
Proximal half of fixed chelal finger with 2–5 rounded and spaced teeth, marginal lamina weakly raised *O. berninii* (Callaini, 1983)
16. Anophthalmic..... 17
With eyes, anterior pair with convex lens, posterior pair reduced to spots 24
17. Trichobothrium *ist* distinctly distad of *esb* 18
Trichobothrium *ist* proximad of *esb* *O. morenoi* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2011)
18. Trichobothrium *ist* proximad of lyrifissure *fb* 19
Trichobothrium *ist* distinctly distad of lyrifissure *fb* 21
19. Larger and more slender: (♀) pedipalpal femur 7.5 times longer than broad, length 0.88 mm; chela (♀) 7.3 times longer than deep, length 1.23 mm *O. sendrai* (Zaragoza, 1985)
Smaller and less slender: (♀) pedipalpal femur 5.8–6.5 times longer than broad, length 0.52–0.62 mm; chela (♀) 5.2–5.5 times longer than deep, length 0.70–0.86 mm 20
20. Chelicera with 6 setae and 4–5 lateral microsetae on hand..... *O. thaleri* (Gardini, 2009)
Chelicera with 6 setae and only 1 lateral microseta on hand..... *O. minutus* (Vachon, 1940)
21. Tergite I with 2 setae..... *O. ambrosiae* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2012)
Tergite I with 4 setae..... 22
22. Cheliceral hand with 6 setae (excluding microsetae) 23
Cheliceral hand with 7–8 setae (excluding microsetae)..... *O. bullonorum* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2012)
23. Larger and slender: pedipalpal femur (♀) 7.5–7.7 times longer than broad, length (♀) 0.93–1.00 mm; chela (♀) 5.9–6.0 times longer than deep, length (♀) 1.27–1.37 mm *O. felgueraorum* Zaragoza, 2017
Shorter and less slender: pedipalpal femur (♀) 5.5 times longer than broad, length 0.56 mm; chela (♀) 5.2 times longer than deep, length 0.78 mm *O. villacarrillo* (Zaragoza & Pérez, 2013)
24. Lyrifissure *ldb* present on cheliceral hand, close to seta *db*. Trichobothrium *ist* slightly distad of *esb* and well proximad of lyrifissure *fb*..... *O. anae* Zaragoza, 2017
Lyrifissure *ldb* absent on cheliceral hand. Trichobothrium *ist* well distad of *esb* and slightly proximad of lyrifissure *fb* *O. dubius* (Mahnert, 1993)
25. Posterior row of carapace with 2 macrosetae..... 26
Posterior row of carapace with 4 macrosetae..... *O. cardosoi* (Zaragoza, 2012)
26. Chelal hand lyrifissure *hp* absent..... 27
Chelal hand lyrifissure *hp* present..... 28
27. Carapace without preocular microsetae (*O. verai*-group)... 33
Carapace with 2 preocular microsetae on each side..... *O. pinai* (Zaragoza, 1985)
28. Epigean species with well developed eyes..... *O. serranoi* Zaragoza, 2017
Hypogean species anophthalmic 29
29. Chelal hand lyrifissure *hd* absent. Pedipalpal coxa setae *dps-mps-lps* forming an angle distinctly greater than 90° 30
Chelal hand lyrifissure *hd* present. Pedipalpal coxa setae *dps-mps-lps* forming an angle distinctly smaller than 90° 31
30. Carapacal sublateral ocular setae (*osl*) extremely reduced to microsetae size, ratio setae *ame/osl* 5.0–7.2 *O. vachoni* sp. nov.
Carapacal sublateral ocular seta (*osl*) not reduced to microsetae size, ratio setae *ame/osl* 1.9–2.5 *O. duecensis* sp. nov.
31. Smaller: pedipalp femur (♀) length 0.72–1.01 mm; chela (♀) length 0.94–1.29 mm..... 32
Larger: pedipalp femur (♀) length 1.28–1.30 mm; chela (♀) length 1.72–1.82 mm..... *O. ortunoii* Zaragoza, 2017
32. Trichobothrium *ist* distinctly proximad of lyrifissure *fb*; trichobothria *eb-esb-ist* in a straight line; femur (♀) 6.4–6.9 times longer than broad, length 0.72–0.79 mm; chela (♀) 5.6–5.8 (♀) times longer than deep, length 0.94–1.01 mm *O. algharbius* sp. nov.
Trichobothrium *ist* close, slightly proximad, of lyrifissure *fb*; trichobothrium *ist* strongly distad of *eb-esb* and forming a distinct angle; femur (♀) 7.4–8.1 times longer than broad, length 0.89–1.01 mm; chela (♀) 6.8 (♀) times longer than deep, length 1.22–1.29 mm *O. goncalvesi* sp. nov.
33. Subterranean species, anophthalmic..... 34
Epigean species with eyes, anterior pair with convex lens..... *O. gardinii* Zaragoza, 2017
34. Chelicera with 6 macrosetae and 1–2 (rarely 3) lateral microsetae. Trichobothrium *ist* distinctly distad of *esb* 35
Chelicera with 6 macrosetae and 4–5 lateral microsetae. Trichobothrium *ist* level with *esb* *O. giennensis* (Zaragoza & Pérez, 2013)
35. Smaller. Chela length about 0.70 mm or less..... 36
Larger. Chela length about 1.00 mm or more 37
36. Fixed chelal finger with 14–15 teeth; stouter and shorter pedipalp: femur (♂) length 0.39–0.42 mm, 4.8–5.0 times longer than broad, chela (♂) length 0.58–0.60 mm, 4.8–5.0 times longer than deep *O. montagudi* Zaragoza, 2017
Fixed chelal finger with 19 teeth; more slender and longer pedipalp: femur (♂) length 0.54 mm, 6.0 times longer than broad, chela (♂) length 0.71 mm, 5.7 times longer than deep..... *O. lencinai* Zaragoza, 2017

37. *Trichobothrium ist* proximad of or level with lyrifissure *fb*; smaller species, pedipalpal femur (♀) 5.7–7.5 times longer than broad, length 0.66–0.94 mm, chela (♀) length 0.94–1.29 mm 38
Trichobothrium ist distinctly distad of lyrifissure *fb*; larger species, pedipalpal femur (♀) 7.9–8.6 times longer than broad, length about 1.10 mm, chela (♀) length 1.40–1.53 mm 46
38. Movable chelal finger with 3–8 rounded vestigial teeth without dental canals in its basal half 39
 Movable chelal finger with 9–12 rounded vestigial teeth without dental canals in its basal half 42
39. *Trichobothrium ist* distinctly proximad of lyrifissure *fb* 40
Trichobothrium ist level with lyrifissure *fb* *O. riopar* Zaragoza, 2017
40. Lyrifissure *ldb* present on cheliceral hand *O. cazorlensis* Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2001
 Lyrifissure *ldb* absent on cheliceral hand 41
41. More slender species, pedipalpal femur (♀) 6.9–7.1 times longer than broad *O. mateui* Zaragoza, 2017
 Stouter species, pedipalpal femur (♀) 6.1 times longer than broad *O. hoerwegi* Zaragoza, 2017
42. Cheliceral fixed finger with 2 large distal teeth 43
 Cheliceral fixed finger with only 1 large distal tooth *O. torremarinae* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2012)
43. Smaller: (♀) pedipalpal femur length 0.66–0.75 mm, 5.7–6.4 times longer than broad; chela (♀) length 0.94–1.10 mm, 5.2–5.5 times longer than deep *O. perezi* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2011)
 Larger: (♀) pedipalpal femur length 0.80–0.99 mm, 6.4–7.5 times longer than broad; chela (♀) length 1.06–1.38 mm, 5.7–6.5 times longer than deep 44
44. Male spinneret prominent *O. verai* (Zaragoza, 1985)
 Male spinneret absent or strongly reduced 45
45. Lyrifissure *ldb* of cheliceral hand present *O. ventalloi* (Beier, 1939)
 Lyrifissure *ldb* of cheliceral hand absent *O. espanyoli* (Zaragoza & Pérez, 2013)
46. Movable chelal finger with 14 vestigial teeth without dental canals in basal half *O. murcia* Zaragoza, 2017
 Movable chelal finger with only 6–8 vestigial teeth without dental canals in basal half 47
47. Lyrifissure *ldb* of cheliceral hand present *O. ruizporteroae* (Carabajal Márquez, García Carrillo & Rodríguez Fernández, 2001)
 Lyrifissure *ldb* of cheliceral hand absent *O. ebo* Zaragoza, 2017

***Occidenchthonius cardosoi* (Zaragoza, 2012)**

(Figs. 3–9)

Chthonius (*Ephippiochthonius*) *cardosoi* Zaragoza 2012:26–27, figs 1–9.

Chthonius cardosoi Zaragoza: Reboleira 2012:162, 164, 331; NECA & Associação de Municípios da Região de Setúbal 2015:299, 2 unnumbered figures; NECA 2016:59, 1 unnumbered figure; Reboleira & Correia 2016:48, fig. 71.

Chthonius (*E.*) *cardosoi* Zaragoza: Reboleira 2012:212.

Occidenchthonius cardosoi (Zaragoza): Zaragoza 2017:140–143, fig. 229.

Type locality.—PORTUGAL: Arrábida karst massif, Setúbal district, Sesimbra municipality, Gruta do Fumo (38°26'03"N, 09°08'39"W; 209 m a.s.l.).

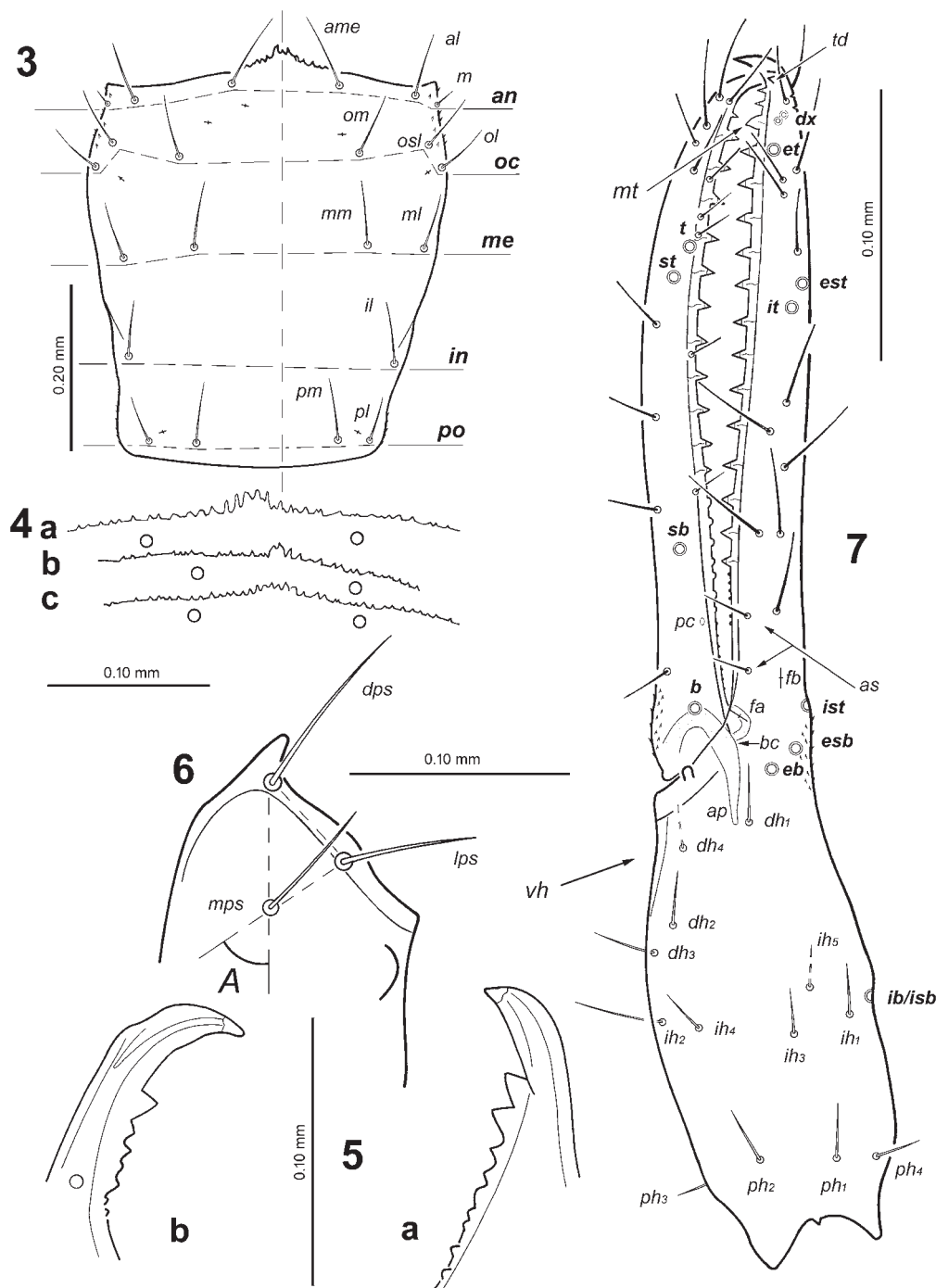
Material examined.—PORTUGAL: Lisboa district, Monte-junto massif, Cadaval municipality, Lamas e Cercal, Algar do Javali (39°12'36"N, 9°02'12"W; 380 m a.s.l.), 1 ♀, 5 April 2009; 1 ♀, 6 June 2009; 1 ♀, 19 November 2009; 1 ♂, 3 ♀, 2 tritonymphs (DEUA), 24 December 2009; all them A.S.P.S. Reboleira. Leiria district, Cesaredas Plateau, Peniche municipality, Bolhos, Gruta dos Bolhos (synonym of Gruta do Casal da Lebre, 39°18'31"N, 9°16'37"W; 145 m a.s.l.), 1 ♀ (DEUA), 18 November 2009, A.S.P.S. Reboleira.

Diagnosis.—Modified from Zaragoza (2017). *Occidenchthonius cardosoi* is a medium-sized hypogean species, weakly troglomorphic. Movable cheliceral finger without isolated subapical tooth (*di*) and spinneret moderately prominent in females, extremely reduced in males, cheliceral lyrifissure *ldb* present. Anophthalmic, anterior margin of carapace with 1–2

preocular microsetae on each side, posterior margin with 4 macrosetae. Pedipalp coxa setae *dps-mps-lps* forming a 50–65° angle; chelal hand distinctly depressed at level of *ib/isb*, with short and very low rounded hump distad of *ib/isb* and very gentle slope between trichobothria *ib/isb* and *eb*; fixed chelal finger with 16–18 teeth; two-thirds distal parts of movable chelal finger with 12–14 pointed teeth with dental canals, basal third of movable chelal finger with 4–6 rounded, partially fused, vestigial teeth without canals on raised lamina; pedipalpal femur (♂) 6.1, (♀) 5.8–6.2 times longer than broad, length (♂) 0.49 mm, (♀) 0.63–0.66 mm; chela (♂) 5.5, (♀) 5.0–5.5 times longer than deep, length (♂) 0.66 mm, (♀) 0.85–0.89 mm; ratio movable chelal finger/chelal hand (♂) 1.5, (♀) 1.4; lacking lyrifissures *ma₁* and *ma₂*, all the other chelal patterns and their standard number are present.

Description (adults from Algar do Javali and Gruta dos Bolhos).—Data that coincide with type specimens (Zaragoza 2012, 2017) are omitted. *Carapace*: subquadrate, slightly longer than broad, constricted posteriorly; medial part of anterior margin strongly prominent, with rudimentary epistome, and strongly dentate, showing variability in its development (Figs. 4a, b, c). Anophthalmic. Chaetotaxy: 20 macrosetae, with 1–2 preocular microsetae on each side, macrosetae formula 4:6:4:2:4; anteromedial setae (*ame*) 0.08–0.11 mm long, sublateral ocular setae (*osl*) 0.05–0.08 mm, ratio setae *ame/osl* 1.2–1.7; postero-medial setae slightly longer than the posterolateral ones.

Chelicera: hand with 6 setae and 1 lateral microseta (1 female 2 lateral microsetae), seta *vb* short (0.025–0.040 mm long), microseta 0.015–0.025 mm. Fixed finger (Fig. 5a) with 7–9 teeth proximally decreasing in size, 2–3 proximal microtubercles, two distal teeth distinctly larger than others. Movable finger (Fig. 5b) without an isolated subapical tooth (*di*), with 5–8 teeth



Figures 3–7.—*Occidenchthonius cardosoi* (Zaragoza), female holotype and dorsal views, unless stated otherwise. (3) Carapace (modified from Zaragoza 2012). (4) Anterior margin of carapace, partial view, (a) female from Algar do Javali, (b) male from Algar do Javali, (c) female Gruta dos Bolhos. (5) Fingers of left chelicera, male from Algar do Javali, partial view, (a) fixed finger, (b) movable finger. (6) Left pedipalpal coxa, female from Algar do Javali, partial view. (7) Left chela, antiaxial view (modified from Zaragoza 2017). See Methods for abbreviations.

proximally decreasing in size, 1–2 proximal microtubercles, the distal tooth larger than others; spinneret moderately prominent and apically rounded in female, vestigial and almost absent in male (Fig. 5b); seta *gl* 0.50–0.55 from base of movable finger. Rallum with 11 blades. Serrula exterior with 14–15 blades, serrula interior with 12 blades.

Abdomen: Tergites IX and XI with 2 sublateral tactile setae on each one (0.16–0.18 and 0.18–0.24 mm long respectively).

Chaetotaxy of sternites II–III 8–10:(3)7–8(3):(2)6–7(2):8, sternite X with 2 submedial tactile setae (0.12–0.21 mm long), genital notch of males flanked by 6–7 setae on each side and 4+4 internal glandular setae.

Coxae: Pedipalpal coxa with distal marginal seta of the disk (*dps*) 0.06–0.10 mm long, areolar insertions of disk setae *dps*–*mps*–*lps* forming a 50–53° angle (Fig. 6) (59–65° in female types); coxa I 3–4 + 3 marginal microsetae, distal marginal seta (*dcs*) 0.03–0.07



Figures 8–11.—Habitus of specimens of *Occidenchthonius* species from Portugal. (8 & 9) *Occidenchthonius cardosoi* (Zaragoza, 2012), Gruta do Fumo, photograph: Francisco Luís Rasteiro. (10 & 11) *Occidenchthonius goncalvesi* sp. nov., female in dorsal and ventral view, Algarão do Remexido.

mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 5–9 bipinnate coxal spines, III 5 + 4–5 bipinnate coxal spines and IV 6.

Pedipalp: femoral chaetotaxy 3:5–6:3:5–6:1. Chelal hand seta *ih*₂ distinctly thinner and longer than other hand setae (0.050–0.075 mm long, ratio hand depth/*ih*₂ length 1.9–2.7) (0.063–0.065 mm long, ratio 2.8 in female types). Fixed finger with 16–18 mostly pointed teeth and with dental canals, two first distal teeth small, third subdistal tooth (*mt*) of the fixed finger distinctly modified in shape and deviated in orientation with respect to the others, dental row reaching up to slightly proximad to trichobothrium *sb*, usually level sensilla *pc*, 6–10 proximal microtubercles; tip of fixed chelal finger of male with a weak hollow on paraxial face, without subdistal protuberance (*sp*); one pair of long antiaxial sensory setae (*as*) at the base, one level and other strongly distad of lyrifissure *fb*, 0.025–0.040 mm long, distance between them 0.032–0.045 mm, fixed finger depth at the base 0.045–0.058 mm; 4–5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.020–0.028 mm. Two-thirds distal parts of movable finger with 12–14 pointed teeth with dental canals that reach up to proximad of halfway between trichobothria *st* and *sb*, two proximal teeth reduced in size, 1–2 distal teeth tiny; third basal part of movable chelal finger with 4–6 rounded, partially fused, vestigial teeth without canals on raised and short lamina, dental row reaching up to level of sensilla *pc*, 6 proximal microtubercles. Trichobothrium *ist* distinctly distad of *esb* and slightly proximad of lyrifissure *fb*; distance between *st-sb* 1.5–1.8 times longer than that between *sb-b*.

Measurements and ratios: Specimens from Algar do Javali: male, followed by females in square brackets, when different:

Body 1.00 [1.16–1.36]. Carapace 0.35/0.31 (1.1) [0.45–0.47/0.41–0.43 (1.1)]. Chelicera 0.30/0.15 (2.0) [0.41/0.19 (2.1–2.2)], movable finger 0.16 [0.20–0.21]. Pedipalp: femur 0.49/0.08 (6.1) [0.65–0.66/0.11 (6.1–6.2)], patella 0.20/0.10 (2.0) [0.27–0.28/0.13–0.14 (2.0–2.1)], chela 0.66/0.12 (5.5) [0.85–0.87/0.17–0.18 (5.0)], hand 0.26 (2.2) [0.35–0.36 (2.1)], movable finger 0.39 [0.50]; ratio movable finger/hand 1.5 [1.4], femur/movable finger 1.3, femur/carapace 1.4, chela/carapace 1.9, chela/femur 1.3. **Female from Gruta dos Bolhos:** Body 1.0. Carapace 0.42/0.40 (1.0). Chelicera 0.36/0.17 (2.1), movable finger 0.18. Pedipalp: femur 0.52/0.10 (5.5), patella 0.22/0.11 (2.0), chela 0.72/0.14 (5.3), hand 0.30 (2.2), movable finger 0.41; ratio movable finger/hand 1.4, femur/movable finger 1.3, femur/carapace 1.2, chela/carapace 1.7, chela/femur 1.4.

Description (tritonymphs).—Carapace slightly longer than broad; medial part of anterior margin moderately prominent and strongly dentate; anophthalmic; macrochaetotaxy as in adult, only one preocular microseta on each side; anteromedial setae (*ame*) 0.075 mm long, sublateral ocular setae (*osl*) 0.040–0.050 mm long, ratio setae *ame/osl* 1.5–1.9; 4 lyrifissures anteriorly and 2 posteriorly. Cheliceral hand with 5 setae (lacks seta *it* respect to adults) and 1 lateral microseta; fixed finger with 7–8 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 5–6 teeth, the distal one larger than others; spinneret moderately prominent, as in adult females; seta *gl* 0.55 from base of movable finger; lyrifissures patterns as in adults. Chaetotaxy of tergites as in adults; sternites 5–7:(2)6(2):(1)6(1–2):7–8:6:6:6:6:1T2T1:0:2. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*)

0.050–0.055 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 50–54° angle; coxa I 3 + 2 marginal microsetae, distal marginal seta (*dcs*) 0.035–0.040 mm long; II 4 + 6–7 bipinnate coxal spines, III 5 + 4 bipinnate coxal spines and IV 5; intercoxal tubercle bisetose. Pedipalp with femoral chaetotaxy 3:5:2:4:1; chelal hand chaetotaxy 4:5:4, seta *ih*₂ 0.050 mm long, ratio hand depth/*ih*₂ length 2.2–2.3; trichobothrium *ist* forming a straight line with *eb-esb*, and strongly proximad of lyrifissure *fb*; fixed finger with 13–14 mostly pointed teeth with dental canals, two first distal teeth small, third subdistal tooth modified (*mt*), 5–6 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.018–0.020 mm; fixed finger with an unique antiaxial sensory setae (*as*) at the finger base, at level of lyrifissure *fb*; distal half of movable finger with 10 pointed teeth with dental canals, distal one tiny, subdistal small; proximal half of finger with 4–5 rounded, vestigial teeth on raised lamina; coupled sensilla *pc* distad of trichobothrium *b*; lacking lyrifissures *fd*₃, *ma*₁ and *ma*₂.

Measurements and ratios (tritonymphs). Body 0.90–0.94. Carapace 0.33–0.34/0.29 (1.1–1.2). Chelicera 0.28/0.14 (2.0), movable finger 0.15–0.16. Pedipalp: femur 0.40–0.42/0.07–0.08 (5.3–5.5), patella 0.17–0.18/0.10 (1.8), chela 0.55–0.57/0.11–0.12 (4.9–5.0), hand 0.22–0.24 (2.0–2.1), movable finger 0.32–0.33; ratio movable finger/hand 1.3–1.4, femur/movable finger 1.2–1.3, femur/carapace 1.2, chela/carapace 1.7, chela/femur 1.4.

Remarks.—*Occidenchthonius cardosoi* (Zaragoza, 2012) is not included in a recognized species-group within the genus. *O. cardosoi* is the only species of the genus without isolated subapical tooth (*di*) on the cheliceral movable finger, which has 4 setae in the posterior row of the carapace (Fig. 3). Additionally to the type locality, two other populations were found in other caves from two different karst units: Montejunto and Cesaredas (Reboleira 2012), considerably increasing its distribution area. The original species description (Zaragoza 2012; redescribed Zaragoza 2017) was based on two females and new material is now incorporated in the diagnosis, including the previously unknown male and tritonymphs. The female from Gruta dos Bolhos (Cesaredas karst) mostly coincide with the *O. cardosoi* description, but it has a distinctly smaller and stouter pedipalp than the types and the specimens from Algar do Javali (Montejunto karst), so its measurement data are not included in the diagnosis until confirmation with new material from the same locality.

Distribution.—PORTUGAL: Arrábida, Montejunto and Cesaredas karst areas.

***Occidenchthonius alandroalensis* sp. nov.**

<http://zoobank.org/8080/NomenclaturalActs/E13093D3-9BC9-44FD-B0A8-2D2454E146CD> (Figs. 12–18)

Chthonius n. sp. 5: Reboleira 2012: 161.

Material examined.—*Holotype female*. PORTUGAL: Alentejo region, Évora district, Alandroal municipality, Algar de Santo António (38°42'14"N, 7°23'59"W; 370 m a.s.l.), 30 December 2009, A.S.P.S. Reboleira (DEUA).

Paratypes. PORTUGAL: 3 ♀ (DEUA, MNCN, MCNB), 1 tritonymph, 1 deutonymph (DEUA), same locality, 30 December 2009, A.S.P.S. Reboleira.

Diagnosis (female).—*Occidenchthonius alandroalensis* sp. nov. is a medium-sized, hypogean species included in the

machadoi-group. Movable cheliceral finger without isolated subapical tooth (*di*) and with moderately prominent spinneret in females, unknown in males; cheliceral lyrifissure *ldb* present. Anophthalmic, anterior margin of carapace without preocular microsetae on each side, posterior margin with 2 macrosetae. Pedipalpal coxa setae *dps-mps-lps* forming a 51–54° angle; chelal hand weakly depressed at level of *ib/isb*, with a low hump distad of *ib/isb* and very gentle slope between trichobothria *ib/isb* and *eb*, chaetotaxy 4:4:4, seta *ih*₅ absent; fixed chelal finger with 18–19 teeth; movable chelal finger with 16–18 pointed teeth with dental canals, proximally with only one rounded tooth without dental canal on weak lamina; pedipalpal femur (♀) 7.0–7.5 times longer than broad, length (♀) 0.95–1.01 mm; chela (♀) 5.7–5.9 times longer than deep, length (♀) 1.28–1.36 mm; ratio movable chelal finger/chelal hand (♀) 1.3–1.4; lacking lyrifissures *ma*₁ and *ma*₂, all the other chelal patterns and their standard number are present.

Description (female).—*Body*: medium-sized hypogean species, moderately troglomorphic with depigmented integument; weak hispid granulation on lateral surfaces of carapace, on the cheliceral hand and almost absent on the base of chelal fingers.

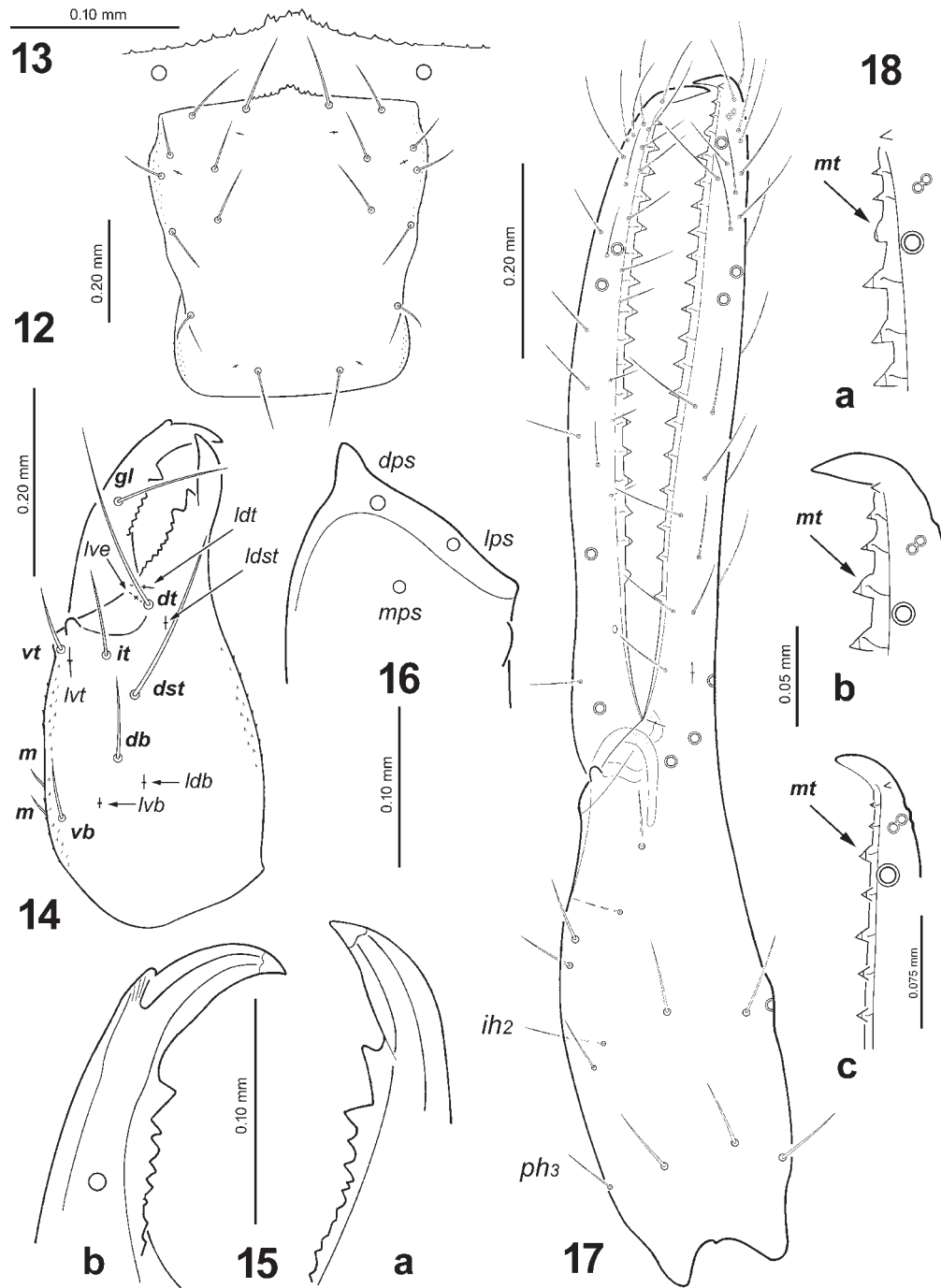
Carapace (Fig. 12): subquadrate, weakly constricted posteriorly; medial part of anterior margin (Fig. 13) strongly prominent and dentate, with a rudimentary epistome. Anophthalmic. Chaetotaxy: 18 setae, without preocular microsetae on each side, 2 setae in posterior row, formula 4:6:4:2:2, anteromedial setae (*ame*) 0.14–0.15 mm long, sub-lateral ocular setae (*osl*) 0.07–0.09 mm, ratio setae *ame/osl* 1.8–2.1; 4 lyrifissures anteriorly and 2 posteriorly.

Chelicera (Fig. 14): hand with 6 setae and 2 lateral microsetae, seta *vb* short (0.055–0.070 mm long), microsetae 0.025–0.035 mm; hand with 5 dorsal lyrifissures and one ventral, lyrifissure *ldb* and all the others (*ldst*, *ldt*, *lvb*, *lve*, *lvt*) present. Fixed finger (Fig. 15a) with 10–11 teeth proximally decreasing in size, two distal teeth distinctly larger than others, 2–3 proximal microtubercles. Movable finger (Fig. 15b) without an isolated subapical tooth (*di*), with 8–9 teeth proximally decreasing in size, the distal tooth larger than others, 0–2 proximal microtubercles; spinneret small and apically rounded in females, unknown in males; seta *gl* 0.55–0.58 from base of movable finger. Rallum with 11 blades. Serrula exterior with 15–17 blades, serrula interior 13–14 blades.

Abdomen: chaetotaxy of tergites 4:4:4:4:6:6:6:1T2T1:4:1T2T1:0, tergites IX and XI with 2 sublateral tactile setae on each one (0.22–0.27 and 0.30–0.31 mm long respectively). Chaetotaxy of sternites 9–10:(3)8–9(3):(2)6–7(2):7–8:6:6:6:6:2T1T2:0:2, lateral setae on sternite III macrosetae size, sternite X with 2 submedial tactile setae (0.23 mm long).

Coxae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.125–0.130 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 51–54° angle (Fig. 16); coxa I 3 + 3 marginal microsetae (holotype 3 + 2 in one coxa, normal in the other), distal marginal seta (*dcs*) 0.075–0.080 mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 10–12 bipinnate coxal spines, III 5 + 7–11 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6:3:5:1. Chela (Fig. 17) with the hand weakly depressed at level of *ib/isb*, with a low hump distad of *ib/isb* and very gentle slope between trichobothria *ib/isb* and *eb*; weak ventral hollow (*vh*) before the base of the movable



Figures 12–18.—*Occidenchthonius alandroalensis* sp. nov., female holotype and dorsal views, unless stated otherwise. (12) Carapace. (13) Anterior margin of carapace, partial view. (14) Left chelicera. (15) Fingers of left chelicera, partial view, (a) fixed finger, (b) movable finger. (16) Left pedipalpal coxa, partial view. (17) Left chela, antiaxial view. (18) Distal portion of fixed chelal finger, (a) female holotype, antiaxial view, (b) female paratype, antiaxial view, (c) female paratype, antiaxio-ventral view. See Methods for abbreviations.

finger with thicker cuticle; width slightly shorter than depth, maximum width slightly proximad to *ib/isb*; chaetotaxy 4:4:4, seta *ih*₅ absent, seta *ph*₃ present, setae *dh*₂ and *dh*₃ removed to halfway between the distal and the intermediary setal rows, seta *ih*₂ distinctly thinner and longer than other hand setae (0.11–0.12 mm long, ratio hand depth/*ih*₂ length 1.9–2.0); distal end of the hand and base of the chelal fingers with sclerotized condylar complex. Fixed finger with 18–19 pointed teeth and with dental

canals, two first distal teeth small, third subdistal tooth (*mt*) distinctly modified in shape and deviated in orientation with respect to the others, apically rounded in holotype (Fig. 18a) and one paratype (apparently worn), pointed in the other paratypes (Fig. 18b), distal half with saw-like shape (Fig. 18c), dental row reaching up to level or proximad to trichobothrium *sb* and distad to sensilla *pc*, towards the base smooth or with some extremely tiny proximal microtubercles; tip of fixed finger with a modified

accessory tooth (*td*) on antiaxial face; one pair of long antiaxial sensory setae (*as*) at the base, one level and the other distad of lyrifissure *fb*, 0.050–0.060 mm long, distance between them 0.055–0.063 mm, fixed finger depth at the base 0.070–0.075 mm; 4 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.025–0.030 mm. Movable finger with 16–18 pointed teeth with dental canals, one tiny distal tooth, dental row reaching up to approximately level trichobothrium *sb*, followed by only one rounded vestigial teeth without dental canal on weak lamina, 4–6 proximal microtubercles; basal condyle (*bc*) present, basal apodeme long and apically narrowed; coupled sensilla *pc* halfway between *sb* and *b* or slightly closer to *b*. Trichobothria as in Fig. 17; trichobothrium *ist* strongly distad of *esb* and level lyrifissure *fb*; trichobothria *ib/ish* equidistant between *esb* and the base of the hand; distance between *st-sb* 1.7–2.0 times longer than that between *sb-b*. Lacking lyrifissures *ma₁* and *ma₂*, all the other chelal patterns and their standard number are present: *fa*, *fb*, *fp*, *hd*, *hp*, *fd₁*, *fd₂*, *fd₃*, *mv₁* and *mv₂* (*mv₂* can be absent in some chelae).

Measurements and ratios: female holotype, followed by female paratypes in square brackets, when different: Body 1.84 [2.12–2.20]. Carapace 0.61/0.55 (1.1) [0.62–0.66/0.56 (1.1–1.2)]. Chelicera 0.53/0.24 (2.2) [0.54–0.56/0.25–0.26 (2.2)], movable finger 0.25 [0.27–0.28]. Pedipalp: femur 0.97/0.13 (7.5) [0.95–1.01/0.14 (7.0–7.2)], patella 0.38/0.16 (2.3) [0.39–0.41/0.17 (2.3–2.5)], chela 1.28/0.22 (5.7) [1.32–1.36/0.23 (5.9)], hand 0.55 (2.5) [0.56–0.57 (2.4–2.5)], movable finger 0.72 [0.75–0.78]; ratio movable finger/hand 1.3 [1.3–1.4], femur/movable finger 1.4 [1.3], femur/carapace 1.6 [1.5], chela/carapace 2.1, chela/femur 1.3 [1.3–1.4].

Description (tritonymph).—Carapace distinctly longer than broad; medial part of anterior margin distinctly prominent and strongly dentate; anophthalmic; macrochaetotaxy as in adult, without preocular microseta on each side; anteromedial setae (*ame*) 0.07 mm long, sublateral ocular setae (*osl*) 0.04 mm long, ratio setae *ame/osl* 2.0; 4 lyrifissures anteriorly and 2 posteriorly. Cheliceral hand with 5 setae (lacks seta *it* respect to adults) and 1 lateral microseta; fixed finger with 6 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 5 teeth, the distal one larger than others; spinneret prominent as in adult females; seta *gl* 0.59 from base of movable finger; lyrifissures patterns as in adults. Chaetotaxy of tergites as in adults; sternites 7:(2)6(2):(1)5(1):6:6:6:6:1T2T1:0:2. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.070 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 68° angle; coxa I 3 + 2 marginal microsetae, distal marginal seta (*dcs*) 0.040 mm long, seta *dps* distinctly longer than seta *dcs*; II 4–5 + 5–8 bipinnate coxal spines, III 5 + 6–8 bipinnate coxal spines and IV 5; intercoxal tubercle bisetose. Pedipalp with femoral chaetotaxy 3:5:2:5:1; chelal hand chaetotaxy 4:3:4 (lack setae *ih₃* and *ih₅*), seta *ih₂* 0.060 mm long, ratio hand depth/*ih₂* length 2.0; trichobothrium *ist* strongly distad of *esb*, and level lyrifissure *fb*; fixed finger with 15 pointed teeth with dental canals, two first distal teeth small, third subdistal tooth modified (*mt*), 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.023–0.025 mm; movable finger with 12 pointed teeth with dental canals, one tiny distal tooth, only two rounded vestigial teeth without dental canals on weak lamina; coupled sensilla *pc* distad of trichobothrium *b*; lacking lyrifissures *fd₃*, *mv₂*, *ma₁* and *ma₂*.

Measurements and ratios (tritonymph paratypes): Body 1.06. Carapace 0.37/0.31 (1.2). Chelicera 0.30/0.14 (2.2), movable finger 0.14. Pedipalp: femur 0.53/0.08 (6.6), patella 0.21/0.10 (2.2), chela 0.72/0.12 (6.0), hand 0.30 (2.4), movable finger 0.42; ratio movable finger/hand 1.4, femur/movable finger 1.3, femur/carapace 1.4, chela/carapace 1.9, chela/femur 1.4.

Description (deutonymph).—Carapace without eyes; chaetotaxy: 4:6:4:2:2, without preocular microsetae. Cheliceral hand with 4 setae (lack setae *db* and *it* respect to adults) and without lateral microsetae, only three lyrifissures present: *lve*, *ldt* and *lvt*; fixed finger with 7 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 4 teeth, the distal one larger than others; spinneret prominent as in adult females; seta *gl* 0.59 from base of movable finger. Chaetotaxy of tergites as in adults. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.065 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 54° angle; coxa I 2 + 1 marginal microseta, distal marginal seta (*dcs*) 0.040 mm long, seta *dps* distinctly longer than seta *dcs*; II 3 + 7 bipinnate coxal spines, III 3 + 6 bipinnate coxal spines and IV 3; intercoxal tubercle bisetose. Pedipalp: chelal hand chaetotaxy 4:2:3 (lack setae *ih₃*, *ih₄*, *ih₅* and *ph₂* respect to adults), seta *ih₂* 0.045 mm long, ratio hand depth/*ih₂* length 2.4; fixed pedipalpal finger with 12 teeth, two distal teeth small, third subdistal tooth modified (*mt*), 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.0175–0.0225 mm; movable finger with 10 pointed teeth with dental canals and only two rounded vestigial teeth without dental canals on weak lamina; coupled sensilla *pc* in subbasal position along the movable finger; lyrifissures *fa*, *fp*, *fb*, *fd₁* and *mv₁* present, lacking all the others.

Measurements and ratios (deutonymph paratype): Body 1.02. Carapace 0.34/0.25 (1.3). Chelicera 0.26/0.12 (2.1). Pedipalp: femur 0.41/0.08 (5.5), patella 0.18/0.09 (1.9), chela 0.57/0.11 (5.3), hand 0.23 (2.1), movable finger 0.34; ratio movable finger/hand 1.5, femur/movable finger 1.2, femur/carapace 1.2, chela/carapace 1.7, chela/femur 1.4.

Remarks.—*Occidenchthonius alandroalensis* sp. nov. is an anophthalmic species that is here tentatively assigned to the *machadoi*-group by the absence of the chelal hand seta *ih₅*, despite not sharing some other characteristics of the group, as the presence of an isolated subapical tooth (*di*) on chelicera and preocular microsetae on carapace, as stated in Zaragoza (2017). Additionally, the shape of the basal lamina on movable chelal finger with only one rounded vestigial teeth (2 in nymphs) without dental canal on weak lamina in *O. alandroalensis* sp. nov., configures unique characteristics for this species within *Occidenchthonius*.

Distribution.—PORTUGAL: Alentejo Region.

Etymology.—The species epithet is a Latin adjective referring to the locality where the type cave is located, Alandroal.

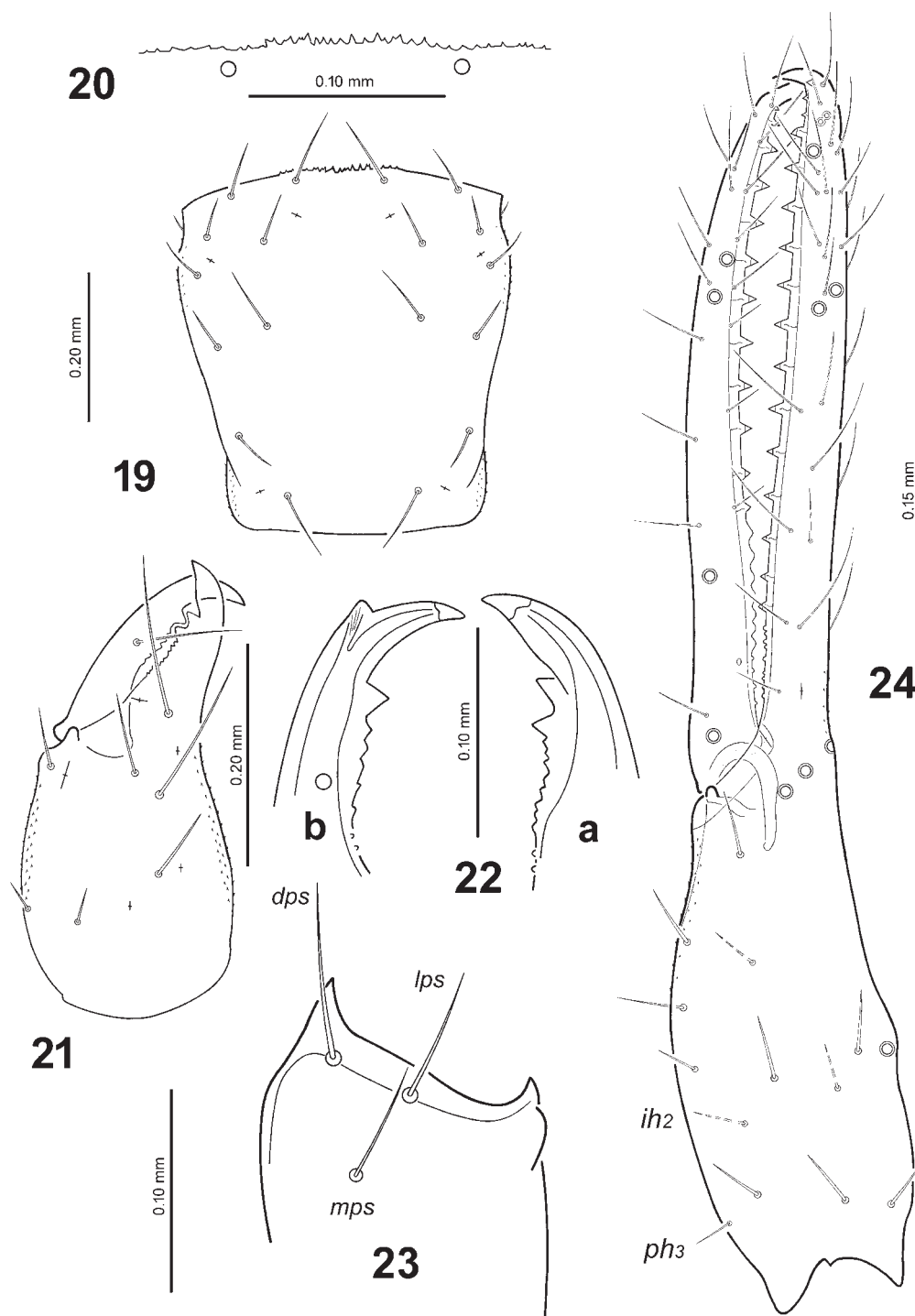
Occidenchthonius algharbicus sp. nov.

<http://zoobank.org/8080/NomenclaturalActs/C26DF4AB-94F1-40BC-9F7C-6C80AA1C320E>
(Figs. 19–24)

Chthonius af. n. sp.1: Reboleira 2012: 161.

Chthonius n. sp. 1: Reboleira 2012: 162.

Material examined.—*Holotype female*. PORTUGAL: Algarve region, Faro district, Olhão municipality, Moncarapa-



Figures 19–24.—*Occidenchthonius algarbicus* sp. nov., female holotype and dorsal views, unless stated otherwise: (19) Carapace. (20) Anterior margin of carapace, partial view. (21) Left chelicera (22) Fingers of left chelicera, partial view, (a) fixed finger, (b) movable finger. (23) Left pedipalpal coxa, partial view. (24) Left chela, antiaxial view. See Methods for abbreviations.

cho, Gruta da Senhora (37°06'20"N, 7°46'35"W; 85 m a.s.l.), 3 July 2011, A.S.P.S. Reboleira (DEUA).

Paratypes. PORTUGAL: 1 ♀ (MNCN), same locality, 14 March 2009; 1 ♀ (MCNB), 06 September 2009; 1 ♀, 1 tritonymph (DEUA), 29 December 2009; 1 ♀ (ZMUC), 3 July 2011; 1 ♀ (MHNG), 18 May 2013; A.S.P.S. Reboleira.

Other material. PORTUGAL: Algarve region, Faro district, Loulé municipality, Vale Telheiro, Gruta do Vale Telheiro (37°10'13"N, 8°02'05"W; 239 m a.s.l.), 1 ♀, 24.V.2009; 1 ♀, 29 December 2009; all A.S.P.S. Reboleira (DEUA).

Diagnosis.—*Occidenchthonius algarbicus* sp. nov. is a medium-sized hypogean species, weakly troglomorphic. Mov-

able cheliceral finger without isolated subapical tooth (*di*) and with well developed spinneret in females, unknown in males; lyrifissure *ldb* and all the others present. Anophthalmic, anterior margin of carapace with one preocular microseta on each side, posterior margin with 2 macrosetae. Pedipalp coxa setae *dps-mps-lps* forming an angle of 46–59°; chelal hand distinctly depressed at level of *ib/isb*, with low and long hump distad of *ib/isb* and gentle slope between trichobothria *ib/isb* and *eb*; fixed chelal finger with 14–15 teeth; two-thirds distal parts of movable chelal finger with 10–12 pointed teeth with dental canals, third basal part with 6–7 rounded teeth without canals on raised lamina; pedipalpal femur (♀) 6.4–6.9 times longer than broad, length (♀) 0.72–0.79 mm; chela (♀) 5.6–5.8 times longer than deep, length (♀) 0.94–1.01 mm; ratio movable chelal finger/chelal hand (♀) 1.4–1.5; lacking lyrifissures *ma*₁, and *ma*₂, all the other chelal patterns and their standard number are present.

Description (female).—*Body*: medium-sized hypogean species with weak troglomorphic facies and depigmented integument; weak hispid granulation on lateral surfaces of carapace, on cheliceral hand, on base of fixed chelal finger and distally on ventral part of chelal hand.

Carapace (Fig. 19): subquadrate, weakly constricted posteriorly; medial part of anterior margin very weakly prominent or straight and strongly dentate (Fig. 20). Anophthalmic. Chaetotaxy: 18 setae, with one preocular microseta on each side (two female paratypes 0–1, lacking one microseta or lost), 2 setae in posterior row, formula 4:6:4:2:2, anteromedial setae (*ame*) 0.08–0.09 mm long, sublateral ocular setae (*osl*) 0.04–0.07 mm, ratio setae *ame/osl* 1.3–2.3; 4 lyrifissures anteriorly and 2 posteriorly.

Chelicera (Fig. 21): with 6 setae and one lateral microseta on hand, seta *vb* short (0.03–0.04 mm long), microsetae 0.02–0.03 mm; hand with 5 dorsal lyrifissures and one ventral, lyrifissure *ldb* present. Fixed finger (Fig. 22a) with 9–10 teeth proximally decreasing in size, two distal teeth distinctly larger than others, 1–3 proximal microtubercles. Movable finger (Fig. 22b) without an isolated subapical tooth (*di*), with 6–8 teeth proximally decreasing in size, the distal tooth larger than others, 1–2 proximal microtubercles; spinneret prominent and well developed in females, unknown in males; seta *gl* 0.52–0.55 from base of movable finger. Rallum with 11 blades. Serrula exterior with 14 blades, serrula interior 11–12 blades.

Abdomen: Chaetotaxy of tergites 4:4:4:4:6:6:6:6:1T2T1:4:1T2T1:0, tergites IX and XI with 2 sublateral tactile setae on each one (0.16–0.18 and 0.21–0.23 mm long respectively). Chaetotaxy of sternites 8–10:(3)6(3):(2)6(2):7–8:6:6:6:6:2T1T2:0:2, lateral setae on sternite III macrosetae size, sternite X with 2 submedial tactile setae (0.15–0.22 mm long).

Coxae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.08–0.09 mm long, areolar insertions of disk setae *dps-mps-lps* forming an angle of 46–59° (Fig. 23); coxa I 3 + 3 marginal microsetae, distal marginal seta (*dcs*) 0.055–0.065 mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 7–11 bipinnate coxal spines, III 5 + 4–5 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6:3:5–6:1. Chela (Fig. 24) with hand distinctly depressed at level of *ib/isb*, with low and long hump distad of *ib/isb* and gentle slope between

trichobothria *ib/isb* and *eb*; weak hollow before base of movable finger with thicker cuticle; width approximately equal to depth, maximum width slightly proximad of *ib/isb*; chaetotaxy 4:5:4, seta *ph*₃ present, seta *dh*₃ removed to halfway between the distal and the intermediary setal rows, seta *ih*₂ same size as others (0.05 mm long, ratio hand depth/*ih*₂ length 3.5); distal end of the hand and base of the chelal fingers with sclerotized condylar complex. Fixed finger with 14–15 pointed teeth and with dental canals, two first distal teeth small, third subdistal tooth (*mt*) distinctly modified in shape and deviated in orientation with respect to the others, dental row reaching up to proximad of trichobothrium *sb* and distad to sensilla *pc*, 4–9 proximal microtubercles; tip of fixed finger with a modified accessory tooth (*td*) on antiaxial face; one pair of long antiaxial sensory setae (*as*) at the base, one level with and the other distad of lyrifissure *fb*, 0.040–0.055 mm long, distance between them 0.040–0.060 mm, fixed finger depth at the base 0.050–0.060 mm; 3–4 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.025–0.035 mm. Two-thirds distal parts of movable finger with 10–12 pointed teeth with dental canals that reach up to distinctly proximad of halfway between trichobothria *st* and *sb*, distal tooth tiny, subdistal tooth small; third basal part of movable chelal finger with 6–7 rounded (rarely 4), partially fused, vestigial teeth without canals on raised lamina; dental row reaching proximad of *sb*, approximately level sensilla *pc*, 1–5 proximal microtubercles; basal condyle (*bc*) present, basal apodeme long and apically indented; coupled sensilla *pc* halfway between trichobothria *sb* and *b* or slightly closer to *b*. Trichobothria as in Fig. 24; trichobothrium *ist* forming a straight line with *eb-esb* and strongly proximad of lyrifissure *fb*; distance between *ib/isb* and the base of the hand slightly shorter than that between *ib/isb* and *esb*; distance between *st-sb* 1.7–1.9 times longer than that between *sb-b*. Lacking lyrifissures *ma*₁ and *ma*₂, all the other chelal patterns and their standard number are present (one female lacks *mv*₂ in one chela).

Measurements and ratios: female holotype, followed by female paratypes, when different: Body 1.55 [1.38–1.44]. Carapace 0.49/0.45 (1.1) [0.48–0.50/0.41–0.44 (1.1–1.2)]. Chelicera 0.43/0.19 (2.2) [0.42–0.45/0.19–0.20 (2.2)], movable finger 0.20 [0.21–0.22]. Pedipalp: femur 0.79/0.12 (6.9) [0.72–0.74/0.11–0.12 (6.4–6.5)], patella 0.29/0.14 (2.1) [0.28–0.29/0.13 (2.1–2.2)], chela 0.98/0.18 (5.6) [0.94–1.01/0.17–0.18 (5.7–5.8)], hand 0.41 (2.3) [0.38–0.41], movable finger 0.56 [0.54–0.60]; ratio movable finger/hand 1.4 [1.4–1.5], femur/movable finger 1.4 [1.2–1.3], femur/carapace 1.6 [1.5], chela/carapace 2.0, chela/femur 1.2 [1.3–1.4]. *Females from Gruta do Vale Telheiro*: Body 0.89–1.10. Carapace 0.41–0.43/0.35 (1.2). Chelicera 0.35–0.38/0.16–0.17 (2.1–2.2). Pedipalp: femur 0.54–0.59/0.10 (5.6–6.1), patella 0.21–0.24/0.11–0.12 (2.0), chela 0.74–0.79/0.14–0.15 (5.2–5.3), hand 0.29–0.32 (2.0–2.1), movable finger 0.53–0.55; ratio movable finger/hand 1.5, femur/movable finger 1.2, femur/carapace 1.3–1.4, chela/carapace 1.8, chela/femur 1.3–1.4.

Description (tritonymph paratype).—Carapace slightly longer than broad; medial part of anterior margin almost straight and strongly dentate; anophthalmic; macrochaetotaxy as in adult, only one preocular microseta on one side, absent in the other; anteromedial setae (*ame*) 0.055 mm long, sublateral ocular setae (*osl*) 0.035 mm long, ratio setae *ame/osl* 1.6; 4

lyrifissures anteriorly and 2 posteriorly. Cheliceral hand with 5 setae (lacks seta *it* respect to adults) and 1 lateral microseta; fixed finger with 6 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 5 teeth, the distal one larger than others; spinneret prominent as in adult females; seta *gl* 0.54 from base of movable finger; lyrifissures patterns as in adults. Chaetotaxy of tergites as in adults; sternites 5:(2)5(2):(1)5(1–2):7:6:6:6:1T2T1:0:2. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.050 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 62° angle; coxa I 3 + 2 marginal microsetae, distal marginal seta (*des*) 0.030 mm long; II 4 + 5 bipinnate coxal spines, III 5 + 4 bipinnate coxal spines and IV 5; intercoxal tubercle bisetose. Pedipalp with femoral chaetotaxy 3:5:2:5:1; chelal hand chaetotaxy 4:5:4, seta *ih*₂ 0.025 mm long, ratio hand depth/*ih*₂ length 4.0; trichobothrium *ist* forming a straight line with *eb-esb*, and strongly proximad of lyrifissure *fb*; fixed finger with 14 mostly pointed teeth with dental canals, two first distal teeth small, third subdistal tooth modified (*mt*), 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.023 mm; fixed finger with an unique anti-axial sensory setae (*as*) at the finger base, at level of lyrifissure *fb*; distal half of movable finger with 10 pointed teeth with dental canals, distal one tiny, subdistal small; proximal half of finger with 5 rounded, vestigial teeth on raised lamina; coupled sensilla *pc* distad of trichobothrium *b*; lacking lyrifissures *fd*₃, *ma*₁ and *ma*₂.

Measurements and ratios (tritonymph paratype): Body 1.04. Carapace 0.33/0.28 (1.2). Chelicera 0.27/0.12 (2.1), movable finger 0.14. Pedipalp: femur 0.41/0.07 (5.7), patella 0.16/0.09 (1.8), chela 0.58/0.10 (5.8), hand 0.23 (2.2), movable finger 0.35; ratio movable finger/hand 1.5, femur/movable finger 1.2, femur/carapace 1.2, chela/carapace 1.8, chela/femur 1.4.

Remarks.—*Occidenchthonius algharbus* sp. nov. does not belong to either of the species-groups recognized within the genus. *O. algharbus* sp. nov. shares with the species *O. goncalvesi* sp. nov. and *O. ortunoi* Zaragoza, 2017, the hypogean life, absence of an isolated subapical tooth on chelicera, posterior row of carapace with 2 macrosetae, presence of preocular microsetae, presence of chelal hand lyrifissures *hd* and *hp* and pedipalpal coxa setae *dps-mps-lps* forming an angle distinctly smaller than 90°. The new species has smaller and stouter pedipalp than *O. ortunoi* [pedipalpal femur (♀) 6.4–6.9 times longer than broad, length 0.72–0.79 mm; chela 5.6–5.8 times longer than deep, length 0.94–1.01 mm in *O. algharbus* sp. nov. versus pedipalpal femur (♀) 8.7–8.8 times longer than broad, length 1.28–1.30; chela 7.5–7.9 times longer than deep, length 1.72–1.82 in *O. ortunoi*]. *O. algharbus* sp. nov. is closer in measurements to *O. goncalvesi* sp. nov., but differs in the position of trichobothrium *ist*, strongly proximad of lyrifissure *fb* and close, forming a straight line, of *eb-esb* in *O. algharbus* sp. nov. versus close, slightly proximad, of lyrifissure *fb* and strongly distad, forming a distinct angle, of *eb-esb* in *O. goncalvesi* sp. nov. Specimens from Gruta do Vale Telheiro cohabit in the same cave with specimens of the species *O. goncalvesi* sp. nov., but are easily distinguished by the characteristics discussed above; syntopy of pseudoscorpions in caves is not frequent but occurs (e.g., Zaragoza 2000; 2007).

Distribution.—PORTUGAL: Algarve Region.

Etymology.—Named after the Arabic name *Al-Gharb*, the origin of Algarve, the southernmost province of Portugal, where the species is endemic.

Occidenchthonius duecensis sp. nov.

<http://zoobank.org:8080/NomenclaturalActs/74147FB4-190B-4B47-9783-FD457BEFD3A6>
(Figs. 25–30)

Chthonius n. sp. 2: Reboleira 2012: 165.

Material examined.—*Holotype female*. PORTUGAL: Centro region, Sicó Massif, Coimbra district, Penela municipality, Taliscas, Dueça Cave System, Gruta do Soprador do Carvalho (39°59'10"N, 8°22'58"W; 200 m a.s.l.), 30.VIII.2009, A.S.P.S. Reboleira (DEUA).

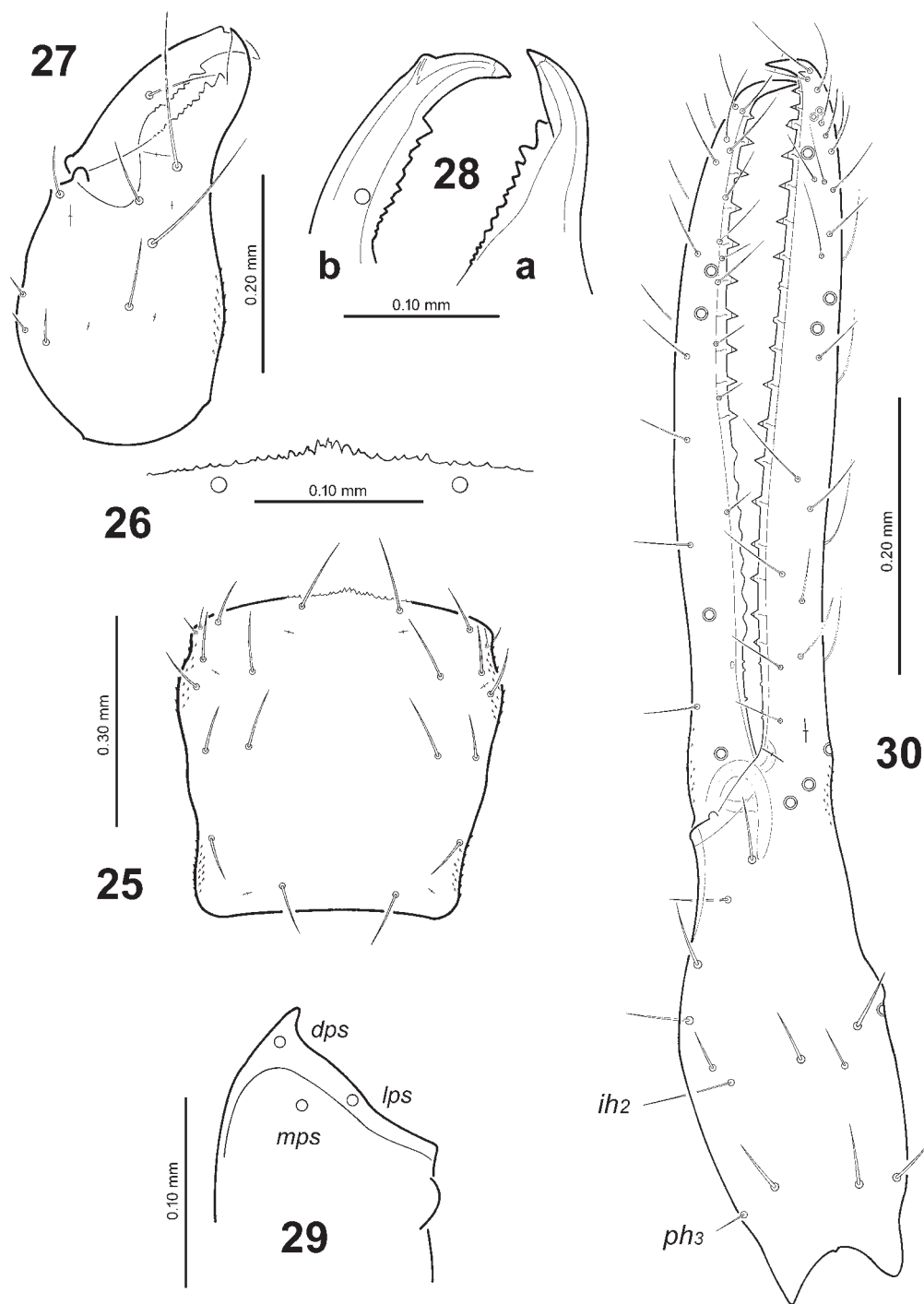
Paratypes. PORTUGAL: 1 ♀ (DEUA), same locality, 21.III.2009, 2 ♀ paratypes (MCNB, MNCN), 30.VIII.2009, A.S.P.S. Reboleira.

Diagnosis (female).—*Occidenchthonius duecensis* sp. nov. is a medium-sized hypogean species, weakly troglomorphic. Movable cheliceral finger without isolated subapical tooth (*di*) and with moderately prominent spinneret in females, unknown in males; all the standard cheliceral lyrifissures present. Anophthalmic, anterior margin of carapace with 2 preocular microsetae on each side, posterior margin with 2 macrosetae. Pedipalp coxa setae *dps-mps-lps* forming an angle of 113–132°; chelal hand distinctly depressed at level of *ib/isb*, with distinct and short hump distad of *ib/isb* and gentle slope between trichobothria *ib/isb* and *eb*; fixed chelal finger with 18 teeth; distal half of movable chelal finger with 10–11 pointed teeth with dental canals, basal half with 7–8 rounded teeth without canals on raised lamina; pedipalpal femur (♀) 5.6–6.0 times longer than broad, length (♀) 0.59–0.63 mm; chela (♀) 5.9–6.5 times longer than deep, length (♀) 0.84–0.91 mm; ratio movable chelal finger/chelal hand (♀) 1.5–1.7; lacking lyrifissures *ma*₁, *ma*₂ and *hd*, all the other chelal patterns and their standard number are present.

Description (female).—*Body*: medium-sized hypogean species of weak troglomorphic facies and depigmented integument; weak hispid granulation on lateral surfaces of carapace, on cheliceral hand and on bases of chelal fingers.

Carapace (Fig. 25): subquadrate, weakly constricted posteriorly; medial part of anterior margin weakly prominent and strongly dentate (Fig. 26). Anophthalmic. Chaetotaxy: 18 setae, with 2 (one female paratype with 2–3) preocular microsetae on each side, 2 setae in posterior row, formula 4: 6:4:2:2, anteromedial setae (*ame*) 0.10–0.11 mm long, sub-lateral ocular setae (*osl*) 0.04–0.06 mm, ratio setae *ame/osl* 1.9–2.5; 4 lyrifissures anteriorly and 2 posteriorly.

Chelicera (Fig. 27): hand with 6 setae and usually 2 (one female paratype 3–4) lateral microsetae, seta *vb* short (0.03–0.04 mm long), microsetae 0.02–0.03 mm; hand with 5 dorsal lyrifissures and one ventral, lyrifissure *ldb* and all the others present. Fixed finger (Fig. 28a) with 9–11 teeth proximally decreasing in size, two distal teeth distinctly larger than others, 2–4 proximal microtubercles. Movable finger (Fig. 28b) without an isolated subapical tooth (*di*), with 8–11 teeth proximally decreasing in size, the distal tooth larger than others; spinneret moderately prominent and apically rounded in females, unknown in males; seta *gl* 0.52–0.56 from base of



Figures 25–30.—*Occidenchthonius duecensis* sp. nov., female holotype and dorsal views, unless stated otherwise: (25) Carapace. (26) Anterior margin of carapace, partial view. (27) Left chelicera. (28). Fingers of left chelicera, partial view, (a) fixed finger, (b) movable finger. (29) Left pedipalpal coxa, partial view. (30) Left chela, antiaxial view. See Methods for abbreviations.

movable finger. Rallum with 11 blades. Serrula exterior with 15 blades, serrula interior 11–12 blades.

Abdomen: Chaetotaxy of tergites 4:4:4:4:6:6:6:6:1T2T1:4:1T2T1:0, tergites IX and XI with 2 sublateral tactile setae on each one (0.22 and 0.22–0.24 mm long respectively). Chaetotaxy of sternites 10:(3)8(3):(2)7(2):7–8:6:6:6:6:2T1T2:0:2, lat-

eral setae on sternite III macrosetae size, sternite X with 2 submedial tactile setae (0.16–0.19 mm long).

Coxae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.065–0.070 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 113–132° angle (Fig. 29); coxa I 3 + 3 marginal microsetae, distal marginal seta (*dcs*) 0.050–0.065 mm long,

seta *dps* distinctly longer than seta *dcs*; II 4 + 7–9 bipinnate coxal spines, III 5 + 3–4 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6–7:3:5:1. Chela (Fig. 30) with hand distinctly depressed at level of *ib/isb*, with distinct, short hump distad of *ib/isb* and gentle slope between trichobothria *ib/isb* and *eb*; weak hollow before base of movable finger with thicker cuticle; width approximately equal than depth, maximum width slightly proximad of *ib/isb*; chaetotaxy 4:5:4, seta *ph₃* present, seta *dh₃* removed to halfway between the distal and the intermediary setal rows, seta *ih₂* distinctly thinner and longer than other hand setae (0.65–0.070 mm long, ratio hand depth/*ih₂* length 2.0–2.4); distal end of the hand and base of the chelal fingers with sclerotized condylar complex. Fixed finger with 18 pointed teeth and with dental canals, two first distal teeth small, third subdistal tooth (*mt*) distinctly modified in shape and deviated in orientation with respect to the others, dental row reaching up to proximad to trichobothrium *sb* and level or distad to sensilla *pc*, 4–6 proximal microtubercles; tip of fixed finger with a modified accessory tooth (*td*) on antiaxial face; one pair of long antiaxial sensory setae (*as*) at the base, one level and the other distad of lyrifissure *fb*, 0.030–0.040 mm long, distance between them 0.036–0.042 mm, fixed finger depth at the base 0.045–0.050 mm; 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.023–0.025 mm. Distal half of movable finger with 10–11 pointed teeth with dental canals that reach up to distad or halfway between trichobothria *st* and *sb*, two distal teeth small; basal half of movable chelal finger with 7–8 rounded, partially fused, vestigial teeth without canals on raised lamina; dental row reaching slightly proximad to *sb* or level sensilla *pc*, 3 proximal microtubercles; basal condyle (*bc*) present, basal apodeme long and apically narrowed; coupled sensilla *pc* slightly proximad to trichobothrium *sb* or halfway between *sb* and *b*. Trichobothria as in Fig. 30; trichobothrium *ist* distinct or slightly distad of *esb* and distinct proximad of lyrifissure *fb*; distance between *ib/isb* and the base of the hand slightly longer than that between *ib/isb* and *esb*; distance between *st-sb* 1.9–2.2 times longer than that between *sb-b*. Lacking lyrifissures *ma₁*, *ma₂* and *hd*, all the other chelal patterns and most of their standard number are present.

Measurements and ratios: female holotype, followed by female paratypes in square brackets, when different: Body 1.60 [1.00–1.36]. Carapace 0.49/0.47 (1.0) [0.43–0.46/0.42–0.44]. Chelicera 0.45/0.22 (2.1) [0.39–0.41/0.19–0.20], movable finger 0.23 [0.20–0.21]. Pedipalp: femur 0.63/0.11 (5.6) [0.59–0.60/0.10–0.11 (5.6–6.0)], patella 0.26/0.13 (2.1) [0.25–0.27/0.12 (2.1–2.3)], chela 0.91/0.16 (5.9) [0.84–0.85/0.13–0.14 (5.9–6.5)], hand 0.35 (2.3) [0.31–0.33 (2.3–2.4)], movable finger 0.55 [0.50–0.53]; ratio movable finger/hand 1.6 [1.5–1.7], femur/movable finger 1.1 [1.1–1.2], femur/carapace 1.3 [1.3–1.4], chela/carapace 1.9 [1.8–2.0], chela/femur 1.4.

Remarks.—*Occidenchthonius duecensis* sp. nov. is not included in a recognized species-group within the genus. It shares with *O. vachoni* sp. nov. the hypogean life-style, absence of an isolated subapical tooth on chelicera, posterior row of carapace with 2 macrosetae, presence of preocular microsetae, chelal hand lyrifissure *hd* absent and pedipalpal coxa setae *dps-mps-lps* forming an angle distinctly greater than 90°. Both

species differ by the size of the carapacial sublateral ocular setae (*osl*), not shortened in *O. duecensis* sp. nov. (ratio *ame/osl* 1.9–2.5) and extremely reduced to microsetae size in *O. vachoni* sp. nov. (ratio *ame/osl* 5.0–7.2); additionally, cheliceral lyrifissure *lvb* is present in *O. duecensis* sp. nov. and absent in *O. vachoni* sp. nov.

Distribution.—PORTUGAL: Centro Region.

Etymology.—The species epithet is a Latin adjective referring to the type locality, the spring of the Dueça River and the major cave of the Dueça Cave System.

Occidenchthonius gonalvesi sp. nov.

<http://zoobank.org:8080/NomenclaturalActs/E734737B-8C49-4FC2-BE35-32EC293770D7>
(Figs. 10–11, 31–37)

Chthonius n. sp. 4: Reboleira 2012: 161, 162.

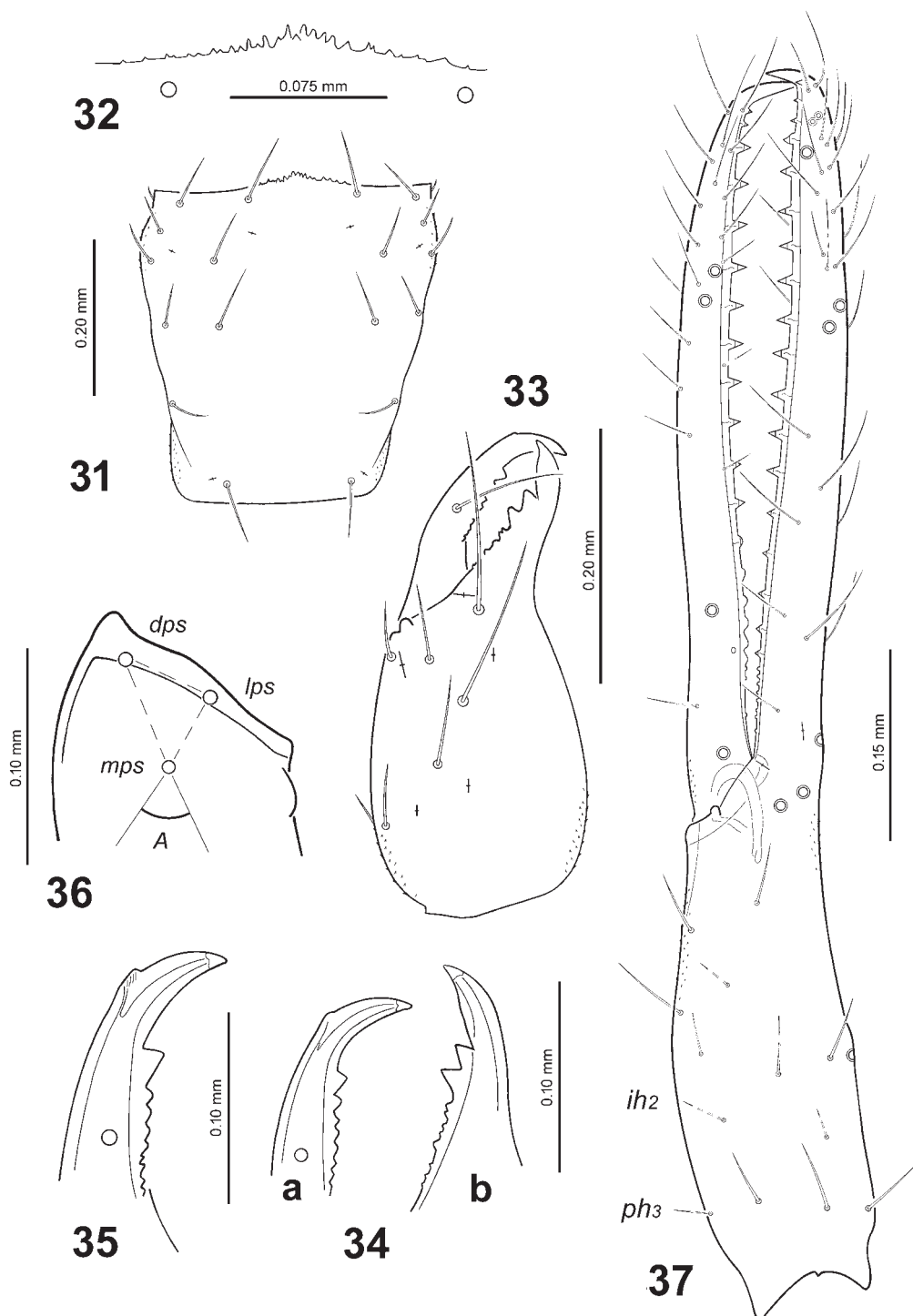
Type locality.—PORTUGAL: Algarve region, Faro district, Silves municipality, São Bartolomeu de Messines, Algarão do Remexido (37°14'29"N, 8°16'36"W; 131 m a.s.l.).

Material examined.—*Holotype male*. PORTUGAL: Algarve region, Faro district, Silves municipality, São Bartolomeu de Messines, Algarão do Remexido (37°14'29"N, 8°16'36"W; 131 m a.s.l.), 5 September 2009, A.S.P.S. Reboleira (DEUA).

Paratypes. PORTUGAL: 1 ♂, 7 ♀, 1 tritonymph [1 ♂, 1 ♀, 1 tritonymph (DEUA), 1 ♀ (MCNB), 1 ♀ (MNCN), 1 ♀ (MHNG), 1 ♀ (MNHN), 1 ♀ (NHMW), 1 ♀ (ZMUC)], 15 March 2009; 3 ♂ [(MCNB), (MHNG), (MNHN)], 1 ♀, 1 tritonymph (DEUA), same locality, 23 May 2009; 2 ♂, 2 ♀, 1 tritonymph, 1 deutonymph (DEUA), same locality, 5 September 2009; 5 ♀, 1 tritonymph (DEUA), same locality, 29 December 2009. Faro district, Loulé municipality, Vale Telheiro, Gruta do Vale Telheiro (37°10'13"N, 8°02'05"W; 239 m a.s.l.), paratypes: 1 ♂ (DEUA), same locality, 30 January 2009; 2 ♀ (DEUA), 24 May 2009; 1 ♀, 1 tritonymph (DEUA), same locality, 29 December 2009. All paratypes A.S.P.S. Reboleira.

Diagnosis.—*Occidenchthonius gonalvesi* sp. nov. is a medium-large hypogean species, distinctly troglomorphic. Movable cheliceral finger without isolated subapical tooth (*di*) and with moderately prominent spinneret in females, almost absent in males; cheliceral lyrifissure *ldb* present. Anophthalmic, anterior margin of carapace with one preocular microseta on each side, posterior margin with 2 macrosetae. Pedipalp coxa setae *dps-mps-lps* forming a 46–52° angle; chelal hand weakly depressed at level of *ib/isb*, with low, almost indistinct hump distad of *ib/isb* and very gentle slope between trichobothria *ib/isb* and *eb*; fixed chelal finger with 17–18 teeth; two-thirds distal parts of movable chelal finger with 12–14 pointed teeth with dental canals, basal third with 5–7 rounded teeth without canals on raised lamina; pedipalpal femur (♂) 7.9, (♀) 7.4–8.1 times longer than broad, length (♂) 0.76–0.91 mm, (♀) 0.89–1.01 mm; chela (♂) 6.8–7.4, (♀) 6.8 times longer than deep, length (♂) 0.98–1.23, (♀) 1.22–1.29 mm; ratio movable chelal finger/chelal hand (♂) 1.5–1.6, (♀) 1.4; lacking lyrifissures *ma₁* and *ma₂*, all the other chelal patterns and their standard number are present.

Description (adults).—*Body:* moderately large, hypogean species with troglomorphic facies and depigmented integu-



Figures 31–37.—*Occidenchthonius goncalvesi* sp. nov., male holotype and dorsal views, unless stated otherwise: (31) Carapace. (32) Anterior margin of carapace, partial view. (33) Left chelicera. (34) Fingers of left chelicera, partial view, (a) fixed finger, (b) movable finger. (35) Movable cheliceral finger, female paratype, partial view. (36) Left pedipalpal coxa, partial view. (37) Left chela, antiaxial view. See Methods for abbreviations.

ment; weak hispid granulation on lateral surfaces of carapace, on cheliceral hand, on base of movable chelal finger and on distal part of chelal hand.

Carapace (Fig. 31): subquadrate, distinctly longer than broad, weakly constricted posteriorly; medial part of anterior

margin prominent, without a well-defined epistome and strongly dentate (Fig. 32). Anophthalmic. Chaetotaxy: 18 setae, with one preocular microsetae on each side (absent or lost in some adults), 2 setae in posterior row, formula 4:6:4:2: 2, anteromedial setae (*ame*) 0.090–0.13 mm long, sublateral

ocular setae (*osl*) 0.030–0.070 mm long, ratio setae *ame/osl* 1.8–2.9; 4 lyrifissures anteriorly and 2 posteriorly.

Chelicera (Fig. 33): with 6 setae and one lateral microseta on hand, seta *vb* short (0.035–0.055 mm long), microseta 0.025–0.035 mm; hand with 5 dorsal lyrifissures and one ventral, lyrifissure *ldb* present. Fixed finger (Fig. 34a) with 8–13 teeth proximally decreasing in size, two distal teeth distinctly larger than others, 1–2 proximal microtubercles. Movable finger (Fig. 34b) without an isolated subapical tooth (*di*), with 6–7 teeth proximally decreasing in size, the distal tooth larger than others, 2 proximal microtubercles; spinneret extremely reduced, almost absent, in males (Fig. 34b) and moderately prominent in females (Fig. 35); seta *gl* 0.55–0.61 from base of movable finger. Rallum with 11 blades. Serrula exterior with 15 blades, serrula interior 13 blades.

Abdomen: Chaetotaxy of tergites 4:4:4:4:6:6:6:6:1T2T1:4:1T2T1:0, tergites IX and XI with 2 sublateral tactile setae on each one (0.22–0.26 and 0.24–0.30 mm long respectively). Chaetotaxy of sternites 9–11:(3)6–8(3):(2)6–7(2):7–9:6–7:6:6:6:2T1T2:0:2, lateral setae on sternite III macrosetae size, sternite X with 2 submedial tactile setae (0.21–0.25 mm long); moreover, genital notch of males flanked by 5–8 setae on each side and 4+4 internal glandular setae.

Coxae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.10–0.13 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 46–52° angle (Fig. 36); coxa I 3 + 3 marginal microsetae, distal marginal seta (*dcs*) 0.07–0.09 mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 6–10 bipinnate coxal spines, III 5 + 4–6 bipinnate coxal spines and IV 5–6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6:3:5:1 (rarely 3:5–6:2–4:5–7:1). Chela (Fig. 37) with hand weakly depressed at level of *ib/isb*, with low, almost indistinct hump distad of *ib/isb* and very gentle slope between trichobothria *ib/isb* and *eb*; weak hollow before base of movable finger with thicker cuticle; width approximately equal than depth, maximum width distinctly proximad of *ib/isb*; chaetotaxy 4:5:4, seta *ph*₃ present, setae *dh*₃ removed close to the intermediary setal row, seta *ih*₂ slightly longer than other hand setae (0.055–0.075 mm long, ratio hand depth/*ih*₂ length 2.4–3.3); distal end of the hand and base of the chelal fingers with sclerotized condylar complex. Fixed finger with 17–18 mostly pointed teeth and with dental canals, two first distal teeth small, third subdistal tooth (*mt*) distinctly modified in shape and deviated in orientation with respect to the others, 0–3 proximal teeth slightly smaller than the others and apically rounded, dental row reaching up to approximately level sensilla *pc*, 8–10 proximal microtubercles; tip of fixed finger with a modified accessory tooth (*td*) on antiaxial face; tip of fixed chelal finger of male with a weak hollow on paraxial face, without subdistal protuberance (*sp*); one pair of long antiaxial sensory setae (*as*) at the base, one level and the other distad of lyrifissure *fb*, (0.040–0.085 mm long), distance between them 0.060–0.110 mm, fixed finger depth at the base 0.052–0.067 mm; 3–4 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.027–0.38 mm. Two-thirds distal parts of movable finger with 12–14 pointed teeth with dental canals that reach up to distinctly proximad halfway between trichobothria *st* and *sb*, two distal teeth tiny; third basal part

of movable chelal finger with 5–7 rounded, partially fused, vestigial teeth without canals on raised lamina; dental row reaching proximad of *sb*, often level sensilla *pc*, 3–8 proximal microtubercles; basal condyle (*bc*) present, basal apodeme long and apically indented; coupled sensilla *pc* distad halfway between *sb* and *b*, usually slightly proximad to trichobothrium *sb*. Trichobothria as in Fig. 37; trichobothrium *ist* strongly distad of *esb* and slightly proximad of lyrifissure *fb*; distance between *ib/isb* and the base of the hand equal or slightly shorter than that between *ib/isb* and *esb*; distance between *st-sb* 1.8–2.3 times longer than that between *sb-b*. Lacking lyrifissures *ma*₁ and *ma*₂, all the other chelal patterns and their standard number are present.

Measurements and ratios: male holotype, followed by male paratypes in square brackets, when different: body 1.33 [1.08–1.36]. Carapace 0.44/0.39 (1.1) [0.43–0.49/0.39–0.46 (1.1)]. Chelicera 0.36/0.17 (2.1) [0.39–0.46/0.18–0.20 (2.2–2.3)], movable finger 0.18 [0.19–0.24]. Pedipalp: femur 0.76/0.10 (7.9) [0.76–0.91/0.10–0.12 (7.9)], patella 0.29/0.12 (2.4) [0.28–0.35/0.12–0.13 (2.3–2.7)], chela 0.98/0.14 (7.0) [1.00–1.23/0.14–0.16 (6.8–7.4)], hand 0.39 (2.8) [0.38–0.47 (2.6–2.8)], movable finger 0.58 [0.60–0.75]; ratio movable finger/hand 1.5 [1.6], femur/movable finger 1.3 [1.2–1.3], femur/carapace 1.7 [1.7–1.9], chela/carapace 2.2 [2.3–2.5], chela/femur 1.3 [1.3–1.4]. **Female paratypes:** body 1.64–1.86. Carapace 0.52–0.53/0.46–0.50 (1.1). Chelicera 0.49–0.50/0.22 (2.2–2.3). Pedipalp: femur 0.89–1.01/0.12–0.13 (7.4–8.1), patella 0.35/0.15 (2.4), chela 1.22–1.29/0.18–0.19 (6.8), hand 0.50–0.54 (2.8), movable finger 0.70–0.74; ratio movable finger/hand 1.4, femur/movable finger 1.3–1.4, femur/carapace 1.7–1.9, chela/carapace 2.3–2.4, chela/femur 1.3–1.4.

Description (tritonymph paratypes).—Carapace distinctly longer than broad; medial part of anterior margin very weakly prominent and strongly dentate; anophthalmic; macrochaetotaxy as in adult, without preocular microseta on each side; anteromedial setae (*ame*) 0.10–0.11 mm long, sublateral ocular setae (*osl*) 0.03–0.04 mm long, ratio setae *ame/osl* 2.8–3.3; 4 lyrifissures anteriorly and 2 posteriorly. Cheliceral hand with 5 setae (lacks seta *it* respect to adults) and 1 lateral microseta; fixed finger with 8–9 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 4–7 teeth, the distal one larger than others; spinneret prominent as in female adults; seta *gl* 0.54–0.56 from base of movable finger; lyrifissures patterns as in adults. Chaetotaxy of tergites as in adults; sternites 5:(2)5(2):(1)5(1):7:6:6:6:6:1T2T1:0:2. Pedipalpal coxa 5 setae (including 2 on the manducatory process), distal marginal seta of the disk (*dps*) 0.090–0.095 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 52° angle; coxa I 3 + 2 marginal microsetae; II 4 + 6–8 bipinnate coxal spines, III 5 + 4 bipinnate coxal spines and IV 5; intercoxal tubercle bisetose. Pedipalp with femoral chaetotaxy 2–3:5:2:4–5:1; chelal hand chaetotaxy 4:5:4; trichobothrium *ist* distinctly distad of *esb*, and distinctly proximad of lyrifissure *fb*; fixed finger with 14–15 pointed teeth with dental canals, two first distal teeth small, third subdistal tooth modified (*mt*), 4 teeth at the level of *est/it* occupying 0.1 mm, distance between apices 0.030–0.033 mm; distal half of movable finger with 11 pointed teeth with dental canals, 2 tiny distal ones; proximal half of finger with 4–5 rounded vestigial

teeth on raised lamina; coupled sensilla *pc* distad of trichobothrium *b*; lacking lyrifissures *fd*₃, *ma*₁ and *ma*₂.

Measurements and ratios (tritonymph paratypes): body 1.10–1.12. Carapace 0.41–0.43/0.34–0.37 (1.2). Chelicera 0.36–0.38/0.16–0.18 (2.2–2.3), movable finger 0.18. Pedipalp: femur 0.65–0.66/0.10 (6.6–6.8), patella 0.26/0.12 (2.1–2.2), chela 0.83–0.88/0.13–0.14 (6.1–6.3), hand 0.34–0.35 (2.5–2.6), movable finger 0.48–0.52; ratio movable finger/hand 1.4–1.5, femur/movable finger 1.3–1.4, femur/carapace 1.5–1.6, chela/carapace 2.0, chela/femur 1.3.

Description (deutonymph paratype).—Carapace distinctly longer than broad; anophthalmic; chaetotaxy: 4:6:4:2:2, without preocular microsetae. Cheliceral hand with 4 setae (lack setae *db* and *it* respect to adults) and without lateral microsetae, only three lyrifissures present: *ldt*, *lve* and *lvf*; fixed finger with 9 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 5 teeth, the distal one larger than others; spinneret prominent as in adult females; seta *gl* 0.55 from base of movable finger. Chaetotaxy of tergites as in adults; sternites 2:4:(1)4(1):6:6:6:6:1TT1:0:2. Pedipalpal coxa 5 setae (including 2 on the manducatory process), distal marginal seta of the disk (*dps*) 0.055 mm long, areolar insertions of disk setae *dps*-*mps*-*lps* forming a 58° angle; coxa I 2 + 1 marginal microseta; II 3 + 3 bipinnate coxal spines, III 3 + 2 bipinnate coxal spines and IV 3; intercoxal tubercle bisetose. Chelal hand chaetotaxy 4:3:4 (lack setae *ih*₃ and *ih*₄ respect to adults); fixed pedipalpal finger with 12 teeth, first distal tooth small, second subdistal tooth modified (*mt*), 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.0225–0.0250 mm; movable finger with 9 pointed teeth and 4 rounded, vestigial teeth on weak lamina; coupled sensilla *pc* in subbasal position along the movable finger; lyrifissures *fa*, *fp*, *fb*, *fd*₁ and *mv*₁ present, absent all the others.

Measurements and ratios (deutonymph paratype): body 0.68. Carapace 0.28/0.19 (1.4). Chelicera 0.22/0.11 (2.1). Pedipalp: femur 0.34/0.07 (5.2), patella 0.15/0.08 (1.9), chela 0.51/0.09 (5.8), hand 0.21 (2.3), movable finger 0.31; ratio movable finger/hand 1.5, femur/movable finger 1.1, femur/carapace 1.2, chela/carapace 1.9, chela/femur 1.5.

Remarks.—*Occidenchthonius gonalvesi* sp. nov. is not included in any of the recognized species-groups within the genus. *O. gonalvesi* sp. nov. is similar to *O. algharbicus* sp. nov. and *O. ortunoi*, but differs from *O. algharbicus* sp. nov. by position of trichobothrium *ist* and has distinctly smaller and stouter pedipalp than *O. ortunoi*, as compared in the key and in the description of *O. algharbicus* sp. nov.

Distribution.—PORTUGAL: Algarve region.

Etymology.—This species is named after Professor Fernando Gonçalves, University of Aveiro, in recognition of his contribution to the study of subterranean biology in Portugal.

***Occidenchthonius vachoni* sp. nov.**

<http://zoobank.org:8080/NomenclaturalActs/DDADC044-02F5-455A-ACA1-6A5EAEDB50C4>
(Figs. 38–45)

Chthonius n. sp. 3: Reboleira 2012: 164.

Material examined.—*Holotype male*. PORTUGAL: Centro region, Sicó Massif, Leiria district, Pombal municipality, Redinha, Gruta da Senhora da Estrela (synonym Gruta da

Serra-do-Poio) (39°55'41"N, 8°32'59"W; 380 m a.s.l.), 29 August 2009, A.S.P.S. Reboleira (DEUA).

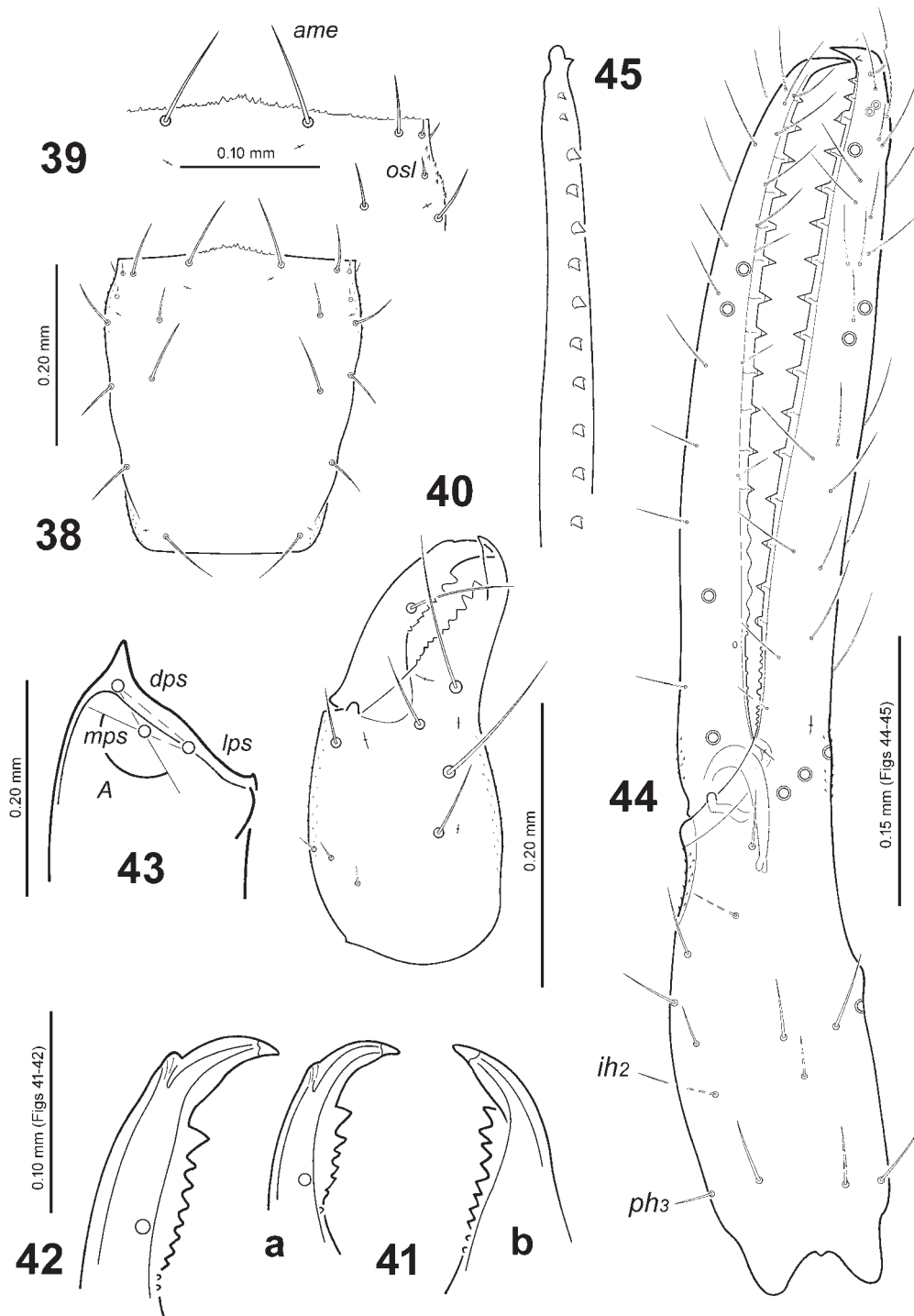
Paratypes. PORTUGAL: 2 ♀ (DEUA), same locality, 11 June 2009; 1 ♀ (DEUA), same locality, 20 November 2009; 4 ♂, 13 ♀, 7 tritonymph [7 ♀, 1 tritonymph (DEUA), 1 ♂, 1 ♀, 1 tritonymph (MCNB), 1 ♂, 1 ♀, 1 tritonymph (MNHN), 1 ♂, 1 ♀, 1 tritonymph (MHNG), 1 ♂, 1 ♀, 1 tritonymph (NHMW), 1 ♀, 1 tritonymph (MNCN), 1 ♀, 1 tritonymph (ZMUC)], same locality, 29 August 2009. Leiria district, Ansião municipality, Santiago da Guarda, Gruta da Cerâmica (39°55'37"N, 8°31'04"W; 355 m a.s.l.): 2 ♂, 3 ♀, 1 tritonymph paratypes [DEUA], 28 November 2009; 2 ♀, 3 tritonymph, 1 deutonymph paratypes [DEUA], same locality, 21 March 2010. All paratypes A.S.P.S. Reboleira.

Diagnosis.—*Occidenchthonius vachoni* sp. nov. is a medium-sized hypogean species, weakly troglomorphic. Movable cheliceral finger without isolated subapical tooth (*di*) and with moderately prominent spinneret in females, lacking in males; cheliceral lyrifissure *lvb* absent. Anophthalmic, anterior margin of carapace with 2 preocular microsetae on each side, sublateral ocular setae (*osl*) reduced to microsetae size, posterior margin with 2 macrosetae. Pedipalp coxa setae *dps*-*mps*-*lps* forming a 141–153° angle; chelal hand distinctly depressed at level of *ib/isb*, with distinct hump distad of *ib/isb* and gentle slope between trichobothria *ib/isb* and *eb*; fixed chelal finger with 16–18 teeth; two-thirds distal parts of movable chelal finger with 10–13 pointed teeth with dental canals, basal third with 4–6 rounded teeth without canals on raised lamina; pedipalpal femur (♂) 6.6–6.8, (♀) 7.2 times longer than broad, length (♂) 0.52–0.54 mm, (♀) 0.76–0.79 mm; chela (♂) 6.3–6.8, (♀) 5.9–6.0 times longer than deep, length (♂) 0.70–0.72, (♀) 1.00–1.05 mm; ratio movable chelal finger/chelal hand (♂) 1.5–1.6, (♀) 1.5; lacking lyrifissures *ma*₁, *ma*₂ and *hd*, all the other chelal patterns and most of their standard number are present.

Description (adults).—*Body*: Medium-sized hypogean species of weak troglomorphic facies and depigmented integument; weak hispid granulation on lateral surfaces of carapace, on the cheliceral hand and on base of chelal fingers.

Carapace (Fig. 38): ubquadrata, distinctly longer than broad, weakly constricted posteriorly; medial part of anterior margin weakly prominent, without a well-defined epistome and strongly dentate (Fig. 39). Anophthalmic. Chaetotaxy: 18 setae, with 2 (one female paratype 1–2) preocular microsetae on each side, 2 setae in posterior row, formula 4:6:4:2:2, anteromedial setae (*ame*) 0.090–0.13 mm long, 0.0040–0.0050 mm wide, sublateral ocular setae (*osl*) reduced to microsetae size: 0.0137–0.0250 mm long, 0.0017–0.0025 mm wide, preocular microsetae 0.0125–0.0175 mm long, 0.0017–0.0020 mm wide, ratio setae *ame/osl* 5.0–7.2; 4 lyrifissures anteriorly and 2 posteriorly.

Chelicera (Fig. 40): with 6 setae and 2 lateral microsetae on hand, seta *vb* very short (0.0125–0.0325 mm long), microsetae 0.0075–0.0225 mm; hand with 4 dorsal lyrifissures and one ventral, lyrifissure *lvb* absent, *ldb* and all the others present. Fixed finger (Fig. 41a) with 6–8 teeth proximally decreasing in size, two distal teeth distinctly larger than others, 1–3 proximal microtubercles. Movable finger (Fig. 41b) without an isolated subapical tooth (*di*), with 5–8 teeth proximally decreasing in size, the distal tooth larger than others, 1–5



Figures 38–45.—*Occidenchthonius vachoni* sp. nov., male holotype and dorsal views, unless stated otherwise: (38) Carapace. (39) Anterior margin of carapace, partial view. (40) Left chelicera. (41) Fingers of left chelicera, partial view, (a) fixed finger, (b) movable finger. (42) Movable cheliceral finger, female paratype from Gruta da Senhora da Estrela, partial view. (43) Left pedipalpal coxa, partial view. (44) Left chela, antiaxial view. (45) Distal portion of fixed chelal finger, ventral view. See Methods for abbreviations.

proximal microtubercles; spinneret extremely reduced, almost absent, in males (Fig. 41b) and moderately prominent in females (Fig. 42); seta *gl* 0.54–0.60 from base of movable finger. Rallum with 11 blades. Serrula exterior with 14 blades, serrula interior 12 blades.

Abdomen: chaetotaxy of tergites 4:4:4:4:6:6:6:6:1T2T1:4:1T2T1:0, tergites IX and XI with 2 sublateral tactile setae on each one (0.21–0.22 and 0.26–0.29 mm long respectively). Chaetotaxy of sternites 9–10:(3)6–8(3):(2)6–7(2):6–7:6:6:6:2T1T2:0:2, lateral setae on sternite III macrosetae size, sternite

X with 2 submedial tactile setae (0.18 mm long); moreover, genital notch of males flanked by 7–9 setae on each side and 4+4 internal glandular setae.

Coxae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.055–0.090 mm long, areolar insertions of disk setae *dps-mps-lps* forming an angle of 141–153° (Fig. 43); coxa I 3 + 3 marginal microsetae, distal marginal seta (*dcs*) 0.045–0.075 mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 7–13 bipinnate coxal spines, III 5 + 4–6 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6:3:5–6:1. Chela (Fig. 44) with hand distinctly depressed at level of *ib/isb*, with distinct hump distad of *ib/isb* and gentle slope between trichobothria *ib/isb* and *eb*; weak hollow before base of movable finger with thicker cuticle; width slightly longer or equal than depth, maximum width distinctly proximad to *ib/isb*; chaetotaxy 4:5:4, seta *ph₃* present, setae *dh₃* removed close to the intermediary setal row, seta *ih₂* distinctly thinner and longer than other hand setae (0.050–0.085 mm long, ratio hand depth/*ih₂* length 1.6–2.7); distal end of the hand and base of the chelal fingers with sclerotized condylar complex. Fixed finger with 16–18 pointed teeth and with dental canals, two first distal teeth small, third subdistal tooth (*mt*) distinctly modified in shape and deviated in orientation with respect to the others, distal half with saw-like shape (Fig. 45), most proximal tooth slightly smaller than the others and apically rounded, dental row reaching up to level sensilla *pc*, 5–10 proximal microtubercles; tip of fixed finger with a modified accessory tooth (*td*) on antiaxial face; tip of fixed chelal finger of male with a weak hollow on paraxial face, without subdistal protuberance (*sp*); one pair of long antiaxial sensory setae (*as*) at the base, one level and the other distad of lyrifissure *fb*, 0.025–0.050 mm long, distance between them 0.026–0.040 mm, fixed finger depth at the base 0.043–0.060 mm; 4–5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.020–0.028 mm. Two-thirds distal parts of movable finger with 10–13 pointed teeth with dental canals that reach up to proximad halfway between trichobothria *st* and *sb*, distal tooth tiny or absent and reduced to a protuberance; third basal part of movable chelal finger with 4–6 rounded, partially fused, vestigial teeth without canals on raised lamina; dental row reaching proximad of *sb*, level sensilla *pc*, 3–6 proximal microtubercles; basal condyle (*bc*) present, basal apodeme long and apically indented; coupled sensilla *pc* distad halfway between *sb* and *b*, slightly proximad to trichobothrium *sb*. Trichobothria as in Fig. 44; trichobothrium *ist* distinct or slightly distad of *esb*, usually forming almost a straight line with *eb-esb*, and distinctly proximad of lyrifissure *fb*; distance between *ib/isb* and the base of the hand slightly longer than that between *ib/isb* and *esb*; distance between *st-sb* 1.7–2.0 times longer than that between *sb-b*. Lacking lyrifissures *ma₁*, *ma₂* and *hd*, all the other chelal patterns and most of their standard number are present.

Measurements and ratios: male holotype, followed by male paratypes in square brackets, when different: body 0.99 [1.10–1.12]. Carapace 0.35/0.30 (1.2) [0.37–0.40/0.31–0.32 (1.2–1.3)]. Chelicera 0.31/0.14 (2.2), movable finger 0.15 [0.16]. Pedipalp: femur 0.52/0.08 (6.8) [0.52–0.54/0.08 (6.6–6.7)], patella 0.19/0.09 (2.1) [0.21/0.10 (2.1–2.2)], chela 0.70/

0.11 (6.4) [0.71–0.72/0.11–0.12 (6.3–6.8)], hand 0.27 (2.5) [0.28 (2.4–2.5)], movable finger 0.43 [0.42–0.43]; ratio movable finger/hand 1.6 [1.5–1.6], femur/movable finger 1.2 [1.2–1.3], femur/carapace 1.5 [1.4], chela/carapace 2.0 [1.8–1.9], chela/femur 1.3 [1.3–1.4]. **Female paratypes:** body 1.42–1.62. Carapace 0.52–0.54/0.46–0.48 (1.1). Chelicera 0.43–0.46/0.19–0.21 (2.2). Pedipalp: femur 0.76–0.79/0.11 (7.2), patella 0.30–0.31/0.14 (2.2–2.3), chela 1.00–1.05/0.17–0.18 (5.9–6.0), hand 0.40–0.42 (2.4), movable finger 0.59–0.62; ratio movable finger/hand 1.5, femur/movable finger 1.3, femur/carapace 1.5, chela/carapace 1.9, chela/femur 1.3.

Description (tritonymph paratypes).—Carapace slightly longer than broad; medial part of anterior margin weakly prominent and strongly dentate; anophthalmic; macrochaetotaxy as in adult, only one preocular microseta on each side; anteromedial setae (*ame*) 0.095 mm long, 0.0032 mm wide, sublateral ocular setae (*osl*) microsetae size: 0.0175 mm long, 0.0017 mm wide, preocular microsetae 0.0150 mm long, 0.0017 mm wide, ratio setae *ame/osl* 5.4; 4 lyrifissures anteriorly and 2 posteriorly. Cheliceral hand with 5 setae (lacks seta *it* respect to adults) and 1 lateral microseta; fixed finger with 7–8 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 6–7 teeth, the distal one larger than others; spinneret prominent as in adult female adults; seta *gl* 0.55–0.56 from base of movable finger; lyrifissures patterns as in adults. Chaetotaxy of tergites as in adults; sternites 5: (2)6(2):(1)5(1):6:6:6:6:1T2T1:0:2. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.060–0.070 mm long, areolar insertions of disk setae *dps-mps-lps* forming an angle of 104–118°; coxa I 3 + 2 marginal microsetae, distal marginal seta (*dcs*) 0.050 mm long, seta *dps* distinctly longer than seta *dcs*; II 4 + 6–10 bipinnate coxal spines, III 5 + 4–6 bipinnate coxal spines and IV 5; intercoxal tubercle bisetose. Pedipalp with femoral chaetotaxy 3:5:2:4–5:1; chelal hand chaetotaxy 4:5:4, seta *ih₂* distinctly thinner and longer than others (0.040–0.045 mm long, ratio hand depth/*ih₂* length 2.0–2.7); trichobothrium *ist* forming a straight line with *eb-esb*, and distinctly proximad of lyrifissure *fb*; fixed finger with 15 pointed teeth with dental canals, two first distal teeth small, third subdistal tooth modified (*mt*), distal half with saw-like shape; 5 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.020–0.025 mm; fixed finger with an unique antiaxial sensory setae (*as*) at the finger base, at level of lyrifissure *fb*; distal half of movable finger with 10 pointed teeth with dental canals, 0–1 tiny distal ones; proximal half of finger with 4–5 rounded vestigial teeth on raised lamina; coupled sensilla *pc* distad of trichobothrium *b*; lacking lyrifissures *fd₃*, *hd*, *ma₁* and *ma₂*.

Measurements and ratios (tritonymph paratypes): body 0.96–1.10. Carapace 0.36–0.39/0.31–0.32 (1.2). Chelicera 0.31–0.32/0.15 (2.1), movable finger 0.17. Pedipalp: femur 0.50/0.09 (5.9), patella 0.20–0.21/0.10 (2.0), chela 0.67/0.13 (5.4), hand 0.27–0.28 (2.1–2.2), movable finger 0.38–0.40; ratio movable finger/hand 1.4–1.5, femur/movable finger 1.3, femur/carapace 1.3–1.4, chela/carapace 1.7–1.9, chela/femur 1.3.

Description (deutonymph paratype).—Carapace almost as long as broad; anophthalmic; chaetotaxy: 4:6:4:2:2, without preocular microsetae. Cheliceral hand with 4 setae (lack setae

db and *it* respect to adults) and without lateral microsetae, anteromedial setae (*ame*) 0.068 mm long, sublateral ocular setae (*osl*) microsetae size: 0.0075 mm long, ratio setae *ame/osl* 9.0, only three lyrifissures present: *ldt*, *lve* and *lvt*; fixed finger with 5 teeth, two distal teeth larger than others; movable finger without an isolated subapical tooth (*di*), with 4 teeth, the distal one larger than others; spinneret prominent as in adult females; seta *gl* 0.55 from base of movable finger. Chaetotaxy of tergites as in adults; sternites 2:4:4:6:6:6:6:1TT1:0:2, stigmatal microsetae apparently absent. Pedipalpal coxa 5 setae (including 2 on manducatory process), distal marginal seta of the disk (*dps*) 0.045 mm long, areolar insertions of disk setae *dps-mps-lps* forming a 123° angle; coxa I 2 + 1 marginal microseta, distal marginal seta (*dcs*) 0.050 mm long; II 3 + 5–6 bipinnate coxal spines, III 3 + 3 bipinnate coxal spines and IV 3; intercoxal tubercle bisetose. Fixed pedipalpal finger with 12 teeth, two first distal teeth small, third subdistal tooth modified (*mt*), distal half with saw-like shape, 7 teeth at level of *est/it* occupying 0.1 mm, distance between apices 0.014–0.016 mm; movable finger with 8 pointed teeth and 4 rounded, vestigial teeth on weak lamina; coupled sensilla *pc* in subbasal position along the movable finger; lyrifissures *fa*, *fp*, *fb*, *fd*₁ and *mv*₁ present, absent all the others.

Measurements and ratios (deutonymph paratype): body 0.58. Carapace 0.25/0.23 (1.1). Chelicera 0.21/0.10 (2.1). Pedipalp: femur 0.30/0.12 (5.1), patella 0.14/0.07 (1.9), chela 0.42/0.09 (4.9), hand 0.17 (1.9), movable finger 0.25; ratio movable finger/hand 1.5, femur/movable finger 1.2, femur/carapace 1.2, chela/carapace 1.7, chela/femur 1.4.

Remarks.—*Occidenchthonius vachoni* sp. nov. is not included in any of the recognized species-groups of the genus. *O. vachoni* sp. nov. shares many characters with *O. duecensis* sp. nov., as discussed in the description of the latter species. Additionally, *O. vachoni* sp. nov. has slender and longer pedipalps than *O. duecensis* sp. nov.: (♀) femur 7.2 times longer than broad, length 0.76–0.79 mm, chela 5.9–6.0 times longer than deep, length 1.00–1.05 mm, ratio chela/femur 1.3 in *O. vachoni* sp. nov. versus (♀) femur 5.6–6.0 times longer than broad, length 0.59–0.63 mm, chela 5.9–6.5 times longer than deep, length 0.84–0.91 mm, ratio chela/femur 1.4 in *O. duecensis* sp. nov.

Distribution.—PORTUGAL: Centro region.

Etymology.—This species is dedicated to the memory of Prof. Max Vachon (1908–1991), for his great contribution to the study of pseudoscorpion fauna and particularly those from Portugal.

Genus *Chthonius* C.L. Koch, 1843

Chthonius ischnocheles (Hermann, 1804)

Material examined.—PORTUGAL: Sicó Massif, Coimbra district, Penela municipality, Taliscas, Dueça Cave System, Soprador do Carvalho (39°59'10"N, 8°22'58"W; 200 m a.s.l.), 1 ♂, 21 March 2009; 1 ♂, 9 ♀, 2 tritonymphs (DEUA), 30 August 2009; all A.S.P.S. Reboleira. Portugal, Coimbra district, Cantanhede municipality, Portunhos, Gruta d'el Rey (40°17'39"N, 8°32'49"W; 70 m a.s.l.), 4 ♀ (DEUA), 19 May 2009; 2 ♂, 3 ♀, 2 tritonymphs (DEUA), 8 October 2009; all A.S.P.S. Reboleira.

Remarks.—*Chthonius ischnocheles* inhabits leaf litter, in humid habitats and in moss; in southern Mediterranean

regions, it is often found in cave entrances, exhibiting a troglone life-style with some populations showing weak hypogean adaptations, usually with the reduction of the posterior pair of eyes (e.g., Mahnert 1977), not observed in the specimens of this study.

The species is widespread in Europe and adjacent areas (Harvey 2013): Andorra, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Croatia, Denmark, France (mainland and Corsica), Germany, Great Britain, Greece, Ireland, Italy (mainland, Sardinia and Sicily), Madeira, Malta, Netherlands, Norway, Poland, Portugal (Azores, Madeira archipelagos), Romania, Serbia, Spain (mainland, Balearic and Canarian archipelagos), Sweden, Switzerland and Turkey. It has been introduced to Saint Helena Island (South Atlantic Ocean) and several Atlantic Coast and Upper Midwestern states in the U.S.A. In Portugal, this species is only known in the middle of the country (Zaragoza 2007; this study).

DISCUSSION

Currently, three Chthoniidae genera occur in mainland Portugal: *Chthonius* (3 spp): *C. halberti* Kew, 1916, *C. ischnocheles* and *C. jonicus* Beier, 1931, *Ephippiochthonius* (3 spp): *E. gibbus* (Beier, 1952), *E. portugalisensis* Zaragoza, 2017 and *E. tetrachelatus* (Preyssler, 1790), and *Occidenchthonius* (9 spp): *O. alandroalensis* sp. nov., *O. algharbicus* sp. nov., *O. cardosoi*, *O. duecensis* sp. nov., *O. gonalvesi* sp. nov., *O. machadoi* (Vachon, 1940), *O. minutus* (Vachon, 1940), *O. serranoi* Zaragoza, 2017 and *O. vachoni* sp. nov. (Fig. 46). Portuguese species of the genera *Chthonius* and *Ephippiochthonius* are scarce and all epigean, whereas the genus *Occidenchthonius* is more diverse and mostly represented by troglone species.

Occidenchthonius is distributed mostly in Southern Iberian Peninsula: mainland Portugal (Coimbra, Évora, Faro, Leiria, Lisboa and Setúbal districts) and mainland Spain (Andalusia, Castilla-La Mancha, Murcia and Valencian Community regions). Outside of the Iberian Peninsula, only four species are known: *O. berninii* (Callaini, 1983) and *O. cassolai* (Beier, 1973), both from Sardinia, *O. thaleri* (Gardini, 2009) from mainland Italy (Veneto) and *O. parmensis* (Beier, 1963) which is widespread in Austria, Croatia, Germany, Italy, Slovenia and Switzerland.

Occidenchthonius is a genus that frequently inhabits hidden subterranean ecosystems, i.e., endogean habitats in micro-caverns within the soil, or hypogean habitats in meso and macrocaverns below the soil, and shows a high degree of endemism. It has also been found at the surface, though up to now such records are scarce (Zaragoza 2017). Due to its small size, we should not dismiss the possibility that the lack of *Occidenchthonius* in surface ecosystems might be a result of overlooking them during sampling. The discovery of five new *Occidenchthonius* species in caves of Portugal with micro-endemic patterns increases to 48 the number of currently known species of the genus (Zaragoza 2017).

Hypogean pseudoscorpions in mainland Portugal are represented by four families, Chthoniidae (*Occidenchthonius*), Neobisiidae (*Roncocreagris* Mahnert, 1976) and two remarkable relict monospecific genera: *Titanobochica* Zaragoza & Reboleira, 2010 (the species name is here changed from *Titanobochica magna* to *Titanobochica magnus*, since the suffix



Figure 46.—Distribution map of *Occidenchthonius* spp. in Portugal.

Bochica corresponds to the name of an Amerindian God, masculine in gender) and *Lusoblothrus* Zaragoza & Reboleira, 2012, of the families Bochicidae and Syarinidae respectively. Pseudoscorpions are now the second most diversified group of troglobionts in mainland Portugal; only terrestrial isopods are richer in mainland Portugal (Reboleira et al. 2015).

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LITERATURE CITED

Chamberlin, J.C. 1931. The arachnid order Chelonethida. Stanford University Publications, Biological Sciences 7(1):1–284.
 Gabbutt, P.D. & M. Vachon. 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. 2013. A revision of the species of the pseudoscorpion subgenus *Chthonius* (*Ephippiochthonius*) (Arachnida, Pseudoscorpiones, Chthoniidae) from Italy and neighbouring areas. Zootaxa 3655:1–151.
 Harvey, M.S. 1992. The phylogeny and classification of the Pseudoscorpionida (Chelicerata: Arachnida). Invertebrate Taxonomy 6:1373–1435.

Harvey, M.S. 2013. Pseudoscorpions of the World, version 3.0. Western Australian Museum, Perth. Available from: <http://www.museum.wa.gov.au/catalogues-beta/pseudoscorpions> (accessed 30 December 2016).
 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 chelal morphology and the composition of the Tyrannochthoniini. Zootaxa 1627:53–68.
 Mahnert, V. 1977. Spanische Höhlenpseudoskorpione. Miscelanea Zoologica 4:61–104.
 Mahnert, V. 1993. Pseudoskorpione (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. 2011a. 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.
 Mahnert, V. 2011b. New records of pseudoscorpions from the Juan Fernandez Islands (Chile), with the description of a new genus and three new species of Chernetidae (Arachnida: Pseudoscorpiones). Revue suisse de Zoologie 118:17–29.
 NECA (Núcleo de Espeleologia da Costa Azul) & Associação de Municípios da Região de Setúbal. 2015. Sistema do Frade. Classificação dos espeleotemas e contribuições para o conhecimento do carso da Arrábida ocidental, Associação de Municípios da Região de Setúbal, Setúbal: 1–332.
 NECA (Núcleo de Espeleologia da Costa Azul). 2016. Arrábida “per fora e por dentro”. Guia do Património Natural no Concelho de Sesimbra, Núcleo de Espeleologia da Costa Azul, Sesimbra. 1–107.
 Reboleira, A.S.P.S. 2012. Biodiversity and conservation of subterranean fauna of Portuguese karst. PhD Thesis, University of Aveiro, Portugal. 1–333.
 Reboleira, A.S.P.S. & F. Correia. 2016. Sesimbra, por fora e por dentro, as grutas, a fauna cavernícola e a sua ecologia. Edições Afrontamento Coleção Biologicando 11:1–172.
 Reboleira, A.S.P.S., P. Borges, F. Gonçalves, A. Serrano & P. Oromí. 2011. The subterranean fauna of a biodiversity hotspot region - Portugal: an overview and its conservation. International Journal of Speleology 40:23–37.
 Reboleira, A.S.P.S., F. Gonçalves & P. Oromí. 2013a. Literature survey, bibliographic analysis and a taxonomic catalogue of subterranean fauna from Portugal. Subterranean Biology 10:51–60.
 Reboleira, A.S.P.S., F. Gonçalves, P. Oromí & S. Taiti. 2015. The cavernicolous Oniscidea (Crustacea: Isopoda) of Portugal. European Journal of Taxonomy 161:1–61.
 Reboleira, A.S.P.S., F. Gonçalves, P. Oromí & J.A. Zaragoza. 2010. *Titanobochica*, surprising discovery of a new cave-dwelling genus from southern Portugal (Arachnida: Pseudoscorpiones: Bochicidae). Zootaxa 2681:1–19.
 Reboleira, A.S.P.S., J.A. Zaragoza, F. Gonçalves & P. Oromí. 2012. *Lusoblothrus*, a new syarinid pseudoscorpion genus (Arachnida) from Portugal, occupying an enigmatic position within the Holarctic fauna. Zootaxa 3544:52–62.
 Reboleira, A.S.P.S., J.A. Zaragoza, F. Gonçalves & P. Oromí. 2013b. On hypogean *Roncocreagris* (Arachnida: Pseudoscorpiones: Neobisiidae) from Portugal, with descriptions of three new species. Zootaxa 3670:283–299.
 Zaragoza, J.A. 2000. Pseudoscorpiones cavernícolas de Asturias, Cantabria y País Vasco (Arachnida). Mediterránea, Série de Estudios Biológicos 17:5–17.
 Zaragoza, J.A. 2007. Catálogo de los pseudoscorpiones de la Península Ibérica e Islas Baleares (Arachnida: Pseudoscorpiones). Revista Ibérica de Aracnología 13:3–91.

- Zaragoza, J.A. 2012. *Chthonius* (*Ephippiochthonius*) *cardosoi*, nueva especie hipogea de Portugal (Pseudoscorpiones: Chthoniidae). *Revista Ibérica de Aracnología* 20:25–30.
- Zaragoza, J.A. 2017. Revision of the *Ephippiochthonius* complex (Pseudoscorpiones, Chthoniidae) in the Iberian Peninsula, Balearic Islands and Macaronesia, with proposed changes to the status of the *Chthonius* subgenera. *Zootaxa* 4246:1–221.
- Zaragoza, J.A., E. de Mas & C. Ribera 2007. Pseudoescorpiones del Parque Naturel del Cadí-Moixeró (Pirineo Catalán): estudio ecológico, faunístico y taxonómico (Arachnida: Pseudoscorpiones). *Revista Ibérica de Aracnología* 14:69–95.

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