

## A new species of *Typhlocirolana* (Isopoda, Cirolanidae) from the Ullal de la Rambla de Miravet, Spain

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### Abstract

A new species of hypogean cirolanid isopod, *Typhlocirolana troglobia* sp. nov. is described, from specimens obtained during speleological explorations of a karstic cave in the Miravet Ravine, Spain. *Typhlocirolana troglobia* sp. nov. can be distinguished from all other species in the genus by the combination of the following characters: lack of sexual dimorphism of pereopod 7, absence of sexual dimorphism in the chaetotaxy of the propodus of pereopod 3, and the excavate and serrate appendix masculina apex.

**Key words:** Crustacea, Cirolanidae, *Typhlocirolana*, hypogean fauna, Spain

### Introduction

The family Cirolanidae is one of the most speciose of isopod families, amongst which are approximately 71 species in 21 genera inhabiting subterranean waters (Botosaneanu *et al.* 1986). The *Typhlocirolana* Racovitza group of genera is geographically widespread, distributed around the Mediterranean basin (*Typhlocirolana*, *Turcolana* Argano & Pesce, 1980; *Marocolana* Boutin, 1993) and in North America (*Cirolanides* Benedict, 1896). Within this group, *Typhlocirolana* is the most speciose genus, with eight described species, one of which is divided into two subspecies: *T. moraguesi moraguesi* Racovitza, 1905; *T. fontis* (Gurney, 1908); *T. buxtoni* Racovitza, 1912; *T. gurneyi* Racovitza, 1912; *T. rifana* Margalef, 1958; *T. leptura* Botosaneanu *et al.*, 1985; *T. moraguesi aureae* Pretus, 1986; *T. margalefi* Pretus, 1986; and *T. haouzensis* Boutin *et al.*, 2002. The true diversity of the genus is, however unknown, as further species in the genus are known but require formal description (Baratti *et al.* 1999; Boutin *et al.* 2002), and the correct generic placement of additional species requires revision (e.g. *Typhlocirolana reichi* Por, 1962; see Botosaneanu

*et al.* 1985; Boutin 1993). A further new species, is here described from the Ullal de la Rambla de Miravet cave (Paraje del Desierto de Las Palmas) in Spain.

Type material has been deposited in the Zoological Collection of the Oxford University Museum of Natural History (OUMNH).

## Family Cirolanidae Dana, 1852

### Genus *Typhlocirolana* Racovitza, 1905

#### *Typhlocirolana troglobia* sp. nov. (Figs. 1–4)

?*Typhlocirolana* sp. – Sanz & Platvoet, 1995: 80.

**Material examined.** Holotype: male, 10.95 mm; caught with hand net in pool, -33 m depth, northern gallery; Ullal de la Rambla de Miravet, Miravet Ravine, 40°06'73''N, 00°03'60''W; 1 October 2001, leg. S. Herrando-Pérez; OUMNH Zoo. Coll. 2002.23.001. Paratypes: non-ovigerous female (dissected), 10.80 mm, OUMNH 2002.23.002; 2 non-ovigerous females (not dissected), 9.55–10.30 mm, OUMNH 2002.23.003; same data as holotype.

**Description.** Body about 3.2 times as long as greatest width; widest at pereonite 4, lateral margins sub-parallel. Pereonite 1 2.2 times as long as pereonite 2; pereonites 2–4 subequal in length, pereonite 3 with dorsal margin slightly produced; pereonite 5 slightly shorter than pereonite 6, which is subequal in length to pereonite 7.

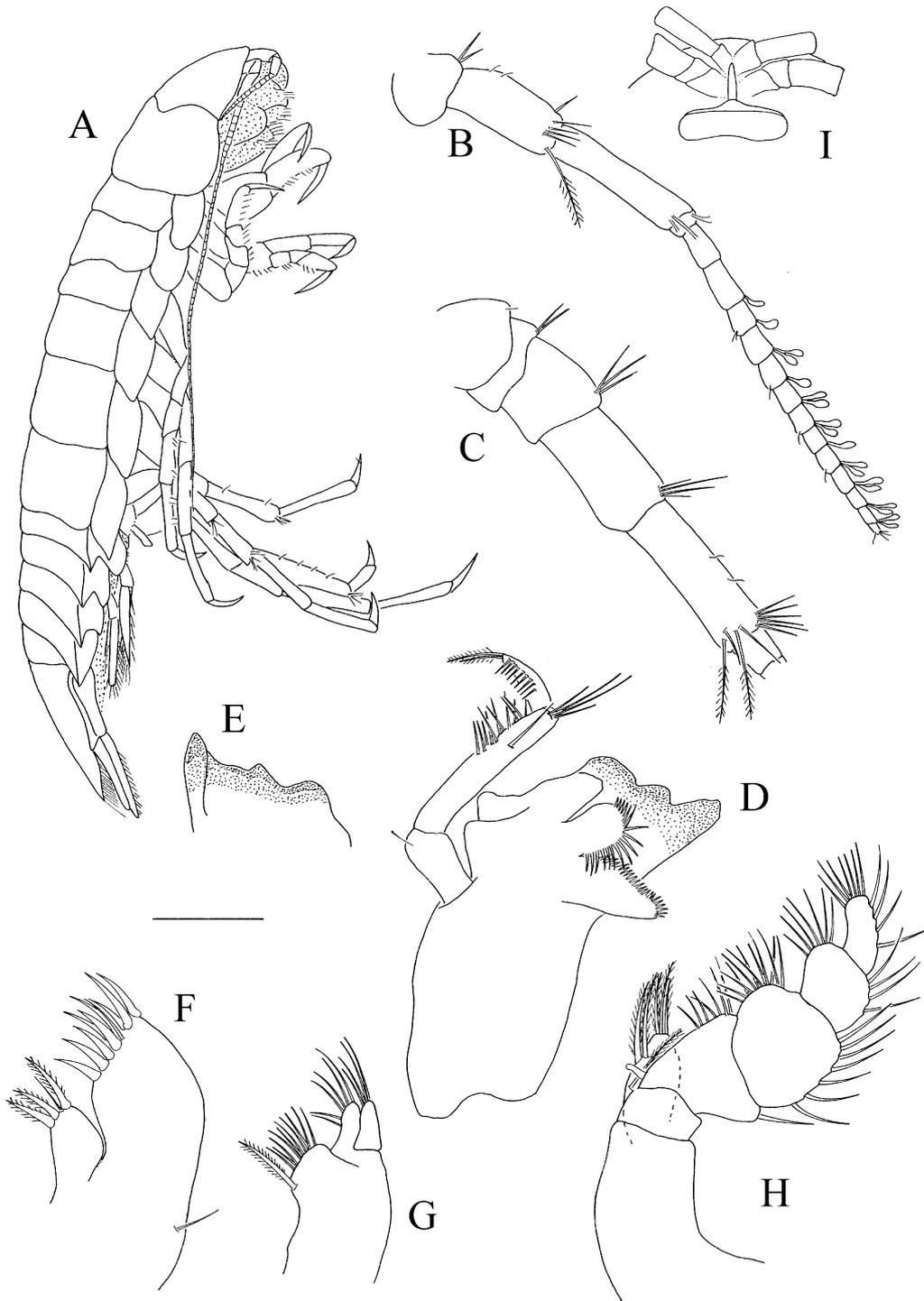
Coxae all with entire oblique suture (Fig. 1A); posterior margins of coxae 2–3 with posterodistal margin broadly rounded; coxae 4–7 posteriorly acute, angle less developed in coxae 4–6.

Pleonites 1–5 subequal in length (Fig. 1A); epimera of pleonites 1–3 with ventral lobe, less developed on pleonites 2–3; epimera with oblique ridge, terminating in pronounced mid-posterodistal point.

Pleotelson 0.9 times as long as greatest width, lateral margins evenly convex, converging to broadly rounded apex; posterior margin with 46 plumose setae; apex with pair of small robust setae (Fig. 5C).

Antennule (Fig. 1B), flagellum falling short of pereonite 1; peduncle article ratio 1.00:1.77:2.54; flagellum with 13 articles, articles 1–2 longest; proximal and terminal articles without aesthetascs.

Antennae (Fig. 1C), flagellum reaching posterior margin of pereonite 7; peduncle article ratios 1.00:0.30:0.90:1.67:2.13; first article with small setae, articles 2–5 each with several simple setae on distolateral margin, additionally article 5 with 2 plumose setae and 2 simple setae at distomedial margin; flagellum articles becoming progressively shorter.



**FIGURE 1.** *Typhlocirolana troglobia* sp. nov. Male holotype (OUMNH 2002.23.001) A, lateral view. Female paratype (OUMNH 2002.23.003) B, antennule; C, antennal peduncle; D, left mandible; E, incisor, right mandible; F, maxillule; G, maxilla; H, maxilliped; I, frons. Scale bar indicates 1.7 mm (A), 1 mm (I), 0.35 mm (D–H), and 0.25 mm (B–C).

Frontal lamina (Fig. 1I) elongate, laterally flattened, tip rounded; clypeus flatly triangular, labrum quadrate, with lateral margins rounded.

Mandible (Fig. 1D–E) typical for the genus; palp article 2 longest, article 3 terminating in 2 stout, barbed setae.

Maxillules stout (Fig. 1F); internal lobe with 3 stout, plumose setae and 1–2 fine, simple setae; lateral lobe with 10 recurved, conical setae.

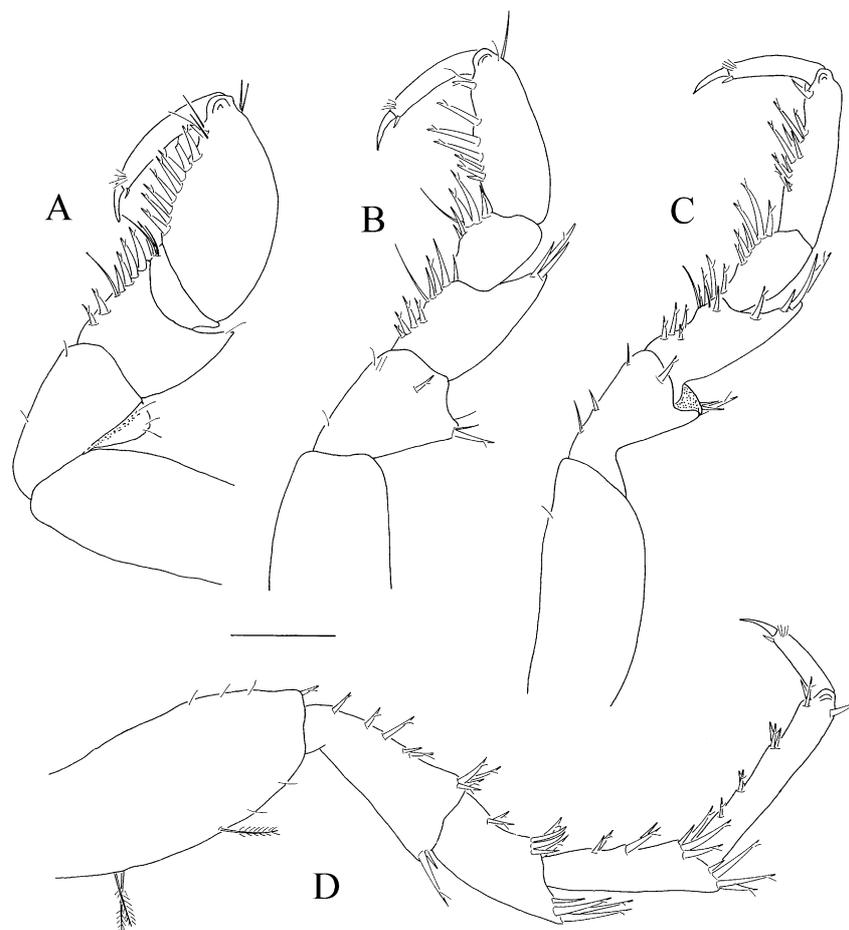
Maxilla (Fig. 1G) outer lobe with 4–5 simple setae along distal margin; medial lobe with 6–8 similar setae along distomedial and distal margin; basal endite with series of simple setae along distal margin and single, plumose, longer seta proximally.

Maxilliped basis curved (Fig. 1H); palp articles with numerous simple setae along medial and lateral margins; endite provided with single coupling hook and 6–7 large circum-plumose setae along medial margin and distally.

Pereopod 1 short and stout (Fig. 2A). Basis 3.2 times as long as wide, without setae; ischium 0.77 times as long as basis, 1.1 times as long as wide, inferior margin with 2 small setae, superior margin with prominent ridge; merus 0.81 times as long as ischium, 0.85 times as long as wide, inferior margin with 6 strong setae set in group of 2 proximally and 4 distally and single simple seta, superior distolateral margin produced, overreaching carpus, not extending over propodus; carpus with cluster of 6 simple slender setae on inferior margin; propodus 1.6 times as long as ischium, 2.0 times as long as wide, inferior margin straight, with 9–10 acute robust setae, superior margin strongly convex, distally provided with 2 elongate setae; dactylus elongate, 0.8 times as long as propodus, extending to inferior margin of carpus.

Pereopod 2 (Fig. 2B). Basis 1.4 times as long as wide, without setae; ischium 0.74 times as long as basis, 0.95 times as long as wide, with prominent sub-distal protrusion along superior margin, protrusion with 1 stout seta and 2 elongated simple setae, mesial surface with 1 stout seta; merus 1.23 times as long as ischium, 1.80 times as long as wide, with 8 stout setae along medial margin and single elongate, non-plumose seta, distolaterally strongly developed and furnished with 3 strong setae; carpus quadrate, distomedially with 5 strong setae; propodus elongate, medial margin nearly straight, furnished with 7 strong setae, lateral margin slightly convex, propodial organ absent in male and females; dactylus elongate, curved, unguis clearly demarcated.

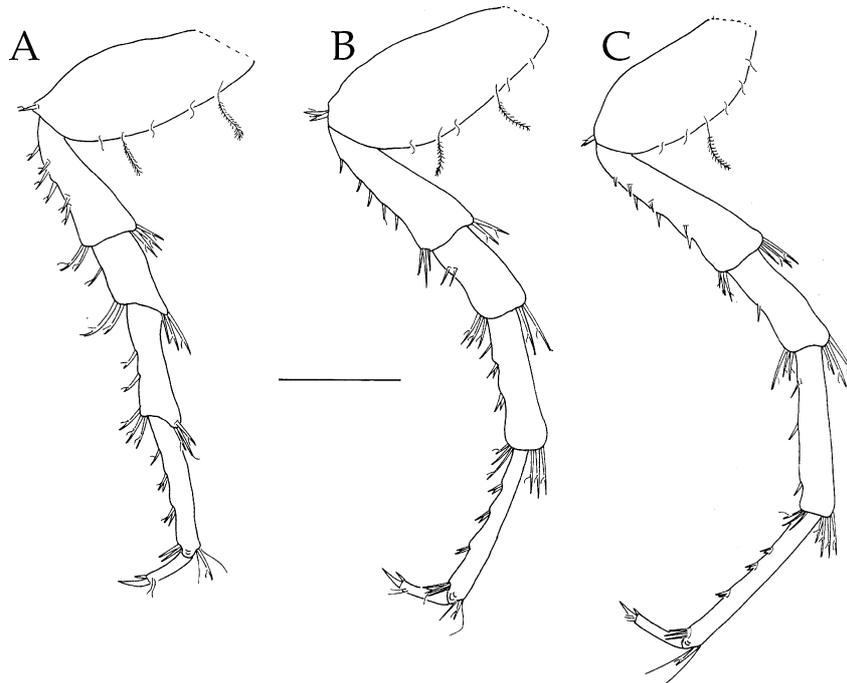
Pereopod 3 more elongate (Fig. 2C) than pereopod 2. Basis elongate; medial margin of ischium with 3 short, stout setae, distolaterally margin produced, provided with single stout seta and two smaller, but stouter setae; medial margin of merus with 8 stout setae and several elongated, simple setae, distolaterally strongly produced and furnished with three stout setae; carpus sub-quadrate, medial margin with 6–7 stout setae; propodus elongate, medial margin nearly straight, furnished with 10 stout setae, outer margin nearly straight, propodial organ absent in male and females; dactylus elongate, curved, unguis clearly demarcated. Not sexually dimorphic.



**FIGURE 2.** *Typhlocirolana troglobia* sp. nov. Female paratype (OUMNH 2002.23.002). A, pereopod 1; B, pereopod 2; C, pereopod 3; D, pereopod 4. Scale bar indicates 0.5 mm.

Pereopod 4 long (Fig. 2D). Lateral margin of basis with three plumose setae, several short simple setae along both medial and lateral margin, distomedially with single stout seta; ischium with five stout setae along medial margin, five stout setae distomedially; distolaterally not strongly produced, furnished with two stout setae; medial margin of carpus with two groups of stout setae, one of which distomedially placed, distolateral margin produced and furnished with 4–5 stout setae; carpus well developed, medial margin with three groups of stout setae, one of which is distomedially placed, distolateral margin produced, furnished with four stout setae; propodus elongate, medial margin with four groups of stout setae, single stout seta distolaterally; dactylus elongate, curved, unguis clearly demarcated.

Pereopods 5–7 (Figs. 3A–C) similar to pereopod 4, provided with a diversified chaetotaxy; length of pereopods and constituent articles increase gradually in length. Pereopod 7 not sexually dimorphic.



**FIGURE 3.** *Typhlocirolana troglobia* sp. nov. Female paratype (OUMNH 2002.23.002). A, pereopod 5; B, pereopod 6; C, pereopod 7. Scale bar indicates 1 mm.

Pleopod 1 endopod and exopod of equal length (Fig. 4A); endopod rectangular; plumose setae along distal half of medial margin continuing to distal margin, lateral margin straight, without setae.

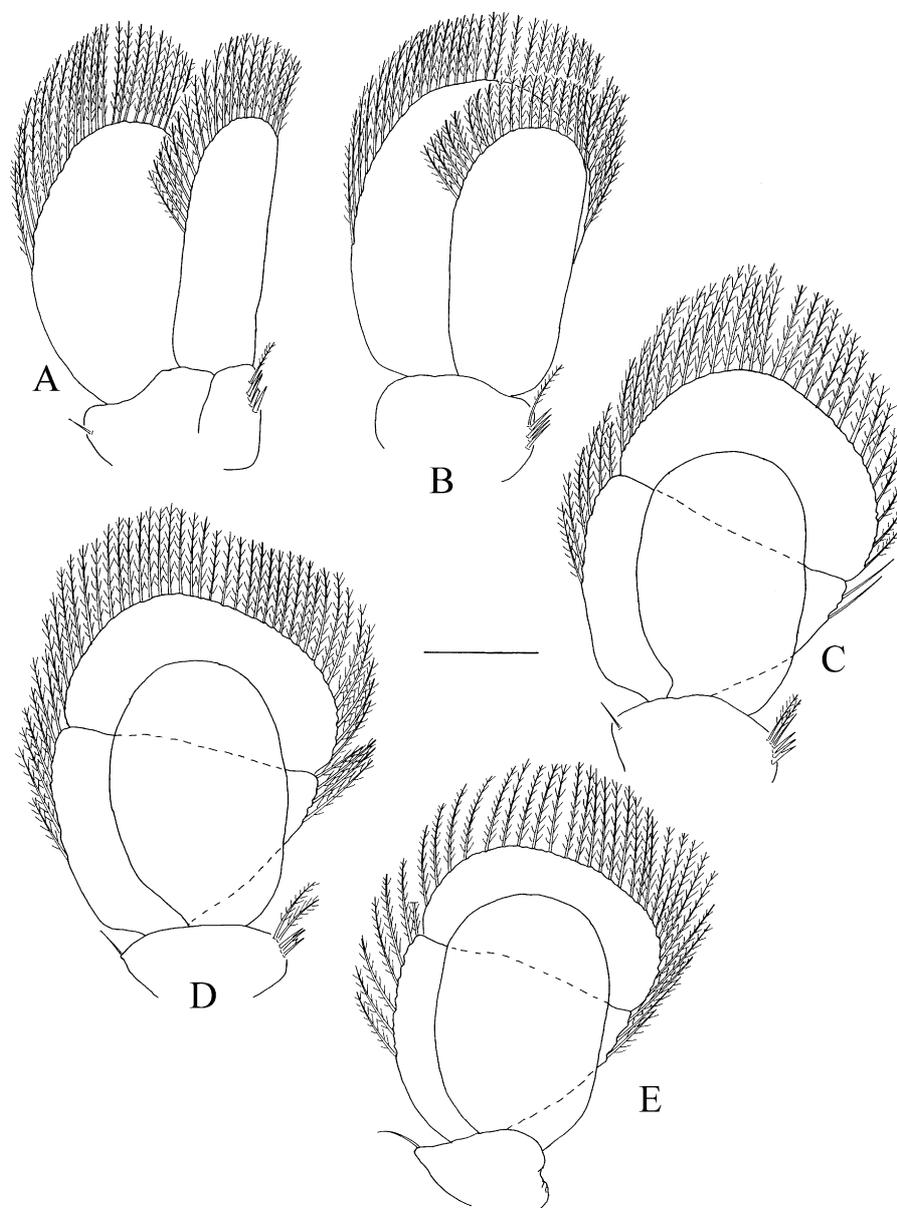
Pleopod 2 endopod more oval than pleopod 1 (Fig. 4B), plumose setae along distal margin, extending only slightly onto medial margin; no transverse suture on exopod; appendix masculina (Fig. 5A) projecting beyond endopod by 0.34 of its length, distal part of medial margin excavate, serrate (Fig. 5B)

Pleopods 3–5 similar to each other (Fig. 4C–E); exopod much larger than endopod, transverse suture complete.

Uropod elongate (Fig. 5D); peduncle distolateral margin with 2 robust setae, distomedial margin only slightly produced, with 4 plumose setae; endopod slightly longer than exopod, lateral margin furnished with series of plumose setae and 3 stout, robust setae; tip quadrate, with stout setae; exopod latero-distal margin with plumose setae, medial margin with 3 stout setae.

Penial processes 2.2 times as long as basal width, tip quadrate (Fig. 5E).

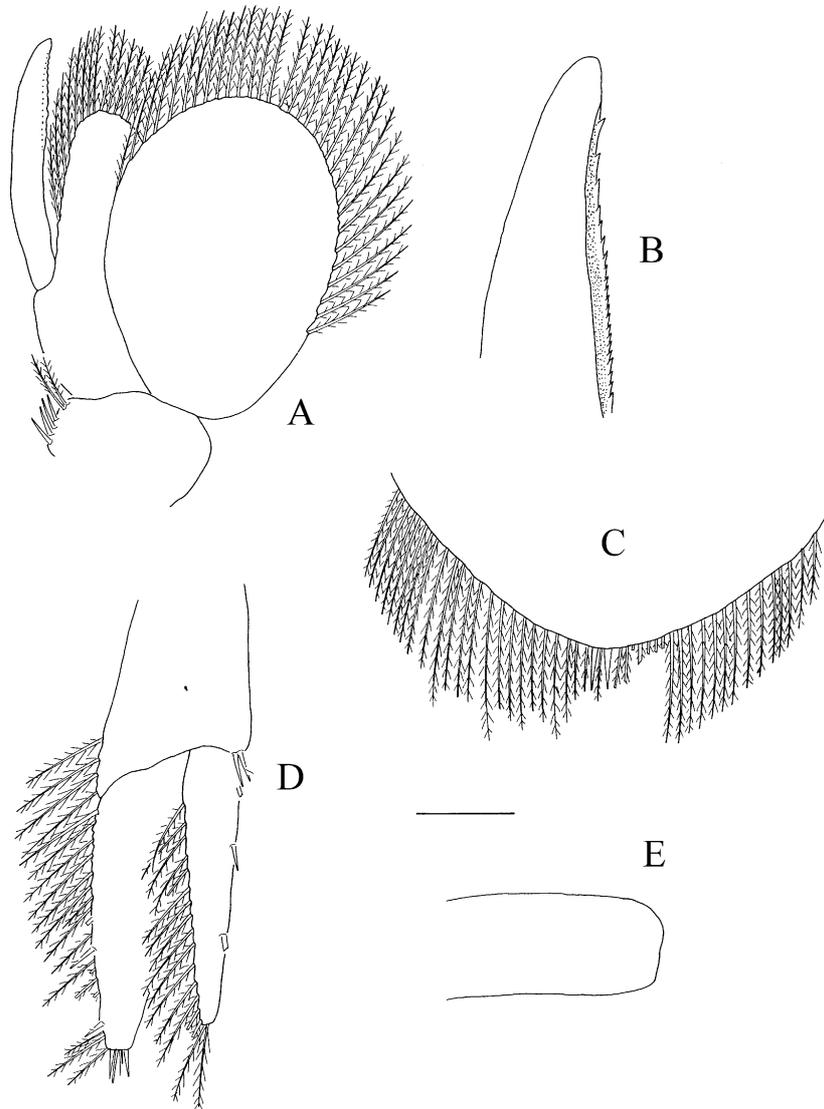
**Sexual dimorphism.** No significant sexual difference in general body morphology, mouthparts, antennule, antennae and pereopods.



**FIGURE 4.** *Typhlocirolana troglobia* sp. nov. Female paratype (OUMNH 2002.23.002). A, pleopod 1; B, pleopod 2; C, pleopod 3; D, pleopod 4; E, pleopod 5. Scale bar indicates 0.5 mm.

**Colour.** Body completely white, without pigments and lacking chromatophores.

**Derivation of name.** Named after the biological research group (TROGLOBIA) that collected the type series; noun in apposition.



**FIGURE 5.** *Typhlocirolana troglobia* sp. nov.. A, pleopod 2; B, distal portion of appendix masculina, C, distal margin of pleotelson; D, uropod; E, penial process. Scale bar indicates 0.4 mm (A, C-D), 0.2 mm (E), and 0.1 mm (B). A-B, E-F from male holotype (OUMNH 2002.23.001, remainder from female paratype (OUMNH 2002.23.002).

**Habitat.** The Paraje del Desierto de Las Palmas is located to the south-east of the Iberian System, a mainly Mesozoic limestone cordillera that crosses the north half of Spain in a NW-SE direction. However, this area shows a particular lithology of predominant Triassic sandstone, and relatively abundant Cretaceous limestone in which numerous caves have developed, 45 being catalogued to date (Arenós 1995). The Ullal de la Rambla de Miravet is the only known cave within the Paraje having a permanent water body, which is

subjected to partial desiccation and gradual fragmentation principally through the summer. This cave consists of a 25.5 metre deep pool bifurcating in a horizontal single gallery running perpendicular to the coastline. The karstic system collects rain water from an endorheic inland plain, up the Miravet ravine, with a total of three sumps, the largest one being the Avenc del Pla de les Foes (40°06'48''N, 00°03'40''E) (Arenós 1997). During seasonal storms generally occurring at least once a year in the area, the system releases the excess water through the Ullal surge (40°06'48''N, 00°03'40''E), there being a further fossil surge, the so-called Forat de L'Horta (40°06'52''N, 00°03'15''E), both of which open to the Miravet Ravine. All of the latter features encompass a geological unit which has been sculptured over time by hydrodynamic action. Access to the deep pool leading to the underground water bodies is undertaken from the top of the Ullal surge, a circular 1.5 x 1.0m opening followed by a winding fall narrowing down to 0.3m at some points. This, together with the presence of siphon chambers throughout the year, poses obvious speleological constraints that have enhanced the conservation of the site; in fact only 260 meters of the horizontal gallery have been explored to date (Arenós 1997). A full cave profile and an extensive description can be found in Arenós (1995), whilst a summary profile has been illustrated by Sanz & Platvoet (1995), together with physico-chemical data.

**Associated fauna.** A single specimen of an undescribed cirolanid genus (N.L. Bruce, pers. comm) was collected with the specimens of *T. troglobia* sp. nov.

**Discussion.** Three major species groups within the genus *Typhlocirolana* were recognised by Baratti *et al.* (1999), although no unique synapomorphies were reported upon: the *T. fontis*, *T. leptura* and *T. moraguesi* groups. Based on the general morphology of *T. troglobia* sp. nov., the new species belongs in their *moraguesi* group. This group is the most geographically widespread and contains the following taxa: *T. moraguesi moraguesi* (Mallorca, Sicily), *T. moraguesi aureae* (Menorca), *T. margalefi* (continental Spain) and *T. rifana* (Morocco), as well as two as yet undescribed species from Morocco (Baratti *et al.* 1999). Furthermore, it has been suggested that the Sicilian population of *T. moraguesi moraguesi* may represent a distinct species (Baratti *et al.* 1999).

*Typhlocirolana troglobia* sp. nov. can be distinguished from all other species in the genus, by the combination of the following characters: lack of sexual dimorphism of pereopod 7, absence of sexual dimorphism in the chaetotaxy of the propodus of pereopod 3, and the excavated and serrate nature of the tip of the appendix masculina. Within this group, *T. troglobia* sp. nov. is most similar to *T. margalefi*, described from Alicante, continental Spain (Pretus 1986), but can be distinguished from that species by the above listed characters, as well as differences in the chaetotaxy on the pereopods, which is much more developed in *T. troglobia* sp. nov., and by the longer appendix masculina (overreaching endopod by 0.45 of its length in *T. margalefi* vs. 0.34 in *T. troglobia* sp. nov.).

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