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The first record of the genus *Vejdovskybathynella* Serban and Leclerc, (Syncarida, Bathynellacea, Bathynellidae) in the Iberian Peninsula: three new species

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The first record of the genus *Vejdovskybathynella* Serban and Leclerc, 1984 (Syncarida, Bathynellacea, Bathynellidae) in the Iberian Peninsula: three new species

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Abstract

Three new species of the genus *Vejdovskybathynella* are described from caves in northern Spain. It is the first time that this genus has been documented in the Iberian Peninsula. *Vejdovskybathynella edelweiss* n. sp. has several unique features: the setal formula of the antenna (0/2+exp/2+0/1+0/0+0/2+2/4); the form of the segments and claws of the mandibular palp of the mandible of the male; exopod of the female thoracopod VIII similar in size to the endopod (exopod is always longer than the endopod); small frontal projection of the basipod of the male thoracopod VIII, large or very large is common; the form and size of the lobes of the male thoracopod VIII is unique; the second spine of the furcal rami 2.5 times longer than the first spine. *Vejdovskybathynella caroloi* n. sp. has a unique male thoracopod VIII with a spur in the exopod that is a feature unknown in the genus, and additionally, this species has the smallest endopod of the thoracopod VIII male of the entire genus; the presence of three aesthetascs in segments VI and VII of the antennule had not been observed in this genus until now; the form of the segments of the mandibular palp of the mandible of the male are unique; the distal spine of the sympod of the uropod is larger than in other species, whereas in the rest of the species of the genus they are equal in size. *Vejdovskybathynella pascalis* n. sp. is the smallest species of the genus and has two and three aesthetascs in segments VI and VII of the antennule, respectively; it is the only species of the genus that has one seta on segment I and two setae on segment IV of the antenna; it has a unique male thoracopod VIII with a small spur on the frontal projection of the basipod and with the endopod larger than all other species in spite of its small size; the basal spine of the sympod of the uropod is smaller than the other three.

Keywords: Bathynellacea, Iberian Peninsula, Spain, subterranean aquatic fauna, Syncarida, *Vejdovskybathynella*, new species

Introduction

The Family Bathynellidae Grobben, 1905 is widespread in Europe (12 genera and 35 species) (Camacho 2006) but has been scarcely studied in the Iberian Peninsula. Some older records mention the presence of the genus *Bathynella* Vejdovsky, 1882 in Portugal,

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and even established subspecies for the material found (*Bathynella stammeri occidentalis* Noodt and Galhano, 1969 and *B. s. reguensis* Noodt and Galhano, 1969 on the Douro River from Regua and *B. s. tameguensis* Noodt and Galhano, 1969 on the Douro River from Entre-os-Rios). However, according to Serban (1977) these are probably representatives of the subfamily Gallobathynellinae and not Bathynellinae to which the genus *Bathynella* belongs. *Bathynella chappuisi* form *hispanica* (Delamare Deboutteville and Chappuis 1954) of the Cueva de le Febro in Tarragona, was considered a valid subspecies by Delamare Deboutteville (1961), but an examination by Serban (1977) determined that it cannot belong to *Bathynella* since the males display sexual dimorphism in the mandibular palp (as in *Pseudobathynella* Serban, Coineau, and Delamare Deboutteville, 1971, *Sardobathynella* Serban, 1973, and *Vejdovskybathynella* Serban and Leclerc, 1984); the masticatory part of the mandible has five teeth (as in *Meridiobathynella* Serban, Coineau, and Delamare Deboutteville, 1971) and there are four spines on the sympod of the uropod, characters that do not occur in the *Bathynella*.

According to Serban (2000), none of these Iberian species belongs to the genus *Bathynella*, most of France and the Iberian Peninsula must be populated by representatives of the subfamily Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971 and the range of *Bathynella* extends to the northeast of France and not beyond the Pyrenees.

The only species of the family well known on the Iberian Peninsula is *Hispanobathynella catalanensis* (Serban, Coineau, and Delamare Deboutteville, 1971) (syn.: *Meridiobathynella catalanensis* Serban, Coineau, and Delamare Deboutteville, 1971) from the Ter River on Torroella de Montgri on Cataluña.

The genus *Vejdovskybathynella* Serban and Leclerc, 1984 belongs to the subfamily Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971, Tribe Vejdovskybathynellini Serban, 1989b and was described from material from France. To date, it includes three species: *V. balazuci* Serban and Leclerc, 1984 (Grotte de la Cocalière, Saint-André-de-Cruzières, Ardèche, France); *V. espattyensis* Serban and Leclerc, 1984 (Aven 1 d'Espatty, Grospierre, Ardèche, France), and *V. leclerci* Serban, 1989 (Rhône River near Saint-Just d'Ardèche, Ardèche, France).

Of the material found on the Iberian Peninsula in the past 25 years (Notenboom and Meijiers 1985; Camacho 1987, 1989a, 1989b, 2003), numerous specimens of Bathynellidae have been found, allowing us to approach the study of this group in an integrated manner and with abundant material. This material is currently being studied. During the years 2002–2003, two projects, the European project PASCALIS and an agreement between CSIC and the Junta de Castilla y León, has allowed the intensive and extensive sampling of four zones in northern Spain. From the samples obtained, numerous specimens of Bathynellidae have been isolated. This work is the first study of a series in which the new species and genera found will be examined in taxonomically related units. This has begun with the study of three new species belonging to the genus *Vejdovskybathynella*, constituting the first records of this genus in Spain.

Material and methods

The specimens studied were found in 14 samples from seven localities (six caves and one spring) in northern Spain (Burgos and Cantabria).

The material was collected with a 0.1 mm mesh hand net (plankton type) from water in small pools, using the Karaman-Chappuis method (Camacho 1992), in the epikarstic zone

of caves. The fixative used with the specimens is 4% buffered formalin and they are stored in alcohol (70%).

A complete dissection of all anatomical parts of all type series was made and kept as permanent preparations (special metal slides, glycerine gelatine stained with methylene blue as the mounting medium). Anatomical examinations were performed using an oil immersion lens (100×) of a Zeiss interference microscope with a drawing tube. The descriptions are based on the type series. The material is deposited in the Museo Nacional de Ciencias Naturales, Madrid (MNCN).

The terminology proposed by Serban (1972 and following papers) was used to name Md. and Th. VIII male. Serban worked in depth with the family Bathynellidae (Serban et al. 1971; Serban and Leclerc 1984; Serban 1989a, 1989b, 1992); he revised and described many genera and his terminology here considered is the most accurate and intuitive.

Systematic account and distribution of the Subfamily Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971

The Family Bathynellidae Grobben, 1905 consists of three subfamilies, Bathynellinae Grobben, 1904, Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971, and Austrobathynellinae Delamare Deboutteville and Serban, 1973. The differences between these three subfamilies are shown in Table I.

According to Serban (2000), it was assumed that most of France and the Iberian Peninsula is populated by representatives of the subfamily Gallobathynellinae. This subfamily consists of four tribes (the differences between these four tribes are shown in Table II), two subtribes, 10 genera, and 22 species including the three new species described here. The majority of the species occur in France, two are known from Italy, one from Switzerland, one from Germany, and five, including the three new species, from Spain.

Table I. Differences amongst the three subfamilies of the Family Bathynellidae: Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971; Bathynellinae Grobben, 1904; and Austrobathynellinae Delamare Deboutteville and Serban, 1973 (modified from Serban 1989b).

	Gallobathynellinae	Bathynellinae	Austrobathynellinae
A. I: no. of segments	6/7	7	7
A. II			
Endopod	3/5 segments	5 segments	5 segments
Exopod: medial seta	Present/absent	Present/absent	Absent
Md.			
Palp	1–3 segments	3 segments	3 segments
Sexual dimorphism	Yes/no	No	No
Paragnaths	Seta	Seta and tooth	Seta and tooth or claw
Th. I–VII: endopod	3 and 4/4 segments	4 segments	4 segments
Th. VIII female	Protopod + 2 branches 1 segment	Protopod + 2 branches 1 segment	Protopod + endp. 1 or 2 segments
Th. VIII male			
Penial region	–	Plaque + inner lobe	Outer lobe
Basipod	Vertical/inclined	Vertical	Vertical
Endopod	Small and one segment	Small and one segment	One or two segments
Exopod	Like exp. of the legs	Like exp. of the legs	Different from exp. of the legs
Uropod			
Sympod	4 spines as maximum	4 spines as minimum	4 spines as maximum
Endopod	2–4 claws	3–4 claws	2 claws and 1 seta

Table II. Differences amongst the tribes of the Subfamily Gallobathynellinae: Gallobathynellini Serban, Coineau, and Delamare Debutteville, 1971; Pseudobathynellini Serban, 1989; Sardobathynellini Serban, 1992; Vajdovskybathynellini Serban, 1989 (modified from Serban 1989a, 1989b, 1992). Terminology of the Thoracopod VIII male translated from the terminology used by Serban: region pénienne=penial region; lobe=lobe (lb); prolongament rostral=frontal projection (fr. pj.); lobule interne=inner lobe (I.lb); lobule externe=outer lobe (O.lb); proéminence externe=outer protuberance (O. prt.).

	Gallobathynellini	Pseudobathynellini	Sardobathynellini	Vejdovskybathynellini
A. I: no. of segments	6/7	7	7	7
A. II				
Endopod	6–7–8	8	7	7
Exopod: medial seta	Present/absent	Present	Present	Present
A. I/A. II	A. I =/ > / < A. II	A. I > A. II	A. I > A. II	A. I = A. II
Md.				
Principal teeth	5–6	7	7	5–6
Palp	1–3 segments	3 segments	3 segments	3 segments
Sexual dimorphism	No	Yes	Yes	Yes
Th. I–VII: endopod	4/4/4/4/4/4/4 4/3/3/3/3/4/4 4/3/3/3/3/3/3 3/3/3/3/3/4/4	4/4/4/4/4/4/4	4/4/4/4/4/3/3	4/4/4/4/4/4/4
Th. VIII male				
Penial region	Lobe + Fr. prj.	Lobe + I. lb. + O. lb.	I. lb. + O. lb	Lobe + Fr. prj. + O. lb.
Basipod	Inclined 35°	Inclined 30°	Inclined 30°	Vertical
O. prt.	On the basipod	On the basipod or coxopod	Not included by coxopod	Included by coxopod
Th. VIII female				
Coxal seta	Long	Short/long	Short	Long
Epipod	Present/absent	Present	Present	Present
Uropod				
Sympod	3–4 spines	3–4 spines	3 spines	4 spines
Endopod	2–3 claws	2–3 claws	4 claws	2–3 claws
Furca: spines	Similar/different	Different	Similar	Different

Table III shows the systematic data for this subfamily and details the similarities between the species as well as the type locality for each.

Family BATHYNELLIDAE Grobben, 1905

Subfamily GALLOBATHYNELLINAE Serban, Coineau, and Delamare Debutteville, 1971

Subfamily diagnosis (translated from Serban et al. 1971; Serban 1989a, 1989b)

Antennule (A. I) six or seven segments; antenna (A. II), three or five segments on the endopod; the apical part of paragnaths with thin setae; prehensile mandibular palp of the mandible (Md.), with one to three segments and both sexes with similar or different claws on the terminal segment; *pars incisiva* (or incisor process) (“*pars incisive*”) of mandible with two teeth; *processus incisivus accessorius* (or molar process) of Md. made up of two parts, the *pars molaris* normally has two simple teeth or denticles on margins; endopod with three segments on thoracopods (Th.) II, IV, V, and VI or with four segments on all the pairs; male Th. VII without coxal endite. Penial region (“*región pénienne*”) of Th. VIII with one lobe and with an apical developed frontal projection (Fr. prj.) (“*prolongement rostral*”) or one lobe and two similar in length lobes or one lobe, one frontal projection and one large

Table III. Systematic account and distribution (type locality of the species) of the Subfamily Gallobathynellinae Serban, Coineau, and Delamare Deboutteville, 1971.

Tribe Gallobathynellini Serban, Coineau, and Delamare Deboutteville, 1971

Subtribe Gallobathynellina Serban, Coineau, and Delamare Deboutteville, 1971

Gallobathynella Serban, Coineau, and Delamare Deboutteville, 1971

G. coiffaiti (Delamare, 1961)

Syn.: *Bathynella natans* form *coiffaiti* Delamare, 1954; *Bathynella natans coiffaiti* Delamare, 1961.

Type locality: Grotte de Falgas, Rieussa, Hérault, France

Other localities: Grotte des Cristaux, Limousis, Aude; Grotte de Lauzinas, St Pons de Thomières and Hérault River, St Jean de Fos, France

G. boui Serban, Coineau, and Delamare, 1971

Type locality: Grotte La Devèze, Courniou, Hérault, France

Other localities: Grotte de la Trayolle, Courniou, Hérault, France

G. juberthiae Serban, Coineau, and Delamare, 1971

Type locality: Agly River, Perpignan, France

G. tarissei Serban, Coineau, and Delamare, 1971

Type locality: Grottes de Limousis, Aude, France

Other localities: Grotte de Villanière and Grotte du Barrenc du Soula del Pinet, Comus, France

^a**G. hispanica** (Delamare and Chappuis, 1954)

Syn.: *Bathynella natans* form *hispanica* Delamare and Chappuis, 1954; *Bathynella chappuisi* form *hispanica* Delamare and Chappuis, 1954; *Bathynella hispanica* Delamare and Chappuis, 1954

Type locality: Cueva de la Febró, Tarragona, Spain

Clamousella Serban, 1989

C. delayi (Serban, Coineau, and Delamare, 1971)

Syn.: *Gallobathynella delayi* Serban, Coineau, and Delamare, 1971; *Gallobathynella (Clamousella) delayi* Serban, Coineau, and Delamare, 1972

Type locality: Grotte de la Clamouse, St Jeans de Fos, Hérault, France

Other localities: Grotte des Demoiselles, St Bauzille de Putois and Valley river, Hérault, France

Vandelibathynella Serban, Coineau, and Delamare Deboutteville, 1971

V. vandeli (Delamare and Chappuis, 1954)

Syn.: *Bathynella vandeli* Delamare and Chappuis, 1954; *B. vandeli* Delamare, 1961

Type locality: Grotte Haount-Santo, Font Saint, Ariège, France

Other localities: Grotte de Passaroles, Encourtiech; Baget, Balaguères, Ariège; Lachein stream, Balaguères, Ariège and Nert River, Encourtiech, France

Subtribe Meridiobathynellina Serban, 1989

Meridiobathynella Serban, Coineau, and Delamare Deboutteville, 1971

M. rouchi Serban, Coineau, and Delamare, 1971

Type locality: Montagnac, Hérault, France

Other locality: Institut of Zoology, University of Rome, Italy

Hispanobathynella Serban, 1989

H. catalanensis (Serban, Coineau, and Delamare, 1971)

Syn.: *Meridiobathynella catalanensis* Serban, Coineau, and Delamare, 1971

Type locality: Ter River, Torroella de Montgri, Girona, Spain

Parameridiobathynella Serban and Leclerc, 1984

P. gardensis Serban and Leclerc, 1984

Type locality: Aven de la Masse, Saint-Privat de Champelos, Gard, France

Tribe Pseudobathynellini Serban, 1989

Pseudobathynella Serban, Coineau, and Delamare Deboutteville, 1971

P. magniezi Serban, Coineau, and Delamare, 1971

Type locality: Loire River, Diou, Allier, France

P. helvetica Serban and Delamare, 1974

Syn.: *Bathynella natans* sensu Chappuis, 1915

Type locality: Bâle, Switzerland

Delamareibathynella Serban, 1989

D. debouttevillei Serban, 1989

Type locality: Font-Vive, Grospierres, Ardèche, France

D. freiburgensis (Jakobi, 1954)

Table III. (Continued).

Syn.: <i>Bathynella natans freiburgensis</i> Jakobi, 1954; <i>Bathynella freiburgensis</i> Jakobi, 1954
Type locality: Freiburg, Germany
Other localities: town around Freiburg, Germany
D. motasi Serban, 1992
Type locality: Loire River, Diou, Allier, France
Tribe Sardobathynellini Serban, 1992
<i>Sardobathynella</i> Serban, 1973
S. cottarellii Serban, 1973
Type locality: Liscia Rver, Arzachena, Sardinia, Italy
Tribe Vejdovskybathynellini Serban, 1989
<i>Vejdovskybathynella</i> Serban and Leclerc, 1984
V. balazuci Serban and Leclerc, 1984
Type locality: Grotte de Cocalière, Saint-André-de-Cruzières, Ardèche, France
V. espattyensis Serban and Leclerc, 1984
Type locality: Aven 1 d'Espatty, Grospierrres, Ardèche, France
V. leclerci Serban, 1989
Type locality: Rhône River, Saint-Just, Ardèche, France
V. edelweiss n. sp.
Type locality: Ojo Guareña Cave, Cornejo, Burgos, Spain
V. caroloi n. sp.
Type locality: Molino Cave, Matienzo, Cantabria, Spain
V. pascalis n. sp.
Type locality: Cubilla Cave, Ogarrío, Cantabria, Spain

^aSpecies not confirmed.

outer lobe (O. lb.) (“lobe externe”); vertical or inclined basipod (bsp.) and generally with an outer protuberance (O. prt.) (“proéminence externe”); exopod (exp.) similar to the thoracopod; endopod (endp.) small with one segment. Female Th. VIII variable, similar to the Bathynellini (in this case the two branches are similar in length) or with two segments (coxopod and basipod); the exopod, with two terminal setae, can be exceptionally smaller than the endopod; elongated coxal seta or of a small size. Sympod of the uropod with three or four spines (“épines”); endopod with two or four claws (“griffes”). Furcal rami with second spine, in almost all cases, longer than the other four.

Tribe VEJDOVSKYBATHYNELLINI Serban, 1989

Tribe diagnosis (translated from Serban 1989a, 1989b)

A. I and A. II with usual structure. Md.: mandibular palp with three segments with the setae longer in the males than in the females. Th. I–VII: endopod with four segments on all the pairs. Male Th. VIII: penial region (“región pénienne”) with one lobe that shows an elongated frontal projection (“prolongement rostral”) and an outer lobe (“lobe externe”) shorter than the projection, vertical basipod with a very prominent frontal crest (Fr. crt.) (“crête rostral”) and with a distal region curved on the external side, forming a spur (“eperon”) (S. fr. crt.); endopod is a single segment, lengthened and shorter than the exopod. Female Th. VIII with habitual structure and coxal seta elongated.

Genus *Vejdovskybathynella* Serban and Leclerc, 1984

Genus diagnosis (modified from Serban and Leclerc 1984)

A. I: with seven segments. Md.: mandibular palp with the setae longer in the males than in the females. Male Th. VIII: penial region with frontal projection and a large outer lobe; the

basis has a vertical position and a prominent frontal crest (Fr. crt.). Female Th. VIII: with a long lateral internal seta on the coxopod; exopod very simplified. Uropod: sympod with four spines and endopod with two or three spines. Furcal rami: the second spine is the longest.

Type species. *Vejdovskybathynella balazuci* Serban and Leclerc, 1984.

***Vejdovskybathynella edelweiss* n. sp.**
(Figures 1–4)

Material examined

Type locality. Ojo Guareña Cave, Cornejo (Burgos, Spain); coordinates X: 448875, Y: 4764802, Z: 673; sampling point OG-09: 22 November 2002, one male collected; 16 February 2002, eight males and 14 females; 1 June 2002, two males and six females collected. The holotype is a male and the allotype is a female and the type series contains 10 males and 19 females (MNCN 20.04/7791). Additional populations include two in the same cave, Ojo Guareña, sampling point OG-01 (30 October 2002, five females and two males; 8 March 2003, six females and four males collected) and sampling point OG-16 (16 February 2002, one male; 22 November 2002, four males and five females; 8 February 2003, one female collected); one population in Fuente Cubio (spring), Ahedo de Linares (Burgos) (coordinates X: 446427 Y: 4763821 Z: 755) (23 November 2002, one male collected); one in Sima Jaime Cave, Cornejo (Burgos) (coordinates X: 449768, Y: 4764276, Z: 636) (26 January 2003, one female collected) and one in Cueva Racino (cave), Villamartin de Sotoscueva (Burgos) (coordinates X: 444103, Y: 4763559, Z: 832) (21 November 2002, eight females and three males collected).

The details of the locality type and the chemical and physical nature of the sampling points can be obtained from Camacho et al. (2006).



Figure 1. Photograph of *Vejdoskybathynella edelweiss* n. sp., male (optical microscope 10 \times).

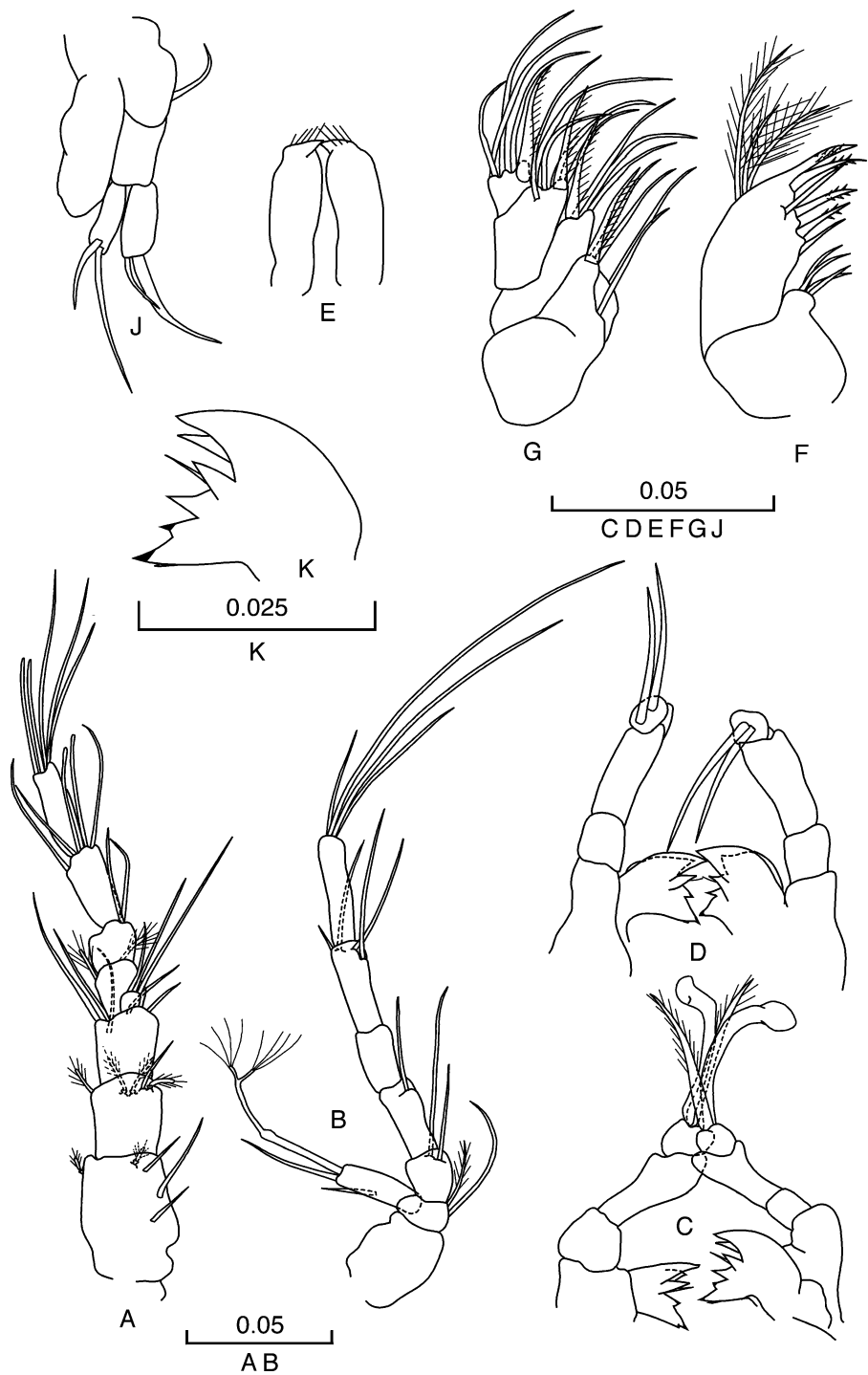


Figure 2. *Vejdoskybathynella edelweiss* n. sp., male holotype unless otherwise stated. (A) Antennule (dorsal view); (B) antenna (dorsal view); (C) mandible (dorsal view); (D) mandible of the female (dorsal view); (E) paragnaths; (F) maxillule (dorsal view); (G) maxilla (dorsal view); (J) thoracopod VIII female (frontal view); (K) masticatory part of mandible (dorsal view). Scale bars in mm.

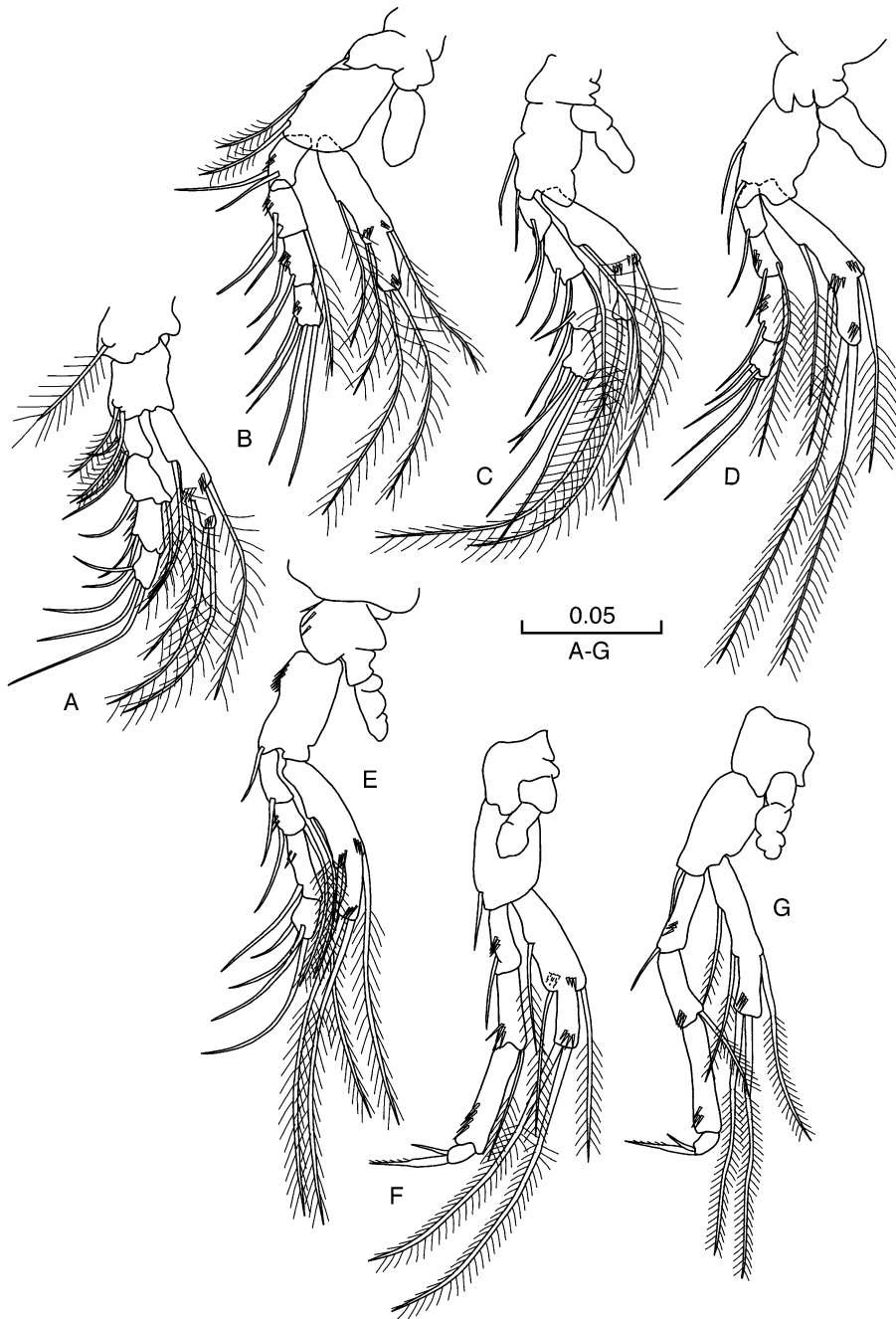


Figure 3. *Vejdoskybathynella edelweiss* n. sp., male holotype. (A) Thoracopod I; (B) thoracopod II; (C) thoracopod III; (D) thoracopod IV; (E) thoracopod V; (F) thoracopod VI; (G) thoracopod VII. Scale bar in mm.

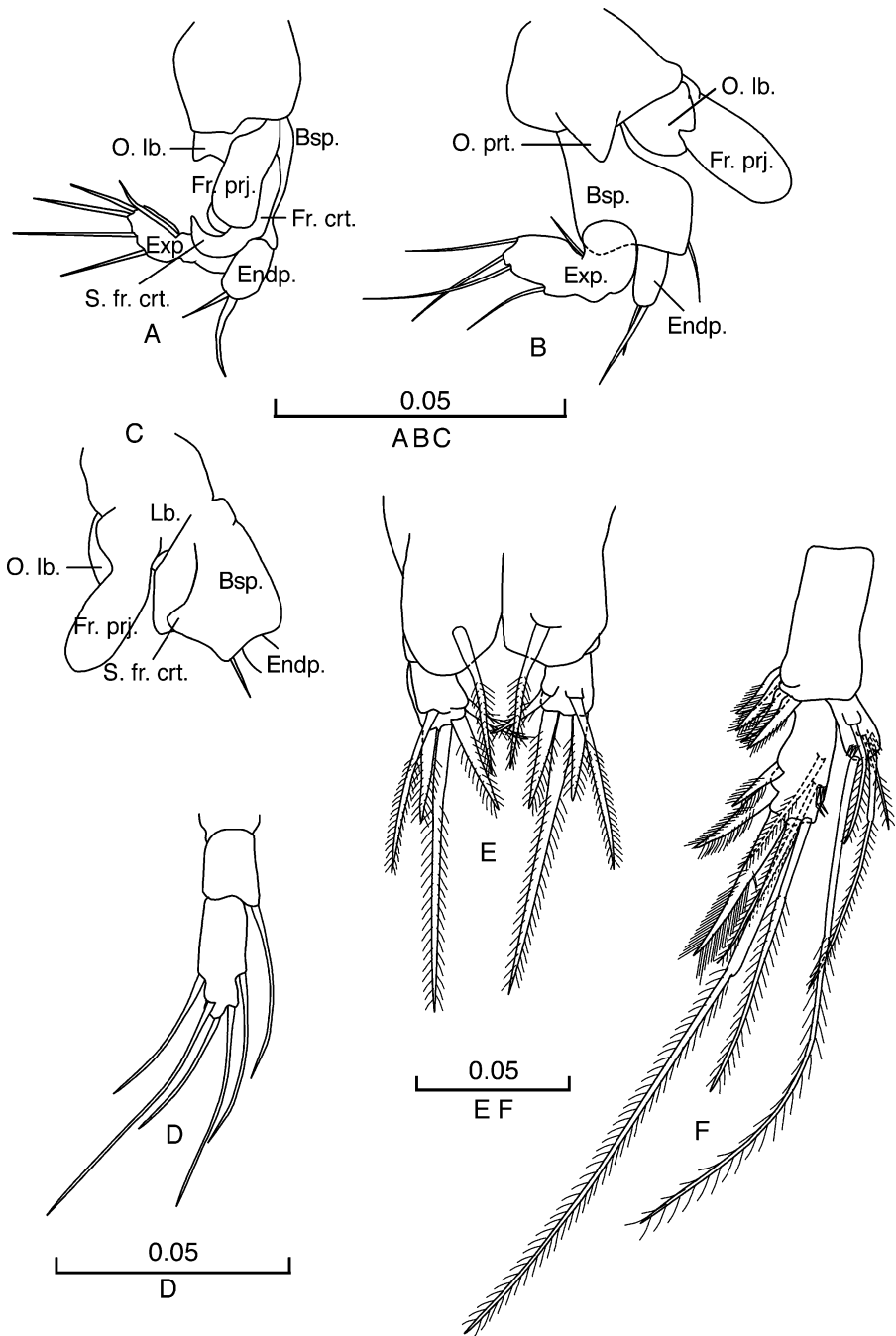


Figure 4. *Vejdoskybathynella edelweiss* n. sp., male holotype. (A) Thoracopod VIII (frontal view); (B) thoracopod VIII (latero-external view); (C) thoracopod VIII penial region (latero-internal view); (D) pleopod (frontal view); (E) furcal rami (dorsal view); (F) uropod (latero-external view). Scale bars in mm.

Description

Body. Total length of holotype (male) 0.81 mm and paratype (female) 0.76 mm. The sizes of the specimens in the different populations found are shown in Table IV. The greatest male found measured 0.90 mm and the smallest 0.58 mm; the largest female measured 1.3 mm and the smallest 0.81 mm. Body form can be observed in Figure 1. All drawings are of the holotype (male) and the allotype (female, Th. VIII and Md.).

Antennule (A. I) (Figure 2A). Seven segments; length of first three segments similar to the first of the other four segments; segments 4 and 5 smaller than the others; setation as in Figure 2A; two aesthetascs on each of segments 6 and 7. A. I slightly longer than the antenna.

Antenna (A. II) (Figure 2B). Slightly shorter than the antennule; seven segments; the two terminal segments longer than the others and similar; setal formula: 0/2+exp/2+0/1+0/0+0/2+2/4; ventromedial seta of exopod present and with two apical setae, one of these bifurcated sensory seta.

Paragnath (Figure 2E). Lengthened and with a projection in the distal part and thin setation.

Mandible (Md.) (Figure 2C, K). Palp with three segments, terminal segment with one plumose claw and another smooth and expanded in the top (see Figure 2C) and segment 2 with a special form expanded at the distal end; in the females segment 2 is more or less cylindrical, without expansions, and claws of segment 3 are equal and smooth (Figure 2D). Masticatory part (Figure 2K): *pars molaris* with two main teeth, the first (the nearest to *processus incisivus accessorius*) simple, the second tooth with one small tooth on inner side and one small tooth in the outer side (secondary formatons); incisor process (*pars incisiva*) of two teeth.

Maxillule (Mx. I) (Figure 2F). Proximal endite with four setae; distal endite with six teeth, four with spines (denticles) and two smooth, and with three plumose setae on the outer margin.

Maxille (Mx. II) (Figure 2G). Four segments; setal formula 5, 4, 6, 5.

Thoracopods I–VII (Th. I–VII) (Figure 3A–G). Th. I (Figure 3A) smaller than others; Th. II (Figure 3B) to V (Figure 3E) similar in size and Th. VI (Figure 3F) to VII (Figure 3G) longer than others. Th. I without epipod; coxa with a long plumose seta; basipod with two plumose setae. Basipod of Th. II–IV with two setae and with one seta on the rest of thoracopods. Exopod with one segment on all thoracopods, shorter than the endopod in all cases; with five barbed setae. Endopod with four segments in all thoracopods, setal formulae: Th. I: 3+0/1+1/2+0/4; Th. II: 2+0/2+1/2+0/4; Th. III: 2+0/2+1/2+0/4; Th. IV: 1+0/1+1/1+0/4; Th. V: 1+0/1+1/1+0/4; Th. VI: 1+0/0+1/0+0/2; Th. VII: 1+0/0+1/0+0/2.

Male thoracopod VIII (Th. VIII) (Figure 3A–C). Outer lobe (O. lb.) (“lobe externe”), shorter than the frontal projection (“prolongament rostral”), similar to outer protuberance (O. prt.) (“proéminence externe”); frontal projection (Fr. prj.) very large with transverse circular section; vertical rectangular basipod (Bsp.); frontal crest (Fr. crt.) (“crête rostral”) of basipod not very prominent and with a very evident spur (S. fr. crt.) (“éperon de la crête

Table IV. Size (mm) of the specimens of the new species *V. edelweiss* n. sp., *V. caroloi* n. sp., and *V. pascalis* n. sp. found in the populations of the different localities.

Species	Sampling site		Male				Female			
	Sampling point	Date	Size			No. of specimens	Size			No. of specimens
			Maximum	Minimum	Mean		Maximum	Minimum	Mean	
<i>V. edelweiss</i>	Ojo Guareña 09	16 February 2002	0.90	0.56	0.77	8	0.94	0.60	0.77	14
	Ojo Guareña 09	1 June 2002	0.90	0.82	0.86	2	0.94	0.62	0.72	6
	Ojo Guareña 09	22 November 2002	0.50	0.50	0.50	1	–	–	–	–
	Ojo Guareña 01	30 October 2002	0.79	0.77	0.78	2	0.94	0.73	0.86	5
	Ojo Guareña 01	8 March 2003	0.94	0.58	0.70	4	0.84	0.76	0.78	6
	Ojo Guareña 16	16 February 2002	0.57	0.57	0.57	1	–	–	–	–
	Ojo Guareña 16	22 November 2002	0.79	0.62	0.69	4	1.03	0.70	0.88	5
	Ojo Guareña 16	8 February 2003	–	–	–	–	0.90	0.90	0.90	1
	Sima Jaime	26 January 2003	–	–	–	–	0.58	0.58	0.58	1
	Fuente Cubio	23 November 2002	0.74	0.74	0.74	1	–	–	–	–
<i>V. caroloi</i>	Cueva Racino	21 November 2002	0.84	0.69	0.79	3	0.95	0.72	0.82	8
	El Molino	11 March 2003	0.66	0.56	0.62	8	0.78	0.60	0.66	6
<i>V. pascalis</i>	Cueva Fresca	7 June 2002	0.67	0.56	0.66	5	1.00	0.59	0.81	14
	Cueva Cubilla	15 March 2003	0.51	–	–	1	0.50	–	–	1

rostral”); exopod with a lateral seta and in the distal end four more setae. Endopod small, one-third the size of the exopod, with two terminal setae.

Female thoracopod VIII (Th. VIII) (Figure 2j). Coxa with one smooth lateral seta; large epipod, longer than the basipod; endopod with single segment with two apical setae, one of these longer and thicker than the other; exopod slightly more slender than endopod, of similar length and with two apical smooth setae of different lengths.

First pleopods (Figure 4D). Two segments, segment 1 with one very long seta; segment 2 with five setae.

Uropods (Figure 4F). Sympod slightly longer than endopod, twice longer than broad and with four equal spines; endopod almost twice as long as the exopod, with three strong claws, the most distal is the longest (twice the length of the second), terminally with two setae (one of these very long) and with two shorter ones located dorsolaterally; exopod with two terminal and two medial setae.

Furcal rami (Figure 4E). Almost square, bearing five spines; long dorsal spine, almost two-thirds the length of second spine, which is 2.5 times longer than the other three spines, which are all almost of the same size.

Etymology

The species name is derived from the Edelweiss Speleological Club from Burgos, which has been working in the karst of Ojo Guareña for over 50 years. The name is in gratitude to their members for finding this new species.

Remarks

This new species is one of the largest of the genus, together with *V. leclerci*. The setal formula of A. II is unique to the genus (see Table VI) and the presence of medial setae on the exopod occurs only in *V. balazuci* and not in the other two Spanish species. The form of one of the claws of the mandibular palp of the male (Figure 2C) is shown to be a new unique character for the genus. The combination of setae in the segments of the endopod of Th. I is unique (see Table V), as well as the combination of setae in the basipod of all the thoracopods and the presence of one seta on the first segment of the endopod in Th. VI and

Table V. Setal formula of the thoracopods of the species of the genus *Vejdovskybathynella* Serban and Leclerc, 1984. It is unknown in *V. espattyensis*.

	<i>V. balazuci</i>	<i>V. leclerci</i>	<i>V. edelweiss</i> n. sp.	<i>V. caroloi</i> n. sp.	<i>V. pascalis</i> n. sp.
Th. I	(3) 3+0/1+1/2+0/4	(3) 3+0/1+1/2+0/4	(2) 3+0/2+1/2+0/4	(3) 2+0/2+1/2+0/4	(2) 2+0/2+1/2+0/4
Th. II	(2) 2+0/1+1/2+0/3	(2) 2+0/1+1/2+0/3	(2) 2+0/2+1/2+0/4	(2) 2+0/2+1/2+0/4	(2) 2+0/2+1/2+0/4
Th. III	(2) 1+0/0+1/2+0/3	(2) 2+0/1+1/2+0/3	(2) 2+0/2+1/2+0/4	(1) 2+0/2+1/2+0/3	(1) 1+0/2+1/2+0/4
Th. IV	(2) 1+0/0+1/2+0/3	(2) 2+0/1+1/2+0/3	(2) 1+0/1+1/1+0/4	(1) 1+0/1+1/1+0/3	(1) 1+0/1+1/1+0/4
Th. V	(1) 1+0/0+1/1+0/3	(1) 1+0/1+1/2+0/3	(1) 1+0/1+1/1+0/4	(1) 0+0/1+1/1+0/3	(1) 0+0/1+1/1+0/4
Th. VI	(1) 0+0/0+0/0+0/2	(1) 0+0/0+0/0+0/2	(1) 1+0/0+1/0+0/2	(1) 0+0/0+1/0+0/2	(1) 0+0/0+1/0+0/2
Th. VII	(1) 0+0/0+0/0+0/2	(1) 0+0/0+0/0+0/2	(1) 1+0/0+1/0+0/2	(1) 0+0/0+1/0+0/2	(1) 0+0/0+1/0+0/2

The number of setae on the basipod appears in parentheses.

Table VI. Differences amongst the six known species of the genus *Vejdovskybathynella* Serban and Leclerc, 1984.

	1 ^a	2	3	4	5	6
A. I: aesthetacs on segments VI/VII	2/2	2/2	2/2	2/2	3/3	2/3
A. II						
Setal formula	0/1/2/1/0/4/4	0/1/2/1/0/4/4?	0/0/2/1/1/4/4	0/2/2/1/0/4/4	0/1/2/1/0/4/4	1/2/2/2/0/4/4
Exopod: medial seta	Present	Present?	Absent	Present	Absent	Absent
Mx. II: setal formula	–	–	–	5/4/6/5	6/5/7/4	6/4/6/5
Th. I–V	–	–	–	exp.<endp.	exp.<endp.	exp.>endp.
Th. VI–VII	–	–	–	exp.<endp.	exp.<endp.	exp.<endp.
Th. VIII female	exp.>endp.	exp.>endp.?	–	exp.=endp.	exp. >> endp.	exp. >> endp.
Th. VIII male						
Exopod: length/width	4 times	3 times	–	2 times	2 times	3 times
Basipod						
Frontal projection	Very large	Large	Very large	Small	Large	Large
Spur frontal projection	Present (large)	Present (large)	Absent	Present (large)	Present (large)	Present (small)
Endopod	Large	Large	–	Large	Small	Very large
Pleopod: setae	1+4	1+6	1+4	1+5	1+5	–
Uropod						
Sympod: spines	Similar	Similar?	Similar	Similar	Distal long	Basal small
Endopod: claws	2	2?	2	3	3	2
Furca: ratio among						
Second/first spines	4 times longer	4 times longer	2 times longer	2.5 times long.	4 times longer	2 times longer
Dorsal/first spines	Dorsal=first	Dorsal=first	Dorsal=first	Dorsal>first	Dorsal=first	Dorsal>first
Maximum length of male	0.65	–	1.10	0.94	0.67	0.51
Maximum length of female	0.75	–	–	1.03	1.00	0.50

^a1, *Vejdovskybathynella balazuci* Serban and Leclerc, 1984 (France); 2, *V. espattyensis* Serban and Leclerc, 1984 (France); 3, *V. leclerci* Serban, 1989 (France); 4, *V. edelweiss* n. sp. (Spain); 5, *V. caroloi* n. sp. (Spain); 6, *V. pascalis* n. sp. (Spain).

VII (Table V); only *V. pascalis* n. sp. has two setae as in *V. edelweiss* in the basipod of Th. I, but *V. pascalis* has only one seta on each of Th. III and IV whereas *V. edelweiss* n. sp. has two, as in the French species. It is the only species that has the exopod and endopod of the female Th. VIII of equal size, whereas all other species known from this genus have the exopod longer than the endopod. The size and the proportion among the different lobes of the male Th. VIII is unique; the exopod is twice as long as wide, as in *V. caroloi* and the frontal crest of the basipod is small, whereas in the rest of the species it is very developed. Nevertheless, the spur of the frontal crest is very developed in this new species; the endopod is large, as in the majority of species of this genus. The second segment of the pleopod has five setae as in *V. caroloi* n. sp. The spines of the sympod of the uropod are similar in size, as in the French species; nevertheless, it has three claws on the endopod as in the Spanish species *V. caroloi* n. sp., unlike the French species that have only two claws, as in *V. pascalis* n. sp., the other new Spanish species. The second spine of the furcal rami is only 2.5 times larger than the first spine, and is another unique character of this species; the dorsal spine is longer than the first spine as occurs only in *V. pascalis* n. sp.; in the other species the two spines are of a similar size. This is the largest species of the genus in Spain, jointly with *V. leclerci*.

***Vejdovskybathynella caroloi* n. sp.**
(Figures 5, 6)

Material examined

Type locality. Molino Cave, Matienzo (Cantabria, Spain) (coordinates X: 451610, Y: 4796220, Z: 165) (11 March 2003, four males and four females collected). The holotype is a male and the type series contains three males and four females (MNCN 20.04/7792). Additional population: Cueva Fresca (cave), Asón (Cantabria, Spain); coordinates X: 451390, Y: 4785780, Z: 410 (7 June 2002, five males, 10 females, and six juveniles collected).

Description

Body. Total length of the holotype (male) 0.61 mm and paratype 0.60 mm. The sizes of the species in the different populations found are shown in Table IV. All drawings are of the holotype (male) and the allotype (female, Th. VIII and Md.).

A. I (Figure 5A). Seven segments; length of first three segments similar to the first of the other four segments; setation as in Figure 3A; on segments 6 and 7 three aesthetascs. A. I slightly longer than the antenna.

A. II (Figure 5B). Slightly shorter than the antennule; seven segments; setal formula: 0/1+exp/2+0/1+0/0+0/2+2/4; exopod similar in size to segment 3, without a ventromedial seta and with two apical setae, one of these a bifurcated sensory seta.

Labrum (Figure 5C). Smooth.

Paragnath (Figure 5D). Lengthened and with a rounded projection in the distal part, and with setation.

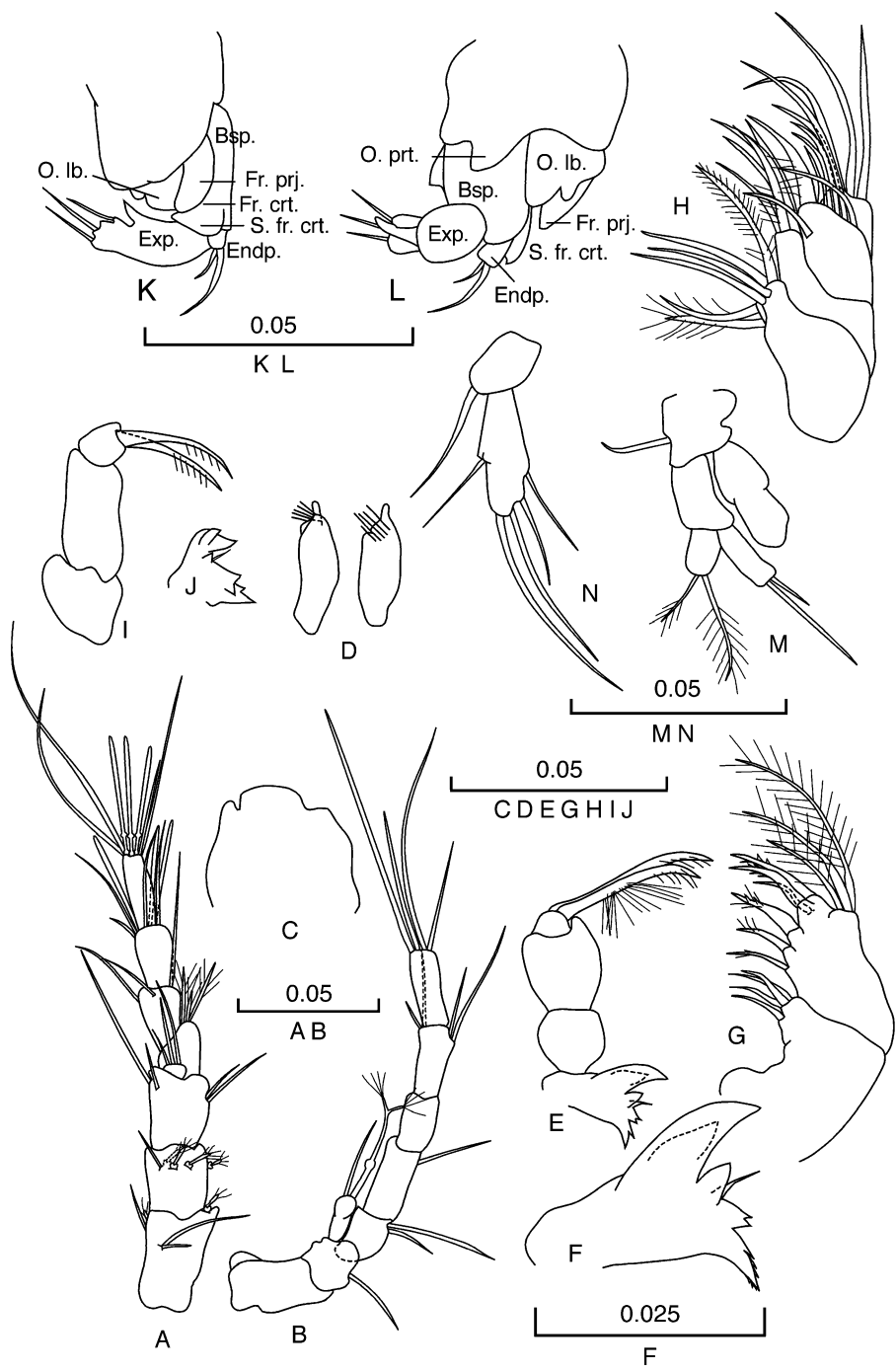


Figure 5. *Vejdoskybathynella caroloi* n. sp., male holotype unless otherwise stated. (A) Antennule (dorsal view); (B) antenna (dorsal view); (C) labro; (D) paragnaths; (E) mandible; (F) masticatory part of mandible; (G) maxillule (dorsal view); (H) maxilla (dorsal view); (I) mandible of the female, mandibular palp (dorsal view); (J) mandible of the female, masticatory part; (K) thoracopod VIII (frontal view); (L) thoracopod VIII (latero-external view); (M) thoracopod VIII, female (frontal view); (N) pleopod. Scale bars in mm.

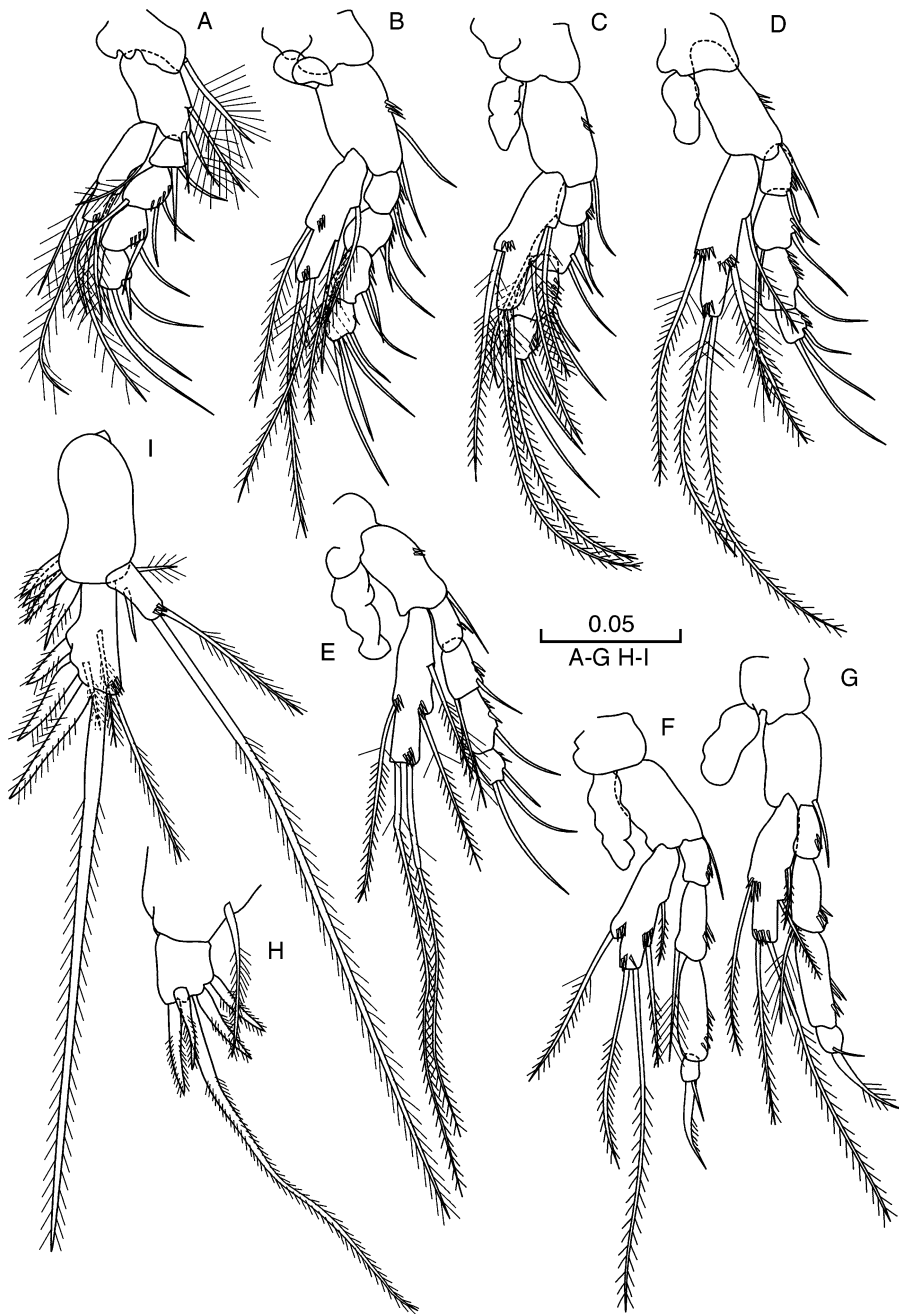


Figure 6. *Vejdovskybathynella caroloi* n. sp., male holotype. (A) Thoracopod I; (B) thoracopod II; (C) thoracopod III; (D) thoracopod IV; (E) thoracopod V; (F) thoracopod VI; (G) thoracopod VII; (H) furcal rami (dorsal view); (I) uropod (latero-external view). Scale bar in mm.

Md. (Figure 5E, F). Palp with three segments, terminal segment with two claws with setation as shown in the figure, and first two segments thick and with rounded aspect; in the females segments 1 and 2 are normal, the second longer, without expansions, and claws of segment 3 equal and with few setae. Masticatory part (Figure 5F): *pars molaris* with two main teeth, the first (the nearest to *processus incisivus accessorius*) bidentate, the second tooth with three small teeth (secondary formations) on each side; incisor process (*pars incisiva*) of two teeth.

Mx. I (Figure 5G). Proximal endite with four setae; distal endite with six teeth, five with spines (denticles), and with three plumose setae on the outer margin.

Mx. II (Figure 5H). Four segments; setal formula 6, 5, 7, 4.

Th. I–VII (Figure 6A–G). *Th. I* (Figure 5A) smaller than others; *Th. II* (Figure 6B) to *V* (Figure 6E) similar in size and *Th. VI* (Figure 6F) to *VII* (Figure 6G) longer than others. *Th. I* without epipod; coxa with a long plumose seta; basipod with two plumose setae and one smooth seta. Basipod of *Th. II* with two setae and with only one seta on the rest of the thoracopods. Exopod with one segment on all thoracopods, shorter than the endopod in all cases; with five barbed setae. Endopod with four segments in all thoracopods, setal formulae: *Th. I*: 2+0/2+1/2+0/4; *Th. II*: 2+0/2+1/2+0/4; *Th. III*: 2+0/2+1/2+0/3; *Th. IV*: 1+0/1+1/1+0/3; *Th. V*: 0+0/1+1/1+0/3; *Th. VI*: 0+0/0+1/0+0/2; *Th. VII*: 0+0/0+1/0+0/2.

Male Th. VIII (Figure 5K, L). Outer lobe (O. lb.) very large, the distal edge almost reaches the edge of the frontal projection; frontal projection (Fr. prj.) with transverse circular section; vertical basipod (Bsp.) not very long and almost square; frontal crest (Fr. crt.) of basipod prominent and with a very evident spur (S. fr. crt.); exopod heavy, with a spur (see Figure 5K), with four setae on the distal end. Very small endopod, one-seventh the size of the exopod, with two smooth terminal setae.

Female Th. VIII (Figure 5M). Coxa with one smooth lateral seta; large epipod, longer than basipod; endopod singly segmented with two plumose apical setae, one of these longer than the other; exopod longer than the endopod, and with two apical smooth setae of different lengths.

First pleopods (Figure 5N). Two segments, first segment with one seta; second segment with five setae.

Uropods (Figure 6I). Sympod slightly longer than endopod, twice longer than broad and with four spines, distal longer than the others; endopod twice as long as the exopod, with three strong claws, the most distal slightly longer, terminally with two setae (one of these very long) and with two shorter ones dorsolaterally; exopod with two terminal and two medial setae.

Furcal rami (Figure 6H). Almost square, bearing five spines; second spine is four times longer than the other four spines, which are all almost of the same size including the dorsal spine.

Etymology

The species name is derived from Carolo, who has worked for more than 23 years with the author and is a best friend, sampling companion, and husband to the author.

Remarks

Vejdovskybathynella caroloi n. sp. has a combination of unique characters (Tables V, VI); it has a unique male thoracopod VIII, with a spur in the exopod that is a feature otherwise unknown to the genus (see Table VI); the basipod is small and the outer lobe and outer protuberance are similar in size; the frontal projection is as short as the basipod; the endopod is the smallest of the whole genus. The presence of three aesthetascs on segments VI and VII of the antennule also was not previously known in this genus; the form of the segments of the mandibular palp of the mandible of the male are unique; the setal formula of the endopod of all thoracopods is unique (see Table V), as having three setae on the basipod of Th. I only occurs in the French species, whereas the Spanish species only has two (Table V) and Th. VI–VII are like those of *V. pascalis* n. sp.; the distal spine of the sympod of the uropod is larger than the others, whereas in the rest of the species they are all equal in size. The setal formula of A. II is similar to the French species. The male is medium sized and the female is large.

Vejdovskybathynella pascalis n. sp.

(Figures 7, 8)

Material examined

Type locality. Cubilla Cave, Ogarrio (Cantabria, Spain) (coordinates X: 456238, Y: 4793438, Z: 132) (15 March 2003, one male and one female collected). The holotype is the male and the paratype is the female (MNCN 20.04/7793).

Description

Body. Total length of the holotype 0.51 mm and of the paratype 0.50 mm. All drawings are of the holotype (male) and the female Th. VIII and Md. are of the paratype.

A. I (Figure 7A). Seven segments; length of the first three segments similar to that of four remaining segments; setation as in Figure 7A; two and three aesthetascs on segments 6 and 7, respectively. A. I longer than A. II.

A. II (Figure 7B). Shorter than A. I; seven segments; setal formula: 1/2+exp/2+0/2+0/0+0/2+2/4; exopod longer than segment 3, without a ventromedial seta and with two apical setae, one of these a bifurcated sensory seta.

Labrum (Figure 7C). Smooth.

Paragnath (Figure 7D). Lengthened and with a projection similar to a tooth in the distal part and with setation.

Md. (Figure 7G, M). Palp with three segments, terminal segment with two claws of similar length and with setation in proximal part, and segment 2 thick, almost square; in the females the segments are normal, the second longer, and claws of segment 3 are unequal and with few setae on the distal end (Figure 7E). The masticatory part of the Md. of the male broke during the dissection and for this reason there is no drawing. *Pars molaris* with two main teeth in the female (Figure 7F, M), the first with a small tooth (secondary

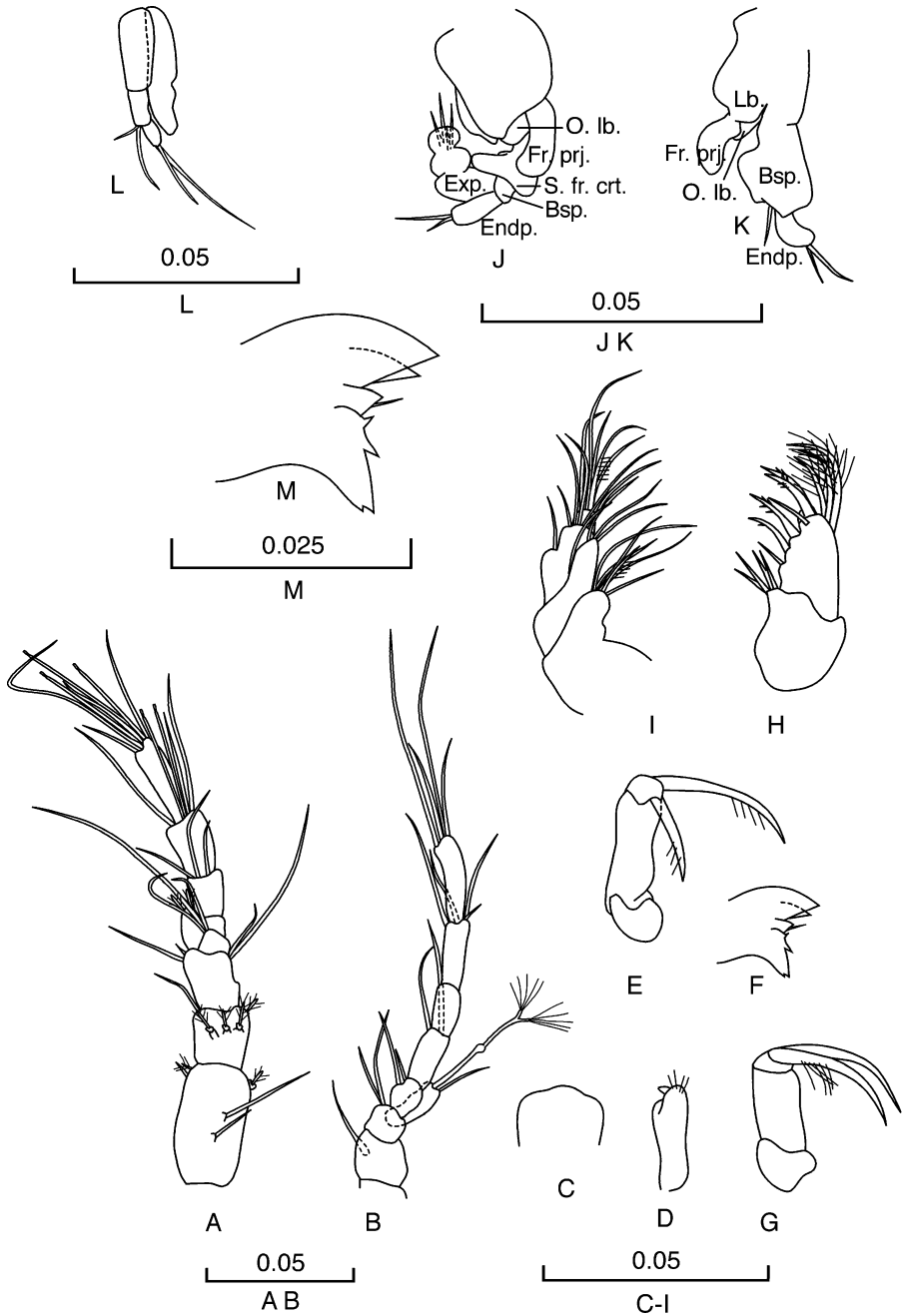


Figure 7. *Vejdovskybathynella pascalis* n. sp., male holotype unless otherwise stated. (A) Antennule (dorsal view); (B) antenna (ventral view); (C) labro; (D) paragnaths; (E) mandibular palp of the female (dorsal view); (F, M) masticatory part of the mandible of the female; (G) mandible, mandibular palp (dorsal view); (H) maxillule (dorsal view); (I) maxilla (dorsal view); (J) thoracopod VIII (frontal view); (K) thoracopod VIII (latero-internal view); (L) thoracopod VIII female (frontal view). Scale bars in mm.

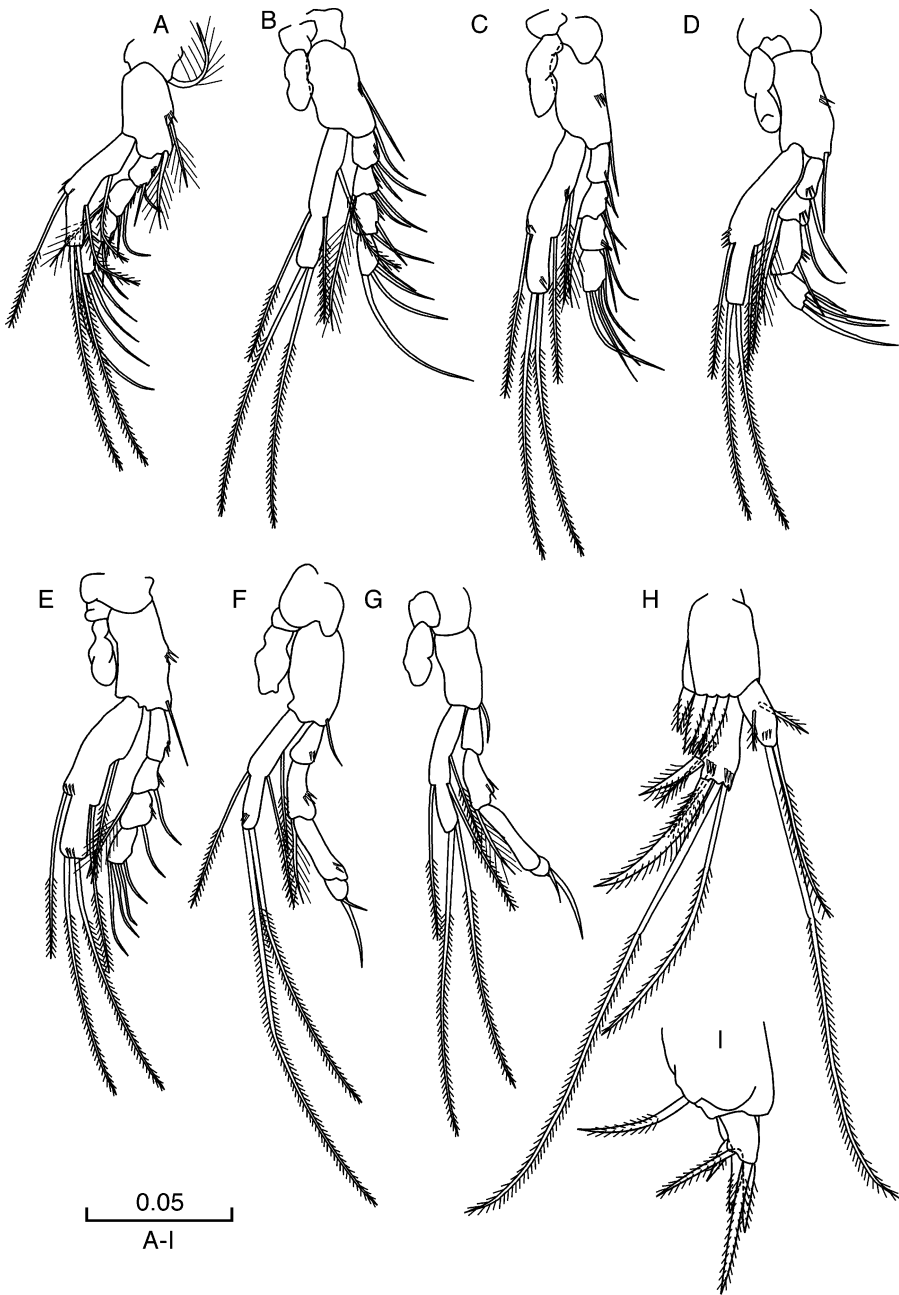


Figure 8. *Vejdovskybathynella pascalis* n. sp., male holotype. (A) Thoracopod I; (B) thoracopod II; (C) thoracopod III; (D) thoracopod IV; (E) thoracopod V; (F) thoracopod VI; (G) thoracopod VII; (H) uropod (latero-external view); (I) furcal rami. Scale bar in mm.

formation) near to *processus incisivus accessorius*, the second tooth with a small tooth (secondary formation) in the outer side; incisor process (*pars incisiva*) with two teeth.

Mx. I (Figure 7I). Proximal endite with four setae; distal endite with six teeth, four with spines (denticles), and with three plumose setae on outer margin.

Mx. II (Figure 7I). Four segments; setal formula 6, 4, 6, 5.

Th. I–VII (Figure 8A–G). Th. I smaller than others; Th. II–V similar in size and Th. VI–VII longer than others. Th. I (Figure 8A) without epipod; coxa with a long plumose seta; basipod with two plumose setae. Basipod of Th. II (Figure 8B) with two smooth setae and with only one smooth seta on the rest of the thoracopods. Exopod with one segment on all thoracopods, of equal length to the endopod in Th. I–V, and shorter in Th. VI (Figure 8F) and VII (Figure 8G); with five barbed setae. Endopod with four segments in all the thoracopods, setal formulae: Th. I: 2+0/2+1/2+0/4; Th. II: 2+0/2+1/2+0/4; Th. III: 1+0/2+1/2+0/4; Th. IV: 1+0/1+1/1+0/4; Th. V: 0+0/1+1/1+0/4; Th. VI: 0+0/0+1/0+0/2; Th. VII: 0+0/0+1/0+0/2.

Male Th. VIII (Figure 7J, K). Outer lobe (O. lb.) not very large, the distal edge does not reach the edge of the frontal projection; long frontal projection (Fr. prj.) with transverse circular section; vertical basipod (Bsp.) long and almost rectangular; frontal crest (Fr. crt.) of basipod prominent and with a spur (S. fr. crt.) not very evident; exopod very curved, with a medial lateral seta and on the distal end four more setae; very long endopod, almost half the length of the exopod, with two smooth terminal setae.

Female Th. VIII (Figure 7L). Coxa broke in the dissection; epipod long, longer than basipod; endopod small, a single segment with two smooth apical setae; exopod twice as long as endopod, and with two smooth apical setae of different lengths, one of these very long.

Uropods (Figure 8H). Sympod slightly longer than endopod, a little longer than wide and with four spines, the basal shorter than the others; endopod 1.5 times longer than exopod, with two strong claws, distal twice as long as the other, terminally with two setae (one of these very long) and with two located dorsolaterally; exopod with two terminal and two medial setae.

Furcal rami (Figure 8I). Almost square, bearing five spines; second spine twice as long as the other three spines, which are shorter than the dorsal spine.

Etymology

The species name is derived from the PASCALIS European Project, thanks to which these populations of Syncarida could be studied.

Remarks

Vejdovskybathynella pascalis n. sp. is the smallest species of the genus with a unique combination of characters (Tables V, VI); it has two and three aesthetascs on segments 6

and 7 of the antennule, respectively. To have two aesthetascs on segment 6 is common in the genus (except *V. caroloi* n. sp. which has three) but to have three in segment 7 is unusual, and only *V. caroloi* n. sp. shares this character; it is the only species of the genus that has one seta on segment 1 and two setae on segment 4 of the antenna. This is the only Spanish species of this genus that has an exopod of Th. I–V longer than the endopod, and the relation of sizes is not known in the French species. The setal formula of the endopod of the thoracopods is unique and the number of setae on the basipod of the thoracopods is also unique; it has a unique male thoracopod VIII, with a small spur of the frontal crest of the basipod (absent or present, but large in this case, in the other five species of the genus) and with the endopod the largest of all species in spite of its small size. The basal spine of the sympod of the uropod is smaller than the other three; the dorsal spine is longer than the first spine, as only occurs in *V. edelweiss* n. sp., in the other species the two spines are a similar size.v

Discussion

Tables V and VI show the similarities and differences between the six species of the genus *Vejdovskybathynella*. In the original description of *V. espattyensis* Serban and Leclerc, 1984 only the differences with the species type *V. balazuci* Serban and Leclerc, 1984 were mentioned and no drawings of the majority of the parts of the body were given. For this reason, there is not the same level of detail for comparison as in the other species. For example, Mx. I and Mx. II are unknown in the French species.

The largest species are *V. leclerci* and *V. edelweiss* n. sp.; the smallest is *V. pascalis* n. sp.

The three French species show more similarity among them than is seen between the Spanish species.

Only *V. caroloi* n. sp. has three aesthetascs on segment 6 of A. I. Only the species *V. pascalis* n. sp. has setae on the first segment of A. II; the medial seta of the exopod of A. II is absent in *V. leclerci*, *V. caroloi* n. sp., and *V. pascalis* n. sp.

The sexual dimorphism in the mandibular palp of the Md. is most evident in *V. edelweiss* n. sp. and *V. caroloi* n. sp. while in the other species it is very subtle.

The setal formula of the endopod of Th. I–VII in the French species is similar, with only slight differences in the number of setae of Th. III–V (Table V). The Spanish species differ in all setae on the segments of the endopod of Th. I–VII as well as in the number of setae on the basipod of the thoracopods (Table V); only *V. edelweiss* n. sp. has one seta on the first segment of the endopod of Th. VI and VII. The exopod of the thoracopods is smaller than the endopod on all thoracopods in *V. edelweiss* n. sp. and *V. caroloi*, whereas it is larger on Th. I–V in *V. pascalis* n. sp.

In the female Th. VIII the exopod is larger than the endopod, except in *V. edelweiss* n. sp. in which they are similar in size.

The male Th. VIII of *V. edelweiss* n. sp. is more similar to Th. VIII of *V. balazuci* and *V. espattyensis* than to the Spanish species, though it has a less-developed frontal projection and a more rectangular basipod than the French species. The male Th. VIII of *V. caroloi* n. sp. and *V. pascalis* n. sp. have a more square aspect.

The pleopod of the new Spanish species (unknown in *V. pascalis* n. sp.) has five setae on the second segment, whereas it has four or six setae in the French species.

Vejdovskybathynella pascalis n. sp. has two claws on the endopod of the uropod as in the French species; in the rest of the new Spanish species there are three claws present.

Vejdovskybathynella edelweiss n. sp. and *V. pascalis* n. sp. have dorsal spines on the furcal rami that are longer than the first spine, and are similar in the rest of the species; the second spine of the furcal rami is very long in *V. balazuci*, *V. espattyensis*, and *V. caroloi* n. sp. (four times longer than the first spine).

There is little doubt that these three new species found in Spain belong to the genus *Vejdovskybathynella* described from the south of France and this confirms the presumption of the presence in Spain of other genera of the Family Bathynellidae, than *Bathynella*, as was postulated by Serban (2000).

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