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On three new *Bathyporeia* species from the Atlantic coasts of North Africa (Crustacea, Amphipoda, Pontoporeiidae)

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Abstract: Three new amphipods of the genus *Bathyporeia* are described from the Atlantic coasts of North Africa : *B. elkaimi* sp. nov., *B. ledoyeri* sp. nov., and *B. microceras* sp. nov. Both *B. elkaimi* sp. nov. and *B. ledoyeri* sp. nov. belong to the *pilosa* group : the carpal fang of their third and fourth pereiopods are blunt-tipped with a subapical setule, and they have no tooth on their coxae 1-3 and on their third epimeral plate. *B. microceras* sp. nov. is unrelated to any previously described species and adult males have very short second antennae.

Résumé : *Sur trois nouvelles espèces de* Bathyporeia *(Crustacea, Amphipoda, Pontoporeiidae) des côtes altlantiques d'Afrique du Nord.* Trois nouveaux amphipodes du genre *Bathyporeia* sont décrits d'après des spécimens des côtes atlantiques d'Afrique du Nord : *B. elkaimi* sp. nov., *B. ledoyeri* sp. nov. et *B. microceras* sp. nov. Les espèces *B. elkaimi* sp. nov. et *B. ledoyeri* sp. nov. appartiennent toutes deux au groupe *pilosa* : le croc carpien de leurs troisièmes et quatrièmes péreiopodes présente une extrémité arrondie, et est muni d'une sétule subapicale; en outre leurs coxas 1-3 et leurs troisièmes plaques épimérales sont dépourvus de dent. *B. microceras* sp. nov. ne présente, par contre, aucune affinité particulière avec les espèces déjà décrites, et se caractérise notamment par l'extrême brièveté des secondes antennes du mâle adulte.

Keywords: *Bathyporeia*, Crustacea, Amphipoda, Taxonomy, North Africa, Eastern Atlantic.

Introduction

The amphipod genus *Bathyporeia* is remarkably homogeneous and the distinction between its various species is often difficult. Despite the works of Watkin (1938), Shoemaker (1949), Toulmond (1966), Vader (1970), Bousfield (1973), Lincoln (1979), Bellan-Santini & Vader (1988) and Bellan-Santini (1973, 1989), many problems remained unsolved. A complete revision of the genus, by geographical areas, is in progress. In a first paper, the species of Western Europe have been thoroughly redescribed and carefully illustrated by one of us (d'Udekem d'Acoz, in press), and several previously overlooked characters have been pointed out in that work. The present paper is devoted to the description of 3 new species from the Atlantic coasts of North Africa.

The occurrence of such a number of new species in North Africa is not really surprising, since so far very little attention has been paid to the marine amphipods from this

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area. With the exception of the systematic publications by Chevreux (1891, 1900, 1927, 1935), Menioui & Bayed (1986), and Menioui & Myers (2001), North-African amphipods have been studied in bionomical and ecological papers only, such as those of Bitar (1987), Menioui & Ruffo (1988) and Bayed (1991). Therefore, the present paper should be considered not only as a taxonomical study on the genus *Bathyporeia* but also as a general contribution to the study of the North-African amphipod fauna.

Materials and methods

The material of *Bathyporeia microceras* sp. nov. and *B. ledoyeri* sp. nov. has been collected with a small dredge handled by a SCUBA diver, in the bay of Dakhla (23°47'N) and off Al Argoub (23°47'N 15°45'W). The dredge characteristics are : width = 330 mm and mesh = 1 mm. During each operation, it has been drawn on a distance of 3 meters, each sample covering therefore 1 m^2. The dredge penetrated down to 50 mm into the sediment.

The type material of *Bathyporeia elkaimi* sp. nov. has been collected in the seventies by Bernard Elkaïm in the estuary of Bou Regreg (34°05'N 06°50'W). This material belongs to the Museo Civico di Storia Naturale di Verona. The holotype of *Bathyporeia elkaimi* sp. nov. has been dissected by the first author, drawn when mounted on provisional glycerin preparations, and afterwards permanently mounted in Faure's liquid. The orientation of the pieces and the presentation of the drawings are as in d'Udekem d'Acoz (in press). The holotypes of *B. ledoyeri* sp. nov. and *B. microceras* sp. nov. have been dissected by the second author and directly mounted in Faure's liquid. In a few cases the orientation of the pieces was not standard. So, in a few cases, in addition to drawings in real position, a reconstruction in standard position has been drawn.

All drawings have been carried out by the first author with a camera lucida Reichert mounted on a Leitz Dialux microscope. For the measurement of the different ratios, see d'Udekem d'Acoz (in press). Such ratios have been used for each description since they are more precise and objective than terms like 'narrow' or 'robust', especially when small overlapping differences are considered. The model of description is actually the same as in d'Udekem d'Acoz (in press). The term 'pseudorostrum' designates the enlarged first article of the peduncle of the first antenna. The terminal crown of seta of the third article of the maxillipedal palp is not illustrated. The 'carpal fang' is a long and strong modified seta found on the carpus of the third and fourth pereiopods in all *Bathyporeia* species. Some abbreviations are adopted in the present paper, either systematically or in some parts of the text:

A1: first antenna (antennula)
A2: second antenna (antenna)
Coxae 1-7: coxal plates of the first to seventh pereiopods
Ep1-Ep3: first to third epimeral plates
Md: mandible
Mx1: first maxilla (maxillula)
Mx2: second maxilla (maxilla)
Mxp : maxilliped
P1: first pereiopod (first gnathopod)
P2: second pereiopod (second gnathopod)
P3-P7: third to seventh pereiopods
U1-U3: first to third uropods

The following abbreviations are used for scientific institutions:

MVRCr = Museo Civico di Storia Naturale di Verona
TMU = Tromsø Museum
ISR = Institut Scientifique, Rabat

Systematics

Species description

Crustacea Amphipoda
Family Pontoporeiidae Dana, 1855
Genus *Bathyporeia* Lindström, 1855

Bathyporeia elkaimi sp. nov.

Figures 1-4

Material. MVRCr 426: one ovigerous albeit not full-grown female (holotype), fully dissected and mounted on 13 slides, Rabat, Estuaria del Bou Regreg (34°05'N-06°50'W), previously identified as *Bathyporeia* sp., B. Elkaïm. MVRCr 426: 12 mature albeit not full-grown females including 3 with one egg (paratypes), in rather poor condition, Bou Regreg, river sand at 10 km upstream of river mouth, previously identified as *Bathyporeia pilosa* Lindstr., coll. B. Elkaïm. The type material has presumably been collected in the seventies.

Etymology. The species is dedicated to Bernard Elkaïm who published a brief account on the biology of that species, as *Bathyporeia pilosa* Lindström, 1855 (Elkaïm, 1972a, 1972b, 1974, 1976a, 1976b) The name is a genitive.

Description (based on holotype female)
Fairly robust species. Eye with well developed ommatidia in adults. Pseudorostrum with tip rounded and narrow, not overhanging, with 1 proximoventral plumose seta; development and number of apical spines normal. Major flagellum of A1 with 5 articles; first article of accessory flagellum with 2 non-apical groups of spines. Anterior border of article 3 of peduncle of A2 with only one group of spinules and setae, in apical position; 4th article with apical and lateral spinules; flagellum with 6 articles. Ratio length / width of 4th article of A2: 3.2, of 5th article: 2.7.

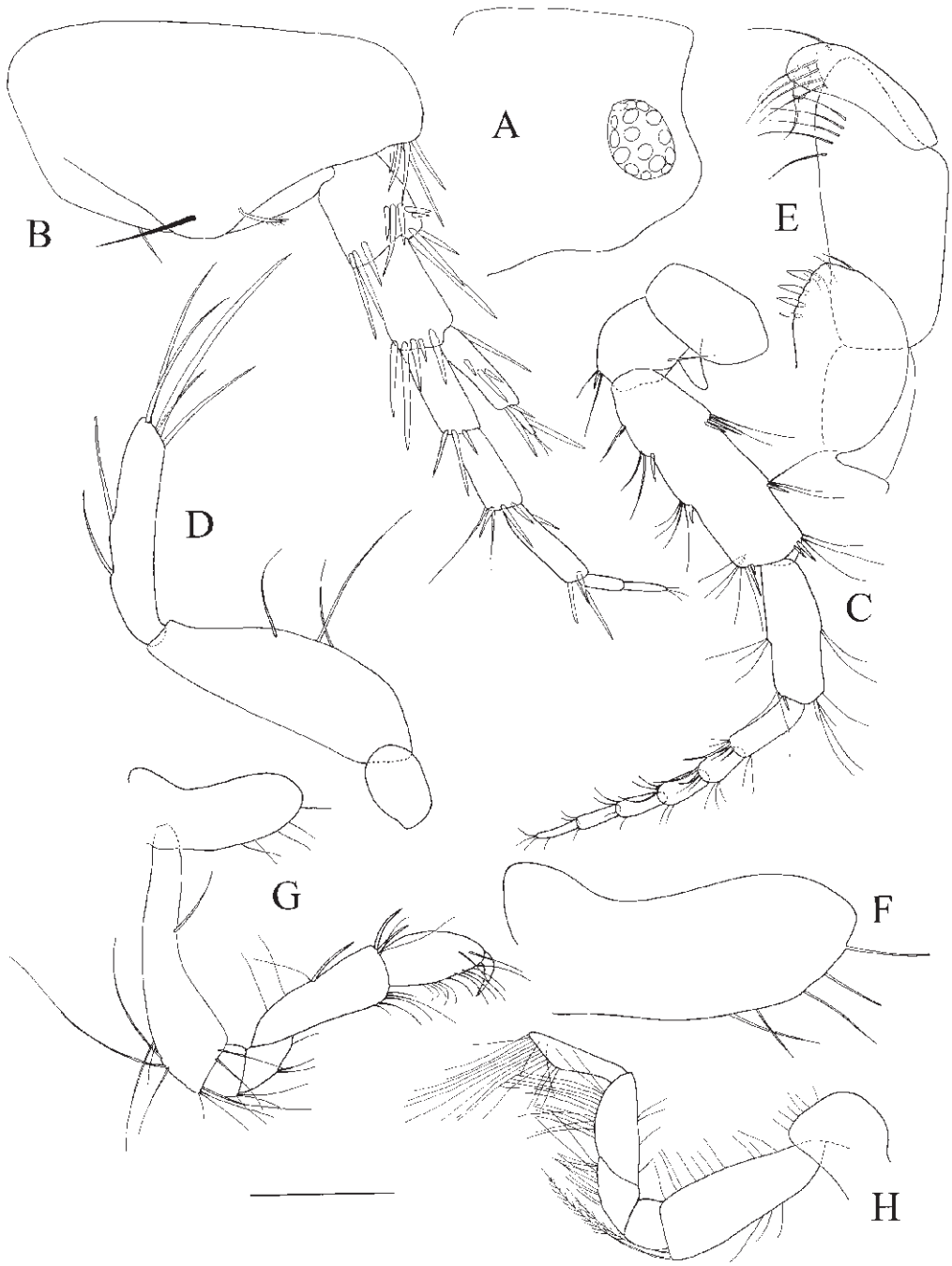

Figure 1. *Bathyporeia elkaimi* sp. nov., female holotype, Bou Regreg. **A.** Head. **B.** right A1. **C.** left A2. **D.** mandibular palp. **E.** right Mxp. **F.** right coxa 1. **G.** right P1. **H.** left P2. Scale bar : D, E, F, 0.10 mm; B, 0.15 mm; A, C, G, 0.21 mm; H, 0.42 mm.

Figure 1. *Bathyporeia elkaimi* sp. nov., holotype femelle, Bou Regreg. **A.** tête. **B.** A1 droite. **C.** A2 gauche. **D.** palpe mandibulaire. **E.** Mxp droit. **F.** coxa 1 droit. **G.** P1 droit. **H.** P2 gauche. Echelle : D, E, F : 0,10 mm ; B : 0,15 mm ; A, C, G : 0,21 mm ; H: 0,42 mm.

Mandibular palp with penultimate article fairly broad, with ultimate article elongate.

Second article of maxilliped palp with about 5 strong setae on dorsal surface, all in a row; third article without longitudinal row of setae on dorsal side (in addition to dorsal and ventral transversal groups of anterior setae); outer plate with 4 nodular spines.

Coxa 1 not especially elongate, with tip broadly rounded, without ventral tooth or distinct notch, with 5 anterior setae, without apical setule.

Coxa 2 without posterior tooth; transition between anterior and ventral border with rather distinct angular discontinuity; anterior border straight; anterior and posterior border subparallel (scarcely diverging downwards); with

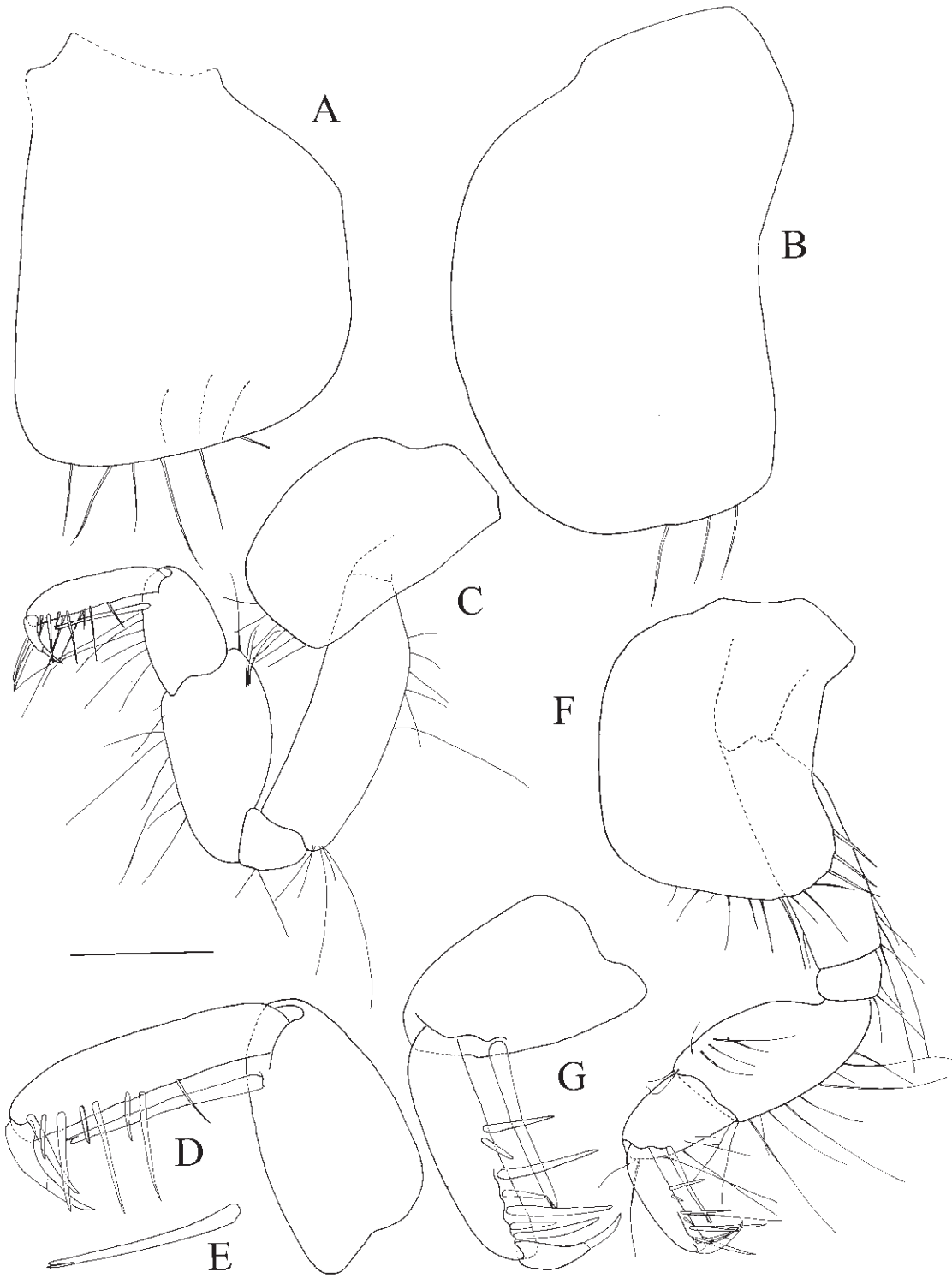

Figure 2. *Bathyporeia elkaimi* sp. nov., female holotype. **A.** right coxa 2. **B.** left coxa 3. **C.** right P3. **D.** anterior part of right P3 (mesial spines/setae of propodus not shown). **E.** carpal fang of left P3. **F.** right P4. **G.** anterior part of right P4 (mesial spines/setae of propodus not shown). Scale bar : A, B, D, E, G, 0.10 mm; C, F, 0.21 mm.

Figure 2. *Bathyporeia elkaimi* sp. nov., holotype femelle. **A.** coxa 2 droit. **B.** coxa 3 gauche. **C.** P3 droit. **D.** partie antérieure du P3 droit (épines/soies mésiales du propode non illustrées). **E.** croc carpien du P3 gauche. **F.** P4 droit. **G.** partie antérieure du P4 droit (épines/soies mésiales du propode non illustrées). Echelle : A, B, D, E, G : 0,10 mm ; C, F: 0,21 mm.

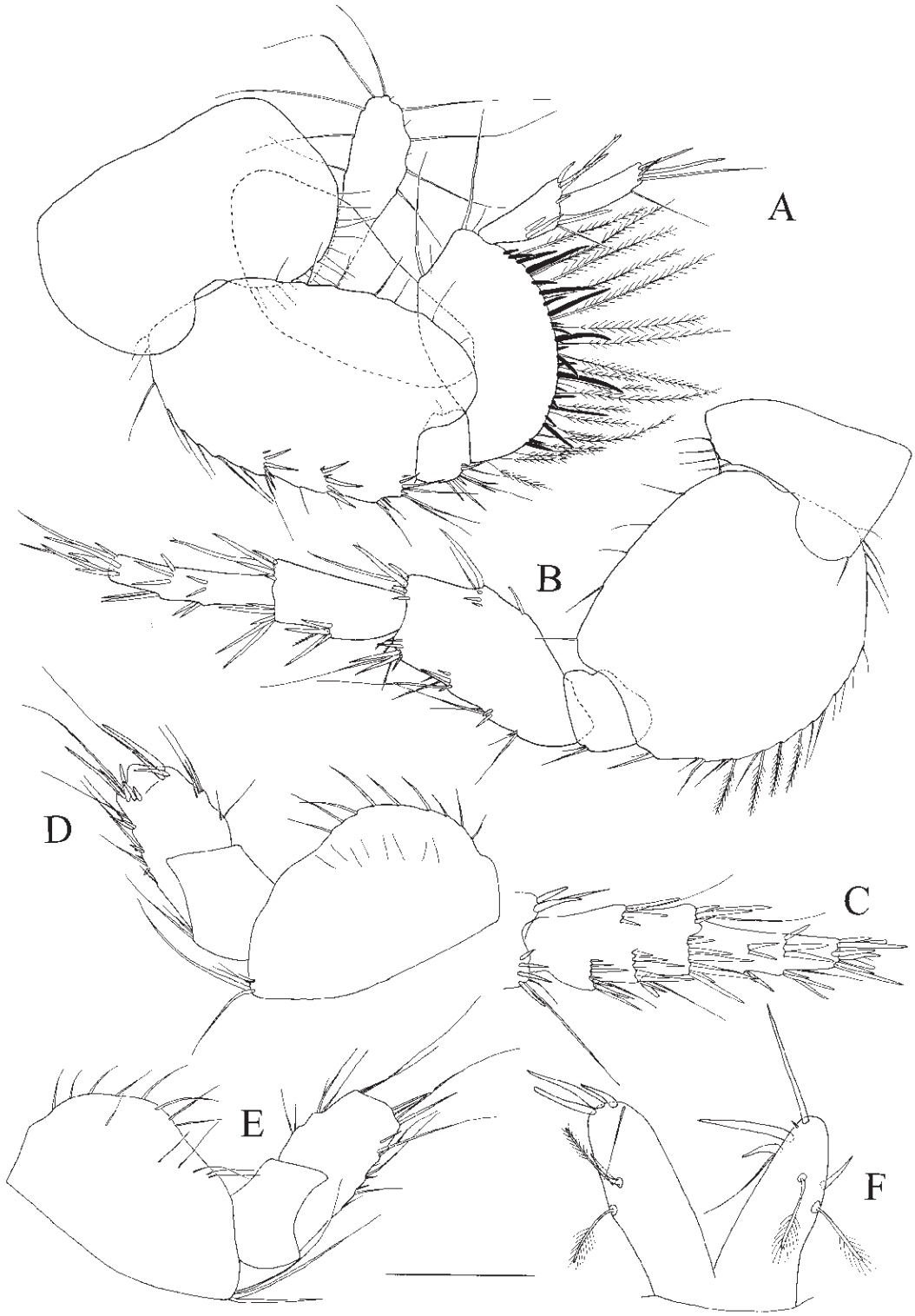

Figure 3. *Bathyporeia elkaimi* sp. nov., female holotype. **A.** left P5; **B.** right P6. **C.** tip of left P7 (outer view). **D.** proximal part of right P7 (outer view). **E.** proximal part of right P7 (mesial view). **F.** telson. Scale bar : E, 0.10 mm; A, B, C, D, E, 0.26 mm.

Figure 3. *Bathyporeia elkaimi* sp. nov., holotype femelle. **A.** P5 gauche ; **B.** P6 droit. **C.** partie distale du P7 gauche (vue externe). **D.** partie proximale du P7 droit (vue externe). **E.** partie proximale du P7 droit (vue mésiale). **F.** telson. Echelle : E : 0,10 mm ; A, B, C, D, E : 0,26 mm.

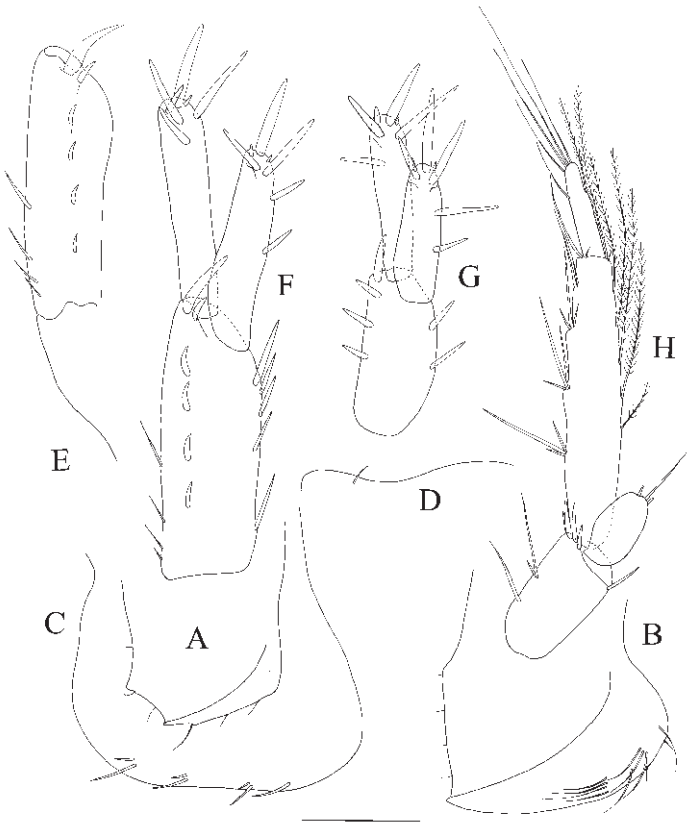

Figure 4. *Bathyporeia elkaimi* sp. nov., female holotype. **A.** right Ep1. **B.** right Ep2. **C.** right Ep3. **D.** dorsal part of urosomite 1 (right side). **E.** peduncle of right U1 in lateral view with ventral part of urosomite 1. **F.** right U1. **G.** right U2. **H.** right U3. Scale bar : D, 0.11 mm; E, F, G, G, 0.15 mm; A, B, 0.21 mm; C, 0.30 mm.

Figure 4. *Bathyporeia elkaimi* sp. nov., holotype femelle. **A.** Ep1 droite. **B.** Ep2 droite. **C.** Ep3 droite. **D.** partie dorsale de l'urosomite 1 (côté droit). **E.** pédoncule de U1 en vue latérale avec la partie ventrale de l'urosomite 1. **F.** U1 droit. **G.** U2 droit. **H.** U3 droit. Echelle : D : 0,11 mm ; E, F, G, G : 0,15 mm ; A, B : 0,21 mm ; C : 0,30 mm.

ventral border with 6 regular-sized, strong setae, the longest ones of normal size; 3 mesial setae.

Coxa 3 without posterior tooth; anterior and posterior border converging downwards; ventral border with 3 to 6 regular-sized slender setae, the longest ones of normal length; mesial setae lacking in dissected specimen.

Coxa 4 with 13 slender and moderately irregular-sized setae of normal length; posterior setae not setulose.

P1 propodus rather elongate.

Ratio length / width of carpus of P2: 2.6; ratio propodus length / carpus length: 0.96.

P3 with carpal fang much shorter than propodus, distally very blunt and with accessory setule slightly overreaching tip of fang; propodus robust; outer spines/setae of propodus 'normal' in number (8) and shape but rather short; dactylus very slender and fairly long, with very long unguis, with posterior border distinctly concave. For P3 the ratios are :
propodus length / merus length: 0.67
dactylus length / propodus length: 0.42
dactylus length / merus length: 0.27
length / width of propodus : 4.6
length / width of dactylus : 4.3
unguis length / total length of dactylus: 0.49
unguis length / dactylus width: 2.1

P4 with carpal fang much shorter than propodus, distally very blunt and with accessory setule as long as tip of fang; propodus robust; outer spines/setae of propodus 'normal' in number (7), and shape but rather short; dactylus very slender and fairly long, with very long unguis, with posterior border distinctly concave. For P4 the ratios are :
propodus length / merus length: 0.62
dactylus length / propodus length: 0.44
dactylus length / merus length : 0.28
length / width of propodus: 4.0
length / width of dactylus: 4.2
unguis length / total length of dactylus: 0.41
unguis length / dactylus width: 1.7

P5 with median part of anterior border of basis faintly convex; merus posteromedian seta group with one long and strong curved major seta and 1 short and slender accessory seta, which is non-setulose; posterodistal seta group with one long strong straight seta (distinctly overreaching tip of carpus) and 1 well developed setule; anterodistal area without plumodenticulate setae; carpus extremely robust (ratio length of posterior border / maximal perpendicular width = 2.6); longest posterior spine of carpus overreaching tip of propodus; ratio carpus + propodus / merus length: 0.75.

P6 with posterodistal lobe of basis not protruding and narrow; anterior border strongly and regularly convex; posterior border almost straight (faintly convex); anterior border with a succession of non setulose setae (or appearing as such on the microscopical preparation), stronger plumose setae, and a few strong non-setulose spines. P6 merus with 3 posterior groups of spines/setae and 4 anterior groups; longest seta of each anterior seta group of significantly increasing size from proximal towards distal part of merus; carpus without posterior spines (distal group not considered); propodus with 2 posterolateral and 2 anteromesial groups of spines (terminal crown of spines not considered). Spines of carpus and merus robust and long. Ratio length of propodus / anterior length of merus in P6: 0.80.

P7 with posterior border of basis having proximally slender ornamentation, 8-9 regular-sized spiniform setae in adults; mesial side without spinules in dissected female. Ischium moderately elongate, reaching 0.51 of outer side of merus; anterodistal border slightly concave on outer side, strongly concave on mesial side; posterodistal border straight both on outer and mesial side. Spines of carpus and

merus robust and long. Ratio length / width of carpus: 2.2, of propodus: 3.6, ratio length of carpus / length of propodus: 1.2, ratio length of propodus + carpus / length of basis: 1.2.

Middle of posterior border of Ep1 produced in a well developed tooth; middle of border of Ep2 bluntly angular and not produced in a tooth.

Ep3 with posteroventral border regularly rounded, without posteroventral tooth, with 4 transverse groups of 1 to 2 spines, without setules on posterior border.

Urosomite 1, dorsally with one pair of anteriorly directed setae and no posteriorly directed spines; ventrolateral border without strong setae arising from outer side.

Peduncle of uropod 1: outer dorsal border with 6 spines consisting of the following succession: 1) 4 regularly spaced short robust spines, of similar size, 2) a larger space followed by a penultimate short robust spine, 3) a very short space followed by a very strong ultimate spine; dorsomesial border with unpaired styliform spines on distal and proximal part. Endopod and exopod fairly robust; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines of normal robustness. Dorsal ratio length of endopod / length of peduncle: about 0.79. Dorsal ratio length / width of endopod: 4.2.

Peduncle of uropod 2: robust (dorsal ratio length / width = 2.3), outer dorsal border with 4 spines that are fairly long and of normal robustness; dorsomesial border with 2 non-grouped long and fairly robust spines. Endopod and exopod short and robust; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines of normal robustness and length. Dorsal ratio length / width of endopod: 3.3.

Peduncle of uropod 3 with distal spines in normal number, the longest ones not reaching tip of endopod (endopodal spines excluded); outer border of peduncle of uropod 3 with 2 groups of 1-2 slender and not so long setae. Endopod elliptic, with 3 spines in apical position. Exopod not swollen in lateral view, with first article narrow and second long. Second article of exopod with 1 lateral seta on mesial side and 1 on outer side. Mesial side of exopod (first and second article together) with 7 long plumose setae of normal morphology and without accessory spines (if the short seta of the tip of the first segment is neglected), almost all plumose setae are longer (albeit not much longer) than the longest setae of the outer side. Outer side of exopod with 6 groups of 2 to 3 spiniform setae, the longest longer than exopod width. For uropod 3 the ratios are:
length / width of second article of exopod: 4.8
length of second article / length of 1st article: 0.38
length of second article / width of 1st article: 1.7
length of second article of exopod / length of endopod: 1.3

Lobes of telson without setae on mesial border; tip of lobes truncated, all apical spines and setae arising from the same level; apical border with 3 spine and 1 seta on each side, and 1 spinule on left side; a single outer spine on each side not reaching tip of telson lobes.

Size. The largest female, which is mature but has presumably not reached its maximal size, was 3.3 mm.

Ecology and distribution. Only known from the estuary of Bou Regreg (North of Morocco, Atlantic coast) (Elkaïm, 1972a, 1972b, 1974, 1976a, 1976b; Menioui & Bayed, 1986, all as *Bathyporeia pilosa*.

Remarks

Bathyporeia elkaimi sp. nov. has been previously identified as *Bathyporeia pilosa* (see above). Although it indeed shares many characters with *B. pilosa* (and with *B. sarsi* Watkin, 1938), such as the usual absence of posteriorly directed spines on the first urosomite and the presence of a bifid blunt-tipped carpal fang, it also exhibits striking differences. First of all, the dactyli of P3-P4 are remarkably long and curved, with a very long unguis, whilst *B. pilosa* and *B. sarsi* have a very short and robust dactylus with a short unguis (d'Udekem d'Acoz, in press). Actually, the dactyli of *B. elkaimi* sp. nov. are similar to those of *B. phaiophthalma* Bellan-Santini, 1973, a related species from the Mediterranean Sea, which has its carpal fang entire and slender, unlike *B. elkaimi* sp. nov., *B. ledoyeri* sp. nov., *B. pilosa* and *B. sarsi* (unpublished observations of the first author).

Examination of other characters confirms the validity of *B. elkaimi* sp. nov. as a good species exhibiting a mosaic of characters of either *B. pilosa* or *B. sarsi*, as well as features not found in either species. The first segment of the antennular segment (pseudorostrum) of *B. elkaimi* sp. nov. is narrow and rounded as in *B. pilosa* and narrower than in *B. sarsi*. The penultimate segment of the mandibular palp is rather broad although not as much as in *B. pilosa*. The fairly broad tip of the coxa 1 in *B. elkaimi* sp. nov. is quite different from that of *B. pilosa* (which is narrow) and more similar to that of *B. sarsi*. The short glabrous accessory seta of the posteromedian group of setae in P5 is similar to that of *B. sarsi* but not to that of *B. pilosa*, in which the accessory seta is quite long and strongly setulose. The very broad carpus of P5 is unique among the *Bathyporeia* species described so far. The poorly developed posterior lobe of the basis of P6 is similar to that of *B. pilosa* and quite different to that of *B. sarsi*, which is well developed. The slender ornamentation of the basis of P7 is similar to that of *B. pilosa*, not to that of *B. sarsi*, which has more spiniform setae. The ischium of P7 is longer than that of *B. sarsi* and especially that of *B. pilosa*, and extends farther on the merus. The third uropod is very different to that of *B. pilosa* and *B. sarsi*. It is depressed in lateral view and not swollen (i.e. sausage-shaped) as in *B. pilosa* and *B. sarsi*; its first article is narrower and its second article longer; the outer setae of the first article are more numerous and much

longer; its second article has setae on both sides, whilst setae never occur on the outer side in *B. pilosa* and *B. sarsi*.

The material examined is unfortunately limited, consisting of a few females which include mature (some are ovigerous) but no full grown specimens (the spines of the exopod of the first uropod are all close to the tip). The palp of the maxilliped, the mesial side of the basis of P7, and the merus of P7 should be re-examined when larger specimens are available. The length and the number of segments in the antennae of adult males should be described when such specimens are found.

Bathyporeia ledoyeri sp. nov.

Figures 5-8

Material. TMU 12 494: a female (holotype), fully dissected and mounted, off Al Argoub (23°47'N 15°45'W), shell sand at 12 m depth, 2001, Coll. M. Menioui. TMU 12 595: 1 female (paratype), Etoile bay, 250 Km south of Dakhla, 0.5 m depth, 2003, Coll. M. Menioui.

Etymology. The species is dedicated to Michel Ledoyer who initiated the second author to marine benthos ecology and amphipod taxonomy. The name is a genitive.

Description.

Eye with well developed ommatidia in adults. Pseudorostrum with tip rather rounded (slightly angular), not overhanging, with 1 proximoventral plumose seta; with 4 well developed apical spines. Major flagellum of A1 with 6 articles; first article of accessory flagellum with 2 non-apical groups of spines. Anterior border of article 3 of peduncle of A2 with only one group of spinules and setae, in apical position; 4th article with slender apical and lateral spinules; flagellum with 7 articles. Ratio length / width of 4th article of A2: 2.7, of 5th article: 2.6.

Mandibular palp normal: penultimate and ultimate articles elongate.

Second article of maxilliped palp with about 5 strong setae on dorsal surface, all but one in a row; third article with longitudinal row of setae on dorsal side present (reduced to one seta), in addition to 2 transversal groups of anterior setae; outer plate with 4 nodular spines.

Coxa 1 not especially elongate, with tip rounded (but not broadly rounded), without ventral tooth or distinct notch, with 4 anterior and 3 ventral setae, without apical setule.

Coxa 2 without posterior tooth; transition between anterior and ventral border without distinct angular discontinuity; anterior border nearly straight (scarcely convex); anterior and posterior border parallel (not diverging downwards); ventral border with 8 moderately irregular-sized, strong setae of normal length; 1 mesial seta.

Coxa 3 without posterior tooth; anterior and posterior border subparallel; ventral border with 8 moderately irregular-sized strong setae, the longest ones of normal length; 2 mesial setae.

Coxa 4 with 12 moderately irregular-sized setae of normal size; posterior setae not setulose.

P1 propodus of normal proportions.

For P2 the ratios are: length / width of carpus: 2.7; propodus length / carpus length: 0.85.

P3 with carpal fang much shorter than propodus, distally very blunt and with accessory setule distinctly overreaching tip of fang; propodus of normal robustness; outer spines/setae of propodus 'normal' in number (7), size and shape; dactylus rather slender, with fairly short unguis, with posterior border straight. For P3 the ratios are:
propodus length / merus length: 0.79
dactylus length / propodus length: 0.34
dactylus length / merus length: 0.27
length / width of propodus: 5.1
length / width of dactylus: 4.3
unguis length / total length of dactylus: 0.18
unguis length / dactylus width: 0.78

P4 with carpal fang shorter than propodus, distally very blunt and with accessory setule slightly overreaching tip of fang; propodus robust; outer spines/setae of propodus 'normal' in number (8), size and shape; dactylus rather slender, with fairly short unguis, with posterior border straight. For P4 the ratios are:
propodus length / merus length: 0.73
dactylus length / propodus length: 0.36
dactylus length / merus length: 0.27
length / width of propodus: 3.8
length / width of dactylus: 3.7
unguis length / total length of dactylus: 0.15
unguis length / dactylus width: 0.57

P5 with median part of anterior border of basis straight; merus posteromedian seta group with one long and strong curved major seta and 1 short and slender accessory seta, which is non-setulose; posterodistal seta group with one long strong straight seta (slightly overreaching tip of carpus) and 2 setules; anterodistal area with 2 strong setae which are only plumose in their proximal part; longest posterior spine of carpus overreaching tip of propodus; ratio carpus + propodus / merus length: 0.78.

Posterodistal lobe of basis of P6 protruding and wide; anterior and posterior border strongly and regularly convex; anterior border with setae, the median ones being setulose. P6 merus with 4 posterior groups of spines and 6 anterior groups; longest seta of each anterior seta group of significantly increasing size from proximal towards distal part of merus; carpus without posterior spines (distal group not considered); propodus with 2 posterolateral and 2 anteromesial groups of spines (terminal crown of spines not considered). Spines of carpus and merus robust and long. Ratio length of propodus / anterior length of merus in P6: 0.69.

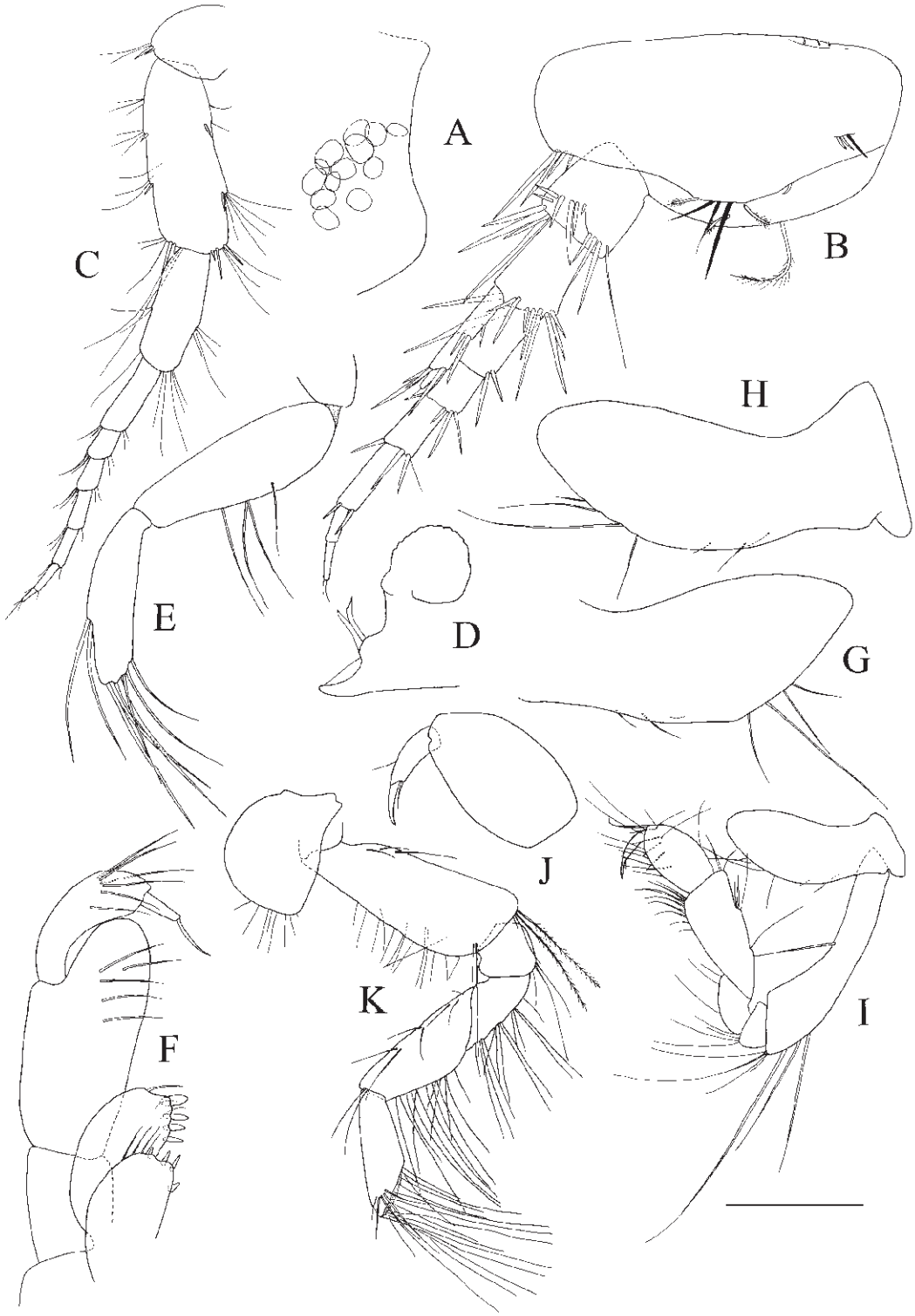

Figure 5. *Bathyporeia ledoyeri* sp. nov., female holotype, off Al Argoub. **A.** head (eye damaged). **B.** left A1. **C.** left A2. **D.** Mandible. **E.** mandibular palp. **F.** left Mxp. **G.** right coxa 1. **H.** left coxa 1. **I.** left P1. **J.** propodus and dactylus of left P1. **K.** left P2. Scale bar : D, E, F, G, H, J, 0.10 mm; A, B, 0.15 mm; C, I, 0.21 mm; K, 0.30 mm.

Figure 5. *Bathyporeia ledoyeri* sp. nov., holotype femelle, au large d'Al Argoub. **A.** tête (œil endommagé). **B.** A1 gauche. **C.** A2 gauche. **D.** Mandibule. **E.** palpe mandibulaire. **F.** Mxp gauche. **G.** coxa 1 droit. **H.** coxa 1 gauche. **I.** P1 gauche. **J.** propode et dactyle du P1 gauche. **K.** P2 gauche. Echelle : D, E, F, G, H, J : 0,10 mm ; A, B : 0,15 mm ; C, I : 0,21 mm ; K : 0,30 mm.

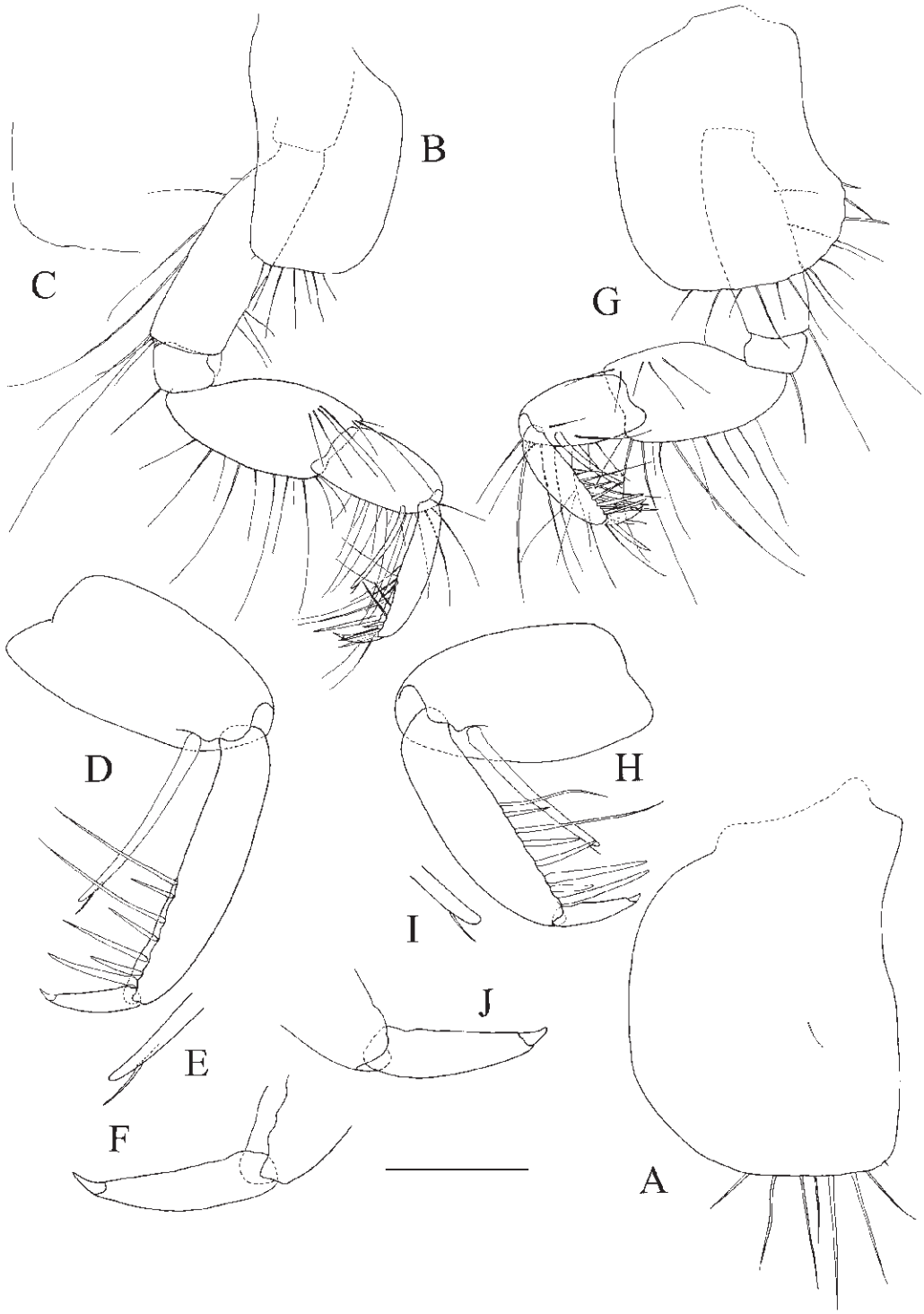

Figure 6. *Bathyporeia ledoyeri* sp. nov., female holotype. **A.** left coxa 2. **B.** right P3. **C.** posteroventral angle of right coxa 3. **D.** anterior part of right P3 (mesial spines/setae of propodus not shown). **E.** tip of carpal fang of right P3. **F.** dactylus of right P3. **G.** left coxa 4. **H.** anterior part of left P4 (mesial spines/setae of propodus not shown). **I.** tip of carpal fang of left P4. **J.** dactylus of left P4. Scale bar : E, F, I, J, 0.05 mm; A, C, D, H, 0.1 mm; B, G, 0.21 mm.

Figure 6. *Bathyporeia ledoyeri* sp. nov., holotype femelle. **A.** coxa 2 gauche. **B.** P3 droit. **C.** angle postéroventral du coxa 3 droit. **D.** partie antérieure du P3 droit (épines/soies mésiales du propode non illustrées). **E.** extrémité du croc carpien du P3 droit. **F.** dactyle du P3 droit. **G.** coxa 4 gauche. **H.** partie antérieure du P4 gauche (épines/soies mésiales du propode non illustrées). **I.** extrémité du croc carpien du P4 gauche. **J.** dactyle du P4 gauche. Echelle : E, F, I, J : 0,050 mm ; A, C, D, H : 0,1 mm ; B, G : 0,21 mm.

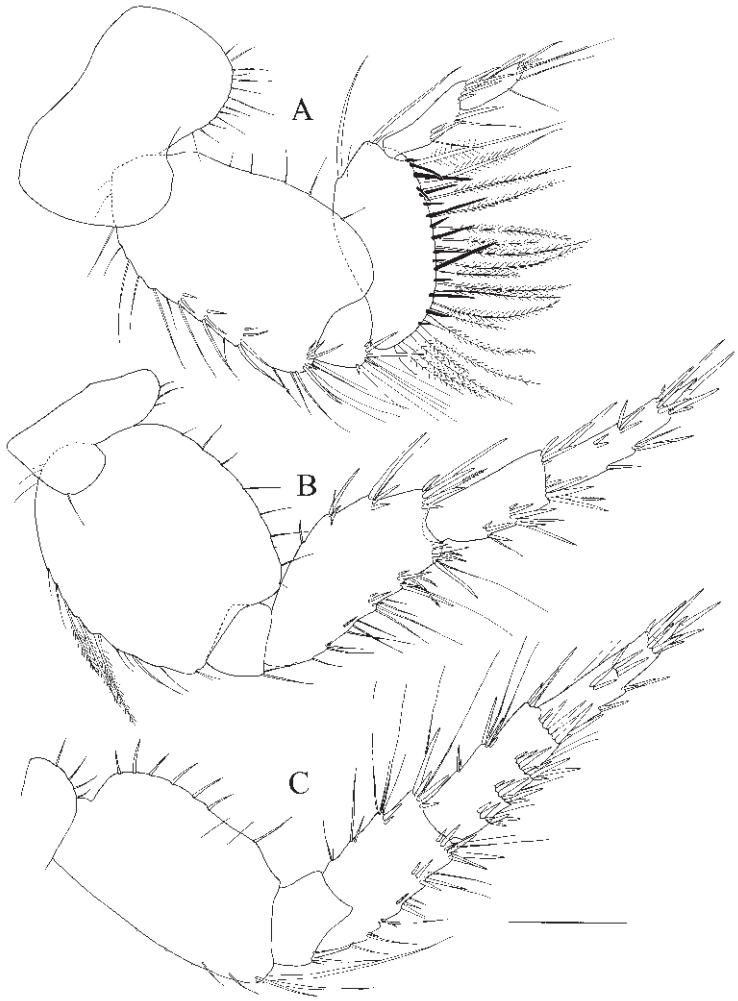

Figure 7. *Bathyporeia ledoyeri* sp. nov., female holotype. **A.** left P5. **B.** left P6. **C.** left P7. Scale bar : A, B, C, 0.21 mm.

Figure 7. *Bathyporeia ledoyeri* sp. nov., holotype femelle. **A.** P5 gauche. **B.** P6 gauche. **C.** P7 gauche. Echelle : A, B, C: 0,21 mm.

Posterior border of basis of P7 with proximal ornamentation neither very slender nor very robust (slender spines), distally with one long robust seta, total number of spines/setae: 7. Ischium rather short, reaching 0.33 of outer side of merus; anterodistal border weakly concave on outer side. Spines of carpus and merus robust and long. Ratio length / width of carpus: 2.5, of propodus: 3.5, ratio length of carpus / length of propodus: 1.1, ratio length of propodus + carpus / length of basis: 1.1.

Middle of posterior border of Ep1 and Ep2 bluntly angular and not produced in a well marked tooth.

Ep3 with posteroventral border regularly rounded, without posteroventral tooth, with 3 lateral spines, with 1 setule on posterior border and 1 setule on ventral border.

Urosomite 1, dorsally with one pair of anteriorly directed setae and one pair of posteriorly directed spines; ventrolateral border without strong setae arising from outer side.

Peduncle of uropod 1: outer dorsal border with 7 spines consisting of the following succession: 1) 5 regularly spaced short robust spines, of slightly and gradually increasing size towards tip, 2) a larger space followed by a penultimate short robust spine, 3) a very short space followed by a very strong ultimate spine; dorsomesial border with 4 single styliform spines, stronger distally. Endopod and exopod fairly short and robust; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines of normal robustness.

Peduncle of uropod 2: robust with dorsal ratio length / width = 2.0; outer dorsal border with 4 to 5 spines that are fairly long and robust; dorsomesial border with 3 non-grouped robust spines. Endopod and exopod fairly short and robust; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines rather robust and of normal length. Dorsal ratio length / width of endopod: 3.9.

Peduncle of uropod 3 with distal spines in normal number, the longest one overreaching endopod (endopodal spines excluded); outer border of peduncle of uropod 3 with 2 isolated setae of normal length. Endopod elliptic, with 2 spines. Exopod with first article moderately narrow and second moderately long. Second article of exopod with 2 lateral setae, both on mesial side [setae rubbed off but insertion scar very distinct]. Mesial side of exopod (first and second article together) with 10 [2 distalmost = rubbed off] long plumose setae of normal morphology and no accessory spiniform non-setulose setae, almost all plumose setae much longer than the longest setae of the outer side. Outer side of exopod with 4 groups of 2-4 spiniform setae, the longest longer than exopod width. For uropod 3 the ratios are:

length / width of second article of exopod: 3.4
length of second article / length of 1st article: 0.34
length of second article / width of 1st article: 1.5
length of second article of exopod / length of endopod: 1.2

Lobes of telson without setae on mesial border; tip of lobes truncated, all apical spines arising from the same level; apical border with 3 spines and 1 spinule on each side, and 1 seta on right side; 2 or 3 outer spines on each side, the longest considerably overreaching telson lobes.

Size. Size unrecorded before dissection. Total length of holotype presumably about 4 mm.

Ecology and distribution. Only known from the area of Al Argoub, Atlantic North Africa. Shallow sublittoral.

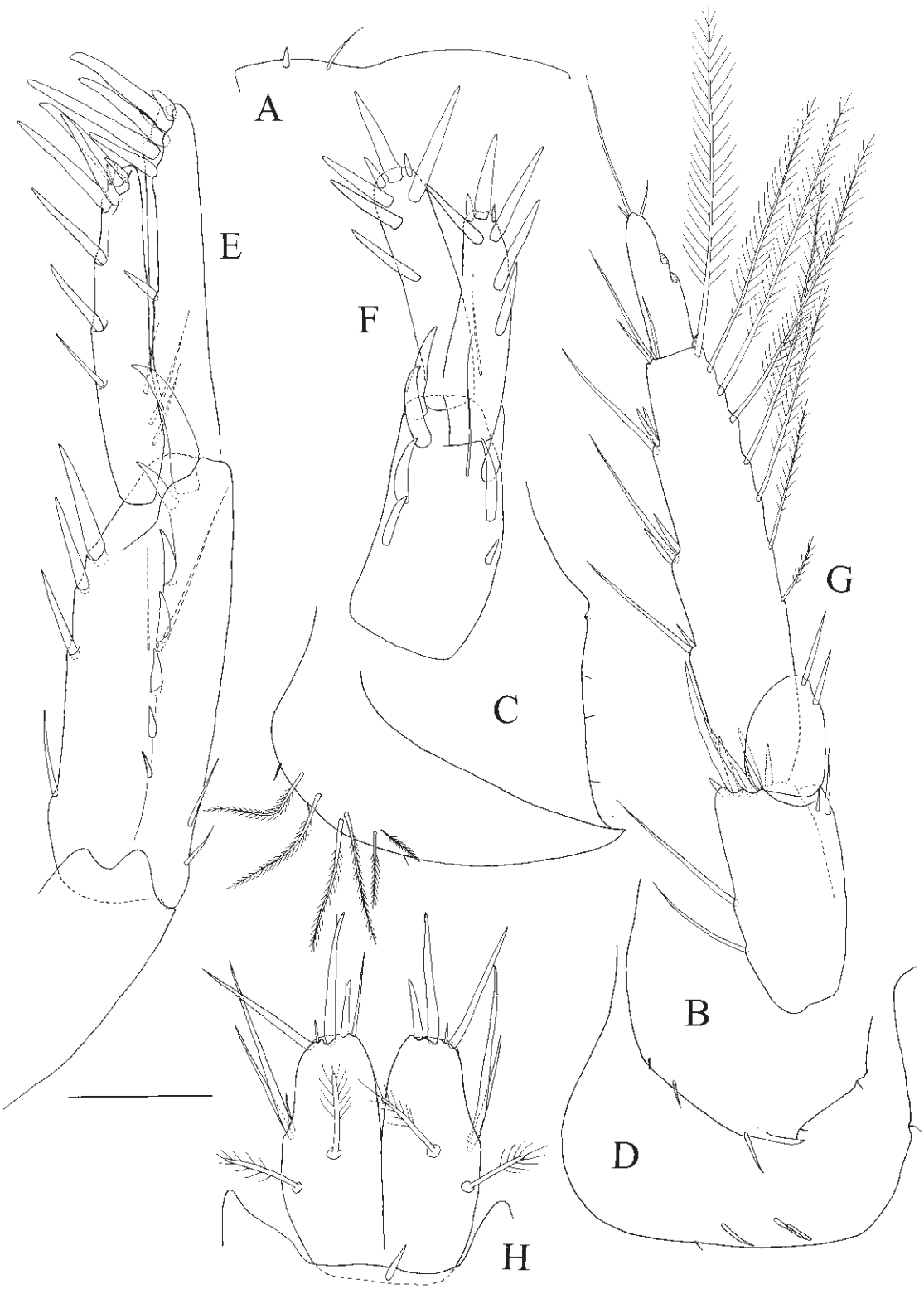

Figure 8. *Bathyporeia ledoyeri* sp. nov., female holotype. **A.** dorsal part of urosomite 1 (right side). **B.** left Ep1. **C.** left Ep2. **D.** left Ep3. **E.** left U1. **F.** right U2. **G.** right U3. **H.** telson. Scale bar : E, F, G, H, 0.1 mm; A, B, C, D, 0.14 mm.

Figure 8. *Bathyporeia ledoyeri* sp. nov., holotype femelle. **A.** partie dorsale de l'urosomite 1 (côté droit). **B.** Ep1 gauche. **C.** Ep2 gauche. **D.** Ep3 gauche. **E.** U1 gauche. **F.** U2 droit. **G.** U3 droit. **H.** Telson. Echelle : E, F, G, H : 0,10 mm ; A, B, C, D : 0,14 mm.

Remarks

Bathyporeia ledoyeri sp. nov. is closely related to *B. sarsi* but exhibits significant differences. The pseudorostrum of *B. ledoyeri* sp. nov. is more rounded (or less angular) than that of *B. sarsi* and it is not overhanging. The tip of its first coxal plate is less broad in *B. ledoyeri* sp. nov. than in *B. sarsi*. The coxa 2 of *B. ledoyeri* sp. nov. has no angular discontinuity on its anteroventral corner whilst such a discontinuity is present in *B. sarsi*. The dactyli of P3-P4 of *B. ledoyeri* sp. nov. are more slender than in *B. sarsi*, reminding those of *B. pelagica* (Bate, 1856). The posterior border of the basis of P6 is more convex in *B. ledoyeri* sp. nov. than in *B. sarsi*. The first urosomite of *B. sarsi* has only a pair of anteriorly directed setae, whilst *B. ledoyeri* sp. nov. also has a pair of posteriorly directed spines, this difference being the most clear-cut one. The third uropod of *B. ledoyeri* sp. nov. is narrower, with a longer second article and longer outer spines than in *B. sarsi*. *B. ledoyeri* sp. nov. has been collected below tide marks on an open coast, whilst in such habitats, *B. sarsi* is only found high on the shore (Vader, 1965). Comparison with other related species is given below, in the key of *Bathyporeia* with bifurcated carpal fang.

Bathyporeia microceras sp. nov.

Figures 9-12

Material. TMU 12 495: 1 mature male (holotype), fully dissected and mounted, bay of Dakhla, 23°47'N, 6 m depth, sand fairly rich in organic matter, Coll. M. Menioui. ISR Bat 5: 1 juvenile (presumably female), fully dissected and mounted, bay of Dakhla, 23°47'N, 6 m depth, sand fairly rich in organic matter, Coll. M. Menioui.

Etymology. *microceras* is the combination of the Greek prefix μκρο = small, and the Greek noun κεραζ = horn : allusion to the very short antennae of the mature male. It is a noun in apposition.

Description of the holotype (male)

Eye with well developed ommatidia in adults. Pseudorostrum with tip rounded and narrow, not overhanging, with 1 proximoventral plumose seta; with only 3 short apical spines. Major flagellum of A1 with 7 articles (last two together much shorter than the antepenultimate); first article of accessory flagellum with 2 non-apical groups of spines. Flagellum of A1 quite long (combined length of major flagellum and 2 distal articles of peduncle twice as long as pseudorostrum). Anterior border of article 3 of peduncle of A2 with 2 groups of spinules and setae: an apical group of 2 setae and one median spiniform seta; 4th article with slender apical and lateral spinules; flagellum with only 5 articles, and much shorter than body. Ratio length / width of 4th article of A2: 3.3, of 5th article: 3.2.

Mandibular palp with penultimate article elongate, with distal article remarkably broad (at least in the mature male). The anterior comb of stiff setae (typical of male *Bathyporeia*) consist of only 4 setae which are restricted to the distal third of the distal article.

Second article of maxilliped palp with only 2 strong setae on dorsal surface; third article with only 1 seta, on dorsal side; outer plate with 3 nodular spines.

Coxa 1 with tip broadly rounded, without ventral tooth or distinct notch, with 2 short anterior setae, without apical setule.

Coxa 2 with well developed posterior tooth; transition between anterior and ventral border with distinct angular discontinuity; anterior border straight; anterior and posterior border parallel; ventral border with 6 setae (5 regular-sized, strong setae of normal length setae + 1 small seta in tooth notch); no mesial setae.

Coxa 3 with well developed posterior tooth; anterior and posterior border parallel; ventral border with 5-6 setae (4-5 regular-sized strong setae of normal length + 1 small seta in tooth notch); no mesial setae.

Coxa 4 with 7 marginal setae; posterior seta strong and non setulose.

P1 propodus of normal proportions.

Ratio length / width of carpus of P2: 3.0; ratio propodus length / carpus length: 0.80.

P3 with carpal fang about as long as propodus, distally styliform and without accessory setule; propodus slender; outer spines/setae of propodus few in number (4-5), of normal size and shape; dactylus rather long, slender, with long unguis, with posterior border distinctly and regularly concave. For P3 the ratios are:

propodus length / merus length: 0.81
dactylus length / propodus length: 0.48
dactylus length / merus length: 0.39
length / width of propodus: 4.8
length / width of dactylus: 5.6
unguis length / total length of dactylus: 0.42
unguis length / dactylus width: 2.4

P4 with carpal fang slightly shorter than propodus, distally styliform and without accessory setule; propodus slender; outer spines/setae of propodus few in number (4), of normal size and shape; dactylus rather long, slender, with long unguis, with posterior border distinctly and regularly concave. For P4 the ratios are:

propodus length / merus length: 0.84
dactylus length / propodus length: 0.50
dactylus length / merus length: 0.42
length / width of propodus: 4.4
length / width of dactylus: 4.7
unguis length / total length of dactylus: 0.47
unguis length / dactylus width: 2.2

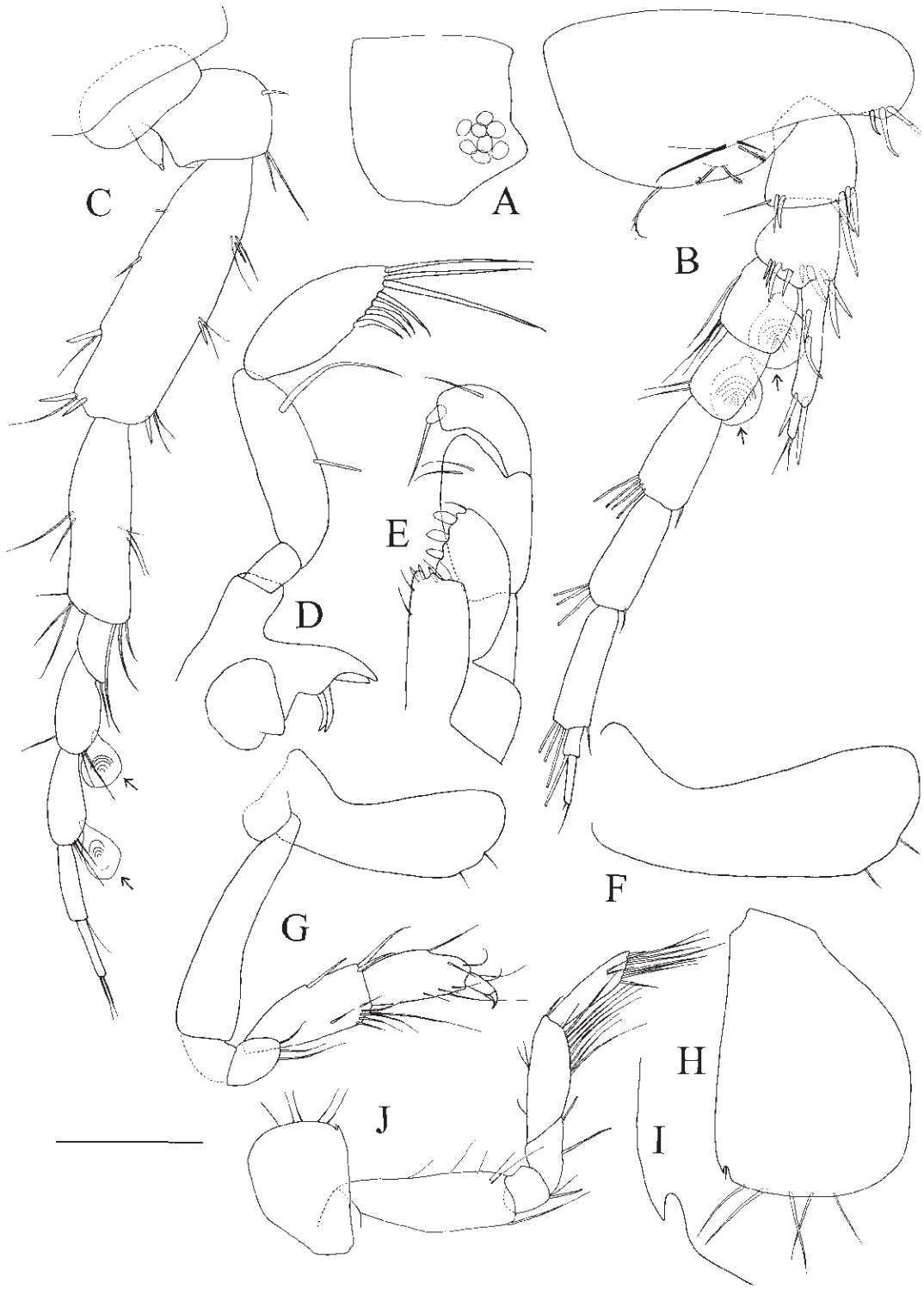

Figure 9. *Bathyporeia microceras* sp. nov., male holotype, Bay of Dakhla. **A.** head. **B.** right A1. **C.** right A2. **D.** left Md. **E.** right Mxp. **F.** right coxa 1. **G.** left P1 (mesial view). **H.** right coxa 2. **I.** posteroventral angle of right coxa 2. **J.** right P2. Scale bar : A, J, 0.2 mm; B, C, G, H, 0.1 mm; D, E, F, 0.07 mm; I, 0.025 mm.

Figure 9. *Bathyporeia microceras* sp. nov., holotype mâle, Baie de Dakhla. **A.** tête. **B.** A1 droite. **C.** A2 droite. **D.** Md gauche. **E.** Mxp droit. **F.** coxa 1 droit. **G.** P1 gauche (vue mésiale). **H.** coxa 2 droit. **I.** angle postéroventral du coxa 2 droit. **J.** P2 droit. Echelle : A, J : 0,2 mm; B, C, G, H: 0,1 mm ; D, E, F : 0,07 mm ; I : 0,025 mm.

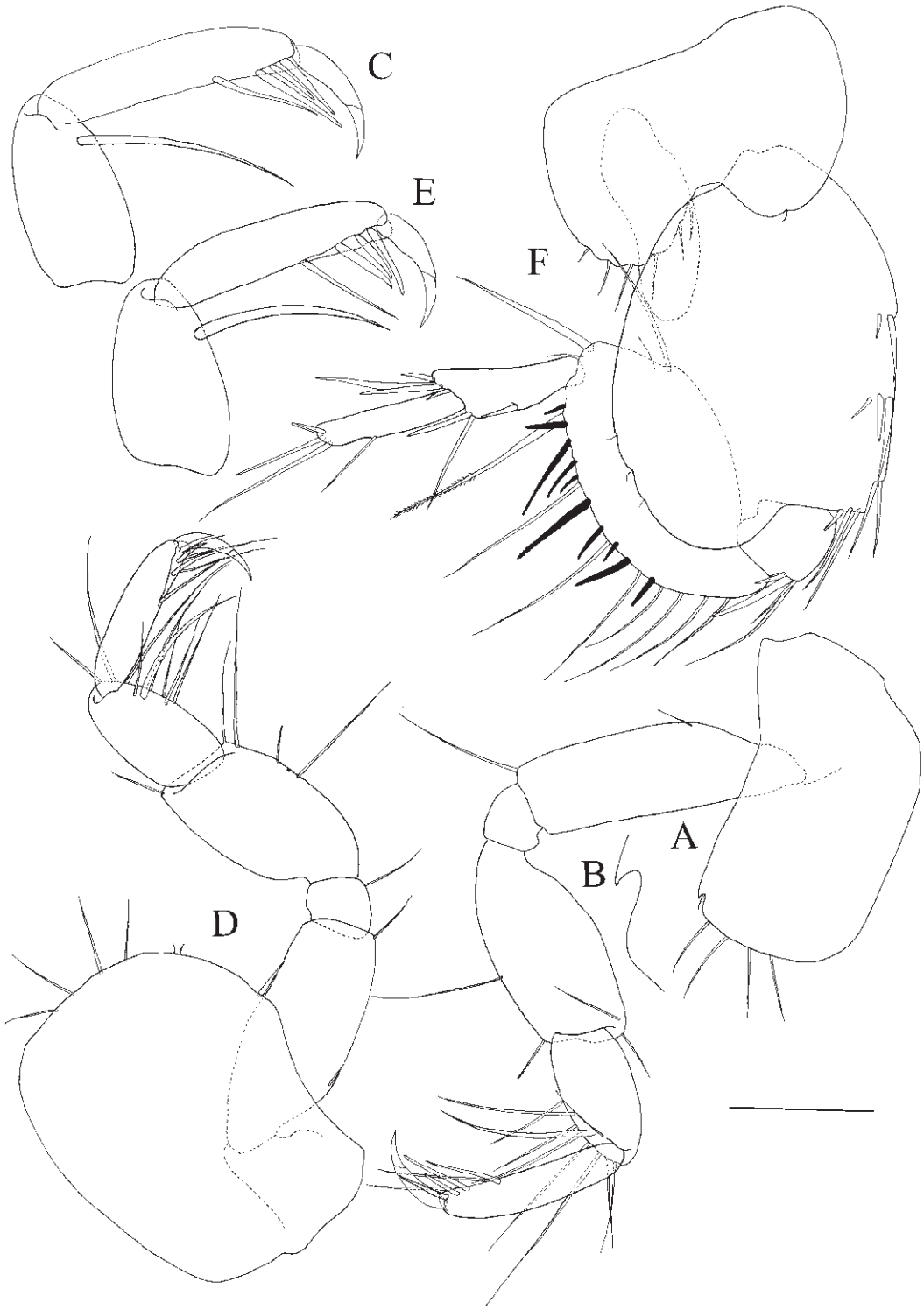

Figure 10. *Bathyporeia microceras* sp. nov., male holotype. **A.** right P3. **B.** posteroventral angle of right coxa 3. **C.** anterior part of right P3 (mesial spines/setae of propodus not shown). **D.** right P4. **E.** anterior part of right P4 (mesial spines/setae of propodus not shown). **F.** right P5. Scale bar : A, D, F, 0.1 mm; C, E, 0.07 mm; B, 0.025 mm.

Figure 10. *Bathyporeia microceras* sp. nov., holotype mâle. **A.** P3 droit. **B.** angle postéroventral du coxa 3 droit. **C.** partie antérieure du P3 droit (épines/soies mésiales du propode non illustrées). **D.** P4 droit. **E.** Partie antérieure du P4 droit (épines/soies mésiales du propode non illustrées). **F.** P5 droit. Echelle : A, D, F: 0,1 mm ; C, E : 0,07 mm ; B : 0,025 mm.

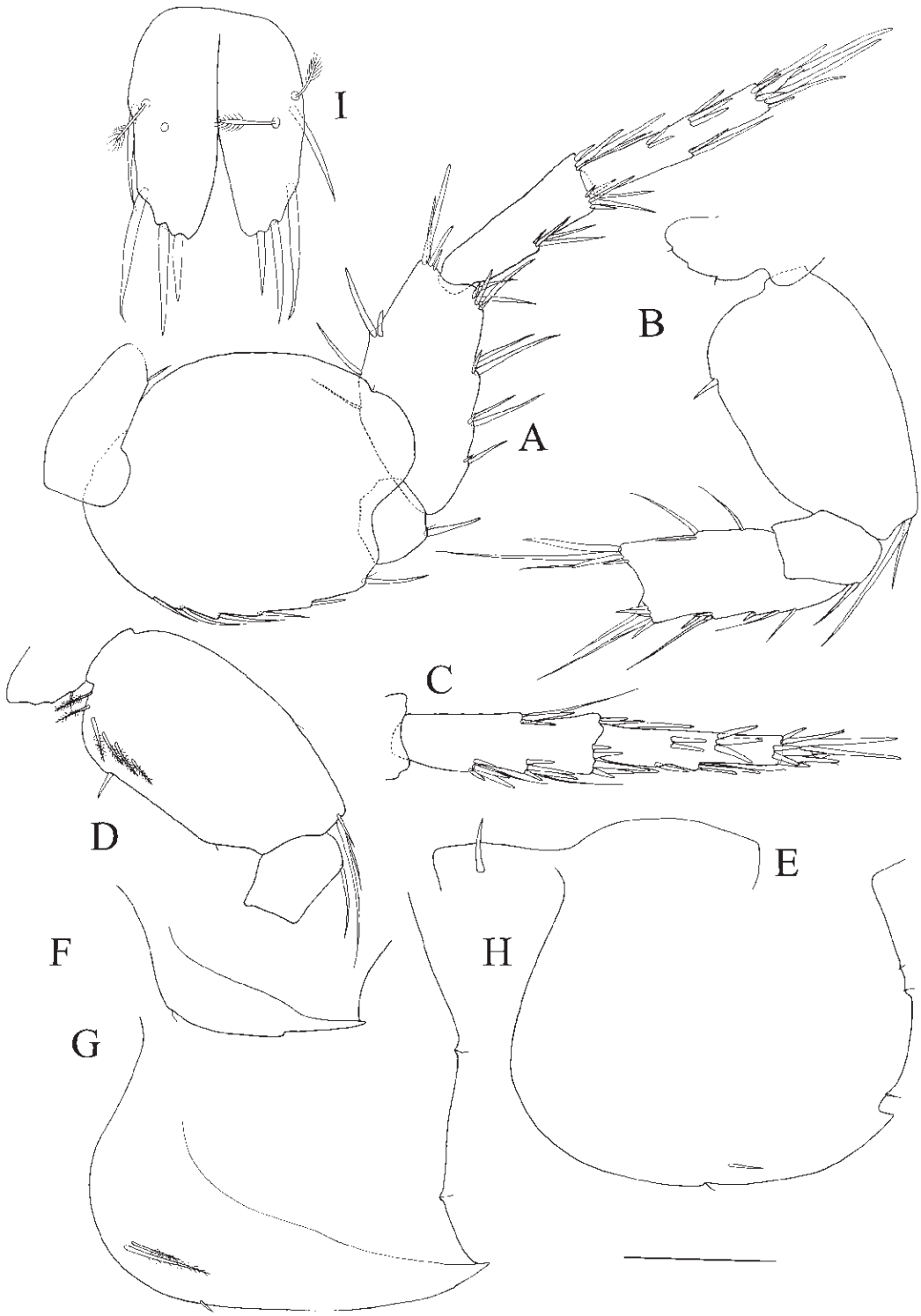

Figure 11. *Bathyporeia microceras* sp. nov., male holotype. **A.** left P6. **B.** proximal part of right P7 (outer view). **C.** distal part of left P7 (outer view). **D.** proximal part of left P7. **E.** dorsal part of urosomite 1 (right side). **F.** right Ep1. **G.** right Ep2. **H.** right Ep3. Scale bar: A, B, C, D, 0.14 mm; E, F, G, H, 0.1 mm; I, 0.07 mm.

Figure 11. *Bathyporeia microceras* sp. nov., holotype mâle. **A.** P6 gauche. **B.** partie proximale du P7 droit (vue externe). **C.** partie distale du P7 gauche (vue externe). **D.** partie proximale du P7 gauche. **E.** Partie dorsale de l'urosomite 1 (côté droit). **F.** Ep1 droite. **G.** Ep2 droite. **H.** Ep3 droite. Echelle : A, B, C, D : 0,14 mm ; E, F, G, H : 0,1 mm ; I : 0,07 mm.

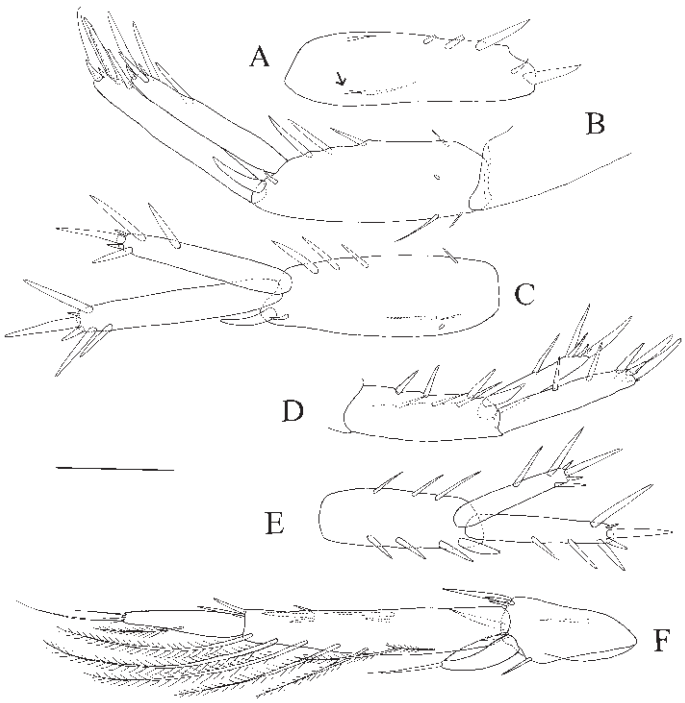

Figure 12. *Bathyporeia microceras* sp. nov., male holotype. **A.** peduncle of left U1 in dorsal view (proximal part on left side of the drawing). **B.** right U1 in lateral view. **C.** reconstruction of right U1 in dorsal view (width of articles not accurate). **D.** left U2 in lateral view. **E.** reconstruction of left U2 in dorsal view (width of articles not accurate). **F.** right U3 in ventral view (the exopod and endopod are broader than illustrated since they have an oblique orientation on the microscopical preparation). Scale bar : A to F, 0.1 mm.

Figure 12. *Bathyporeia microceras* sp. nov., holotype mâle. **A.** pédoncule de U1 gauche en vue dorsale (partie proximale sur la partie gauche du dessin). **B.** U1 droit en vue latérale. **C.** reconstruction de U1 droit en vue dorsale (largeur des articles non reconstruite avec précision). **D.** U2 gauche en vue latérale. **E.** reconstruction de U2 gauche en vue dorsale (largeur des articles non reconstruite avec précision). **F.** U3 droit en vue ventrale (l'exopodite et l'endopodite sont plus larges que sur le dessin car ils ont une orientation oblique sur la préparation microscopique). Echelle : de A à F: 0,1 mm.

P5 with median part of anterior border of basis convex; merus posteromedian seta group with one long and strong curved major seta and 1 short and slender accessory seta, which is non-setulose; posterodistal seta group with one long and very strong straight seta (nearly reaching tip of carpus) and 1 setule; anterodistal area with 1 denticulate seta; anterior border of merus sparsely spiny and sparsely setose; carpus robust, with ratio length of posterior border / maximal perpendicular width: 2.9; longest posterior spine of carpus reaching tip of propodus; ratio carpus + propodus / merus length: 0.92.

P6 with posterodistal lobe of basis protruding and very wide; both anterior and posterior border strongly and regularly convex (the basis is nearly circular); anterior border with spines which appears as non setulose on microscopical preparations. P6 merus with 4 posterior groups of spines/setae and 4 anterior groups; longest seta of each anterior seta group not of significantly increasing size from proximal towards distal part of merus; carpus without posterior spines (distal group not considered); propodus with 2 posterolateral and 1 anteromesial groups of spines (terminal crown of spines not considered). Spines of carpus and merus robust and long. Ratio length of propodus / anterior length of merus: 0.84.

P7 with only one short and robust spine, in proximal position on posterior border of basis. Ischium very short, reaching 0.29 of outer side of merus; anterodistal border scarcely concave on outer and on mesial side; posterodistal border straight both on outer and mesial side. Spines of carpus and merus robust and long. Ratio length / width of carpus: 3.2, of propodus: 4.9, ratio length of carpus / length of propodus: 1.1, ratio length of propodus + carpus / length of basis: 1.3.

Ep2 with middle of posterior border bluntly angular and not produced in a tooth; Ep2 with very reduced pilosity.

Ep3 with posteroventral border rounded, with a well developed posteroventral tooth followed by a notch, with only one spine on lateral surface, with 1 setule on ventral border and 3 setules on posterior border (i.e. a normal number).

Urosomite 1, dorsally with one pair of anteriorly directed setae (which are quite short and strong) and no posteriorly directed spines; ventrolateral border without strong setae arising from outer side.

Peduncle of uropod 1: outer dorsal border with 3 spines consisting of the following succession: 1) 1 short and rather slender proximal spine, 2) a large space followed by a penultimate short spine, 3) a very short space followed by a very strong ultimate spine; dorsomesial border with 4 isolated styliform spines; outer ventral border with only 2 spiniform setae. Endopod and exopod of normal length and robustness; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines of rather robust.

Peduncle of uropod 2: of normal robustness, outer dorsal border with 4 spines of normal length and robustness; dorsomesial border with 3 non-grouped long slender spines. Endopod and exopod of normal length and robustness; endopod with border facing exopod, with only one long spine, in subdistal position. Endopod and exopod spines of normal length and robustness.

Peduncle of uropod 3 with few distal spines: 2 dorsal and 3 ventral (dorsal and ventral spines forming 2 well separated groups), the longest ones reaching the length of the endopod; outer border of peduncle of uropod 3 with a single and not so

long spiniform seta. Endopod with a unique seta, in apical position. Exopod with first article narrow and second very long. Second article of exopod with 1 lateral seta, on mesial side. Mesial side of exopod (first and second article together) with 8 long plumose setae and no accessory spiniform non-setulose setae, almost all plumose setae much longer than the longest setae of the outer side. Outer side of exopod with 3 groups of 2 to 3 spiniform setae, the longest slightly longer than exopod width. For uropod 3 the ratios are:
length / width of second article of exopod: 5.0
length of second article / length of 1st article: 0.47
length of second article / width of 1st article: 2.7
length of second article of exopod / length of endopod: 1.5
(measurements including widths not very accurate, because the uropod has a somewhat oblique orientation on the microscopical preparation)

Lobes of telson without setae on mesial border; tip of lobes narrow (not truncated); no discontinuity at the junction between the apical and outer border : apical + outer border forming a quite regular curve; apical border of each lobe with 3 spines, without setae and spinules; a single outer spine on each side, not reaching tip of telson lobes.

Morphology of the juvenile
Very similar to the adult male. A1 major flagellum shorter than in male, with 5 articles; combined length of major flagellum and 2 distal articles of peduncle 1.5 as long as pseudorostrum. A2 flagellum with 3 articles only. Coxa 1 with 3 short anterior setae, coxa 2 with 8 setae, coxa 3 with 9 setae, coxa 4 with 10 setae. Basis of P6 with a protruding posterodistal lobe. Outer dorsal border of peduncle of first uropod with 5 spines consisting of the following succession: 1) 3 regularly spaced short spines, 2) a penultimate short spine, 3) a very short space followed by a very strong ultimate spine. Uropod 3: second article without lateral setae; mesial side of first article with 2 setae; outer side with 3 groups of 2 spines.

Size of holotype. Not precisely recorded before dissection, but its is a very small specimen with a total length less than 3 mm.

Ecology and distribution. Only known from the bay of Dakhla, Atlantic North Africa, at 6 m depth.

Remarks
Despite its very small size, the holotype male of *Bathyporeia microceras* sp. nov. is definitely a mature specimen. Indeed, it has calceoli on the flagella of its 2 pairs of antennae and it has a comb of lateral short stiff setae on the ultimate segment of its mandibular palp, these two characters being found only in the mature male of *Bathyporeia* (d'Udekem d'Acoz, in press).

Bathyporeia microceras sp. nov. exhibits a unique combination of characters and its identification should not be problematic. Like *Bathyporeia gracilis* G.O. Sars, 1891 (Watkin, 1938; Vader, 1970), *B. parkeri* Bousfield, 1973 and an undescribed species from South Africa (unpublished observations by the first author), the mature male of *B. microceras* sp. nov. has short second antennae, whilst in most species the second antennae of males dramatically increase in length after the moult of puberty (Bonnier, 1890; d'Udekem d'Acoz, in press). However, the mature males of no other species has second antennae as short as in *B. microceras* sp. nov. With its broad distal segment and its reduced number of lateral stiff setae, the mandibular palp is different from that of any other known Eastern Atlantic species, but interestingly is similar to that of the American species *B. parkeri* (unpublished observations by the first author). The dentition of the coxal plates (coxa 1 toothless; coxa 2 and 3 with a tooth) is rather similar to that of *B. pelagica*, *B. gracilis*, *B. tenuipes* Meinert, 1877 and *B. lindstromi* Stebbing, 1906. Of all known *Bathyporeia* species, *B. microceras* sp. nov. is the one which has the most reduced ornamentation on the posterior border of the basis of P7: one spine only. That reduction can partly, albeit not entirely, be attributed to the small size of the species. The occurrence of a tooth followed by a notch on the third epimeral plate is shared with *B. quoddyensis* Shoemaker, 1949, *B. parkeri*, and most specimens of *B. pelagica* and *B. guilliamsoniana* (Bate, 1857). On the other hand the ornamentation of the surface of the third epimeral plate is remarkably reduced. The absence of posteriorly directed spines on the dorsal side of the first urosomite is shared with several unrelated *Bathyporeia* species and this character has probably not so much evolutionary significance. The normal ornamentation of the outer dorsal part of the peduncle of the first uropod should be confirmed when more specimens are available. The second article of the third uropod is remarkably long, and finally the non-truncated tip of the telson lobes is unique within the genus. The co-occurrence of some characters in *B. microceras* sp. nov. and in the American *Bathyporeia*, *B. parkeri* and *B. quoddyensis* is interesting since the last two species exhibit many characters not found in any other species, and have possibly diverged early from the stem of the genus.

Although the study of the genus *Bathyporeia* is in progress, much remains to be done, and there are several undescribed species in South Africa and at least one in the Mediterranean Sea. As a consequence, it is much too early to give a general key of the genus. However, a key restricted to the already described species with a two-branched carpal fang is given here, since the understanding of that group has significantly been improved with the present study. Note by the way that material of *B. pseudopelagica* Bellan-Santini & Vader, 1988 and *B. phaiophthalma* Bellan-Santini, 1973 has been examined by the first author. The carpal fang of those Mediterranean forms is entire and narrow, as in

B. microceras, hence those three species are not included in the key.

Key to the Northeastern Atlantic *Bathyporeia* with a bifurcate carpal fang.

1.- Coxae 2-3 without posterior tooth. Carpal fang with a broad blunt tip and a accessory subdistal setule; posteroventral border of Ep3 always rounded and toothless; 2

- Coxae 2-3 with small posterior tooth separated from coxal plate by a shallow notch. Tip of carpal fang consisting of 2 narrow branches with an acute tip; posteroventral border of Ep3 with a small tooth in females and immature males (often without a tooth in adult males); ..... *Bathyporeia pelagica* (Bate, 1856)

2.- Dactylus of P3-P4 short or fairly short, with posterior margin straight or convex and with short unguis 3

- Dactylus of P3-P4 long, with posterior margin concave and with long unguis ..... *Bathyporeia elkaimi* sp. nov.

3.- Dactylus of P3-P4 stout, with posterior margin convex; urosomite 1 with a pair of anteriorly directed setae and usually without posteriorly directed spines (estuarine *B. pilosa* rarely have a pair of posteriorly directed spines; such specimens are usually males); second segment of third uropod shorter than width of first segment 4

- Dactylus of P3-P4 moderately robust, with posterior margin straight; urosomite 1 with a pair of anteriorly directed setae and a pair of posteriorly directed spines; second segment of third uropod longer than width of first segment ..... *Bathyporeia ledoyeri* sp. nov

4.- Apex of pseudorostrum regularly rounded and very narrow; tip of coxa 1 fairly narrow; subdistal setule of carpal fang about as long as tip of fang; P5 merus posteromedian group of setae consisting of 1 major glabrous seta and 1 (rarely 2) long very plumose accessory seta; basis of P7 with narrow setae on posterior border in females; ventrolateral part of first urosomite never with strong outer setae ..... *B. pilosa* Lindström, 1855

- Apex of pseudorostrum subrectangular and always broad in females, more rounded and fairly narrow (i.e. much less characteristic) in males; tip of coxa 1 broadly rounded; subdistal setule of carpal fang much longer than tip of fang; P5 merus posteromedian group of setae consisting of 1 major glabrous seta and 1 to 2 very short setae which are sparsely setulose or appears as non-setulose on microscopical preparations; basis of P7 with spines on posterior border in females; ventrolateral part of first urosomite often with 1 or several short strong outer setae ..... *B. sarsi* Watkin, 1938

Distribution

Bathyporeia pelagica: NW Europe, as far south as Portugal, usually at the level of the middle of the shore, sometimes subtidally.

Bathyporeia elkaimi sp. nov.: North Africa, around 34°N, in estuaries.

Bathyporeia ledoyeri sp. nov.: North Africa, around 24°N, shallow subtidal, on open coasts.

Bathyporeia pilosa: NW Europe, as far south as the bay of Biscay, at various depths in brackish waters, and very high on the shore in open habitats.

Bathyporeia sarsi: NW Europe, as far south as Portugal, at various depths in estuaries, and high on the shore in open habitats.

Discussion

The current and previous records of *Bathyporeia* along the Atlantic coasts of North Africa, as well as their distribution patterns deserve a brief discussion. The biogeographical analysis of the Moroccan marine macrozoobenthos carried out by Bitar (1987) and Menioui & Ruffo (1988) has demonstrated that the Lusitanian and Boreolusitanian components largely predominate in the area, as much as 64% of the species belonging to those groups. A careful examination of literature has shown that so far, four pontoporeiid amphipods only have been recorded in Morocco: *Bathyporeia guilliamsoniana, B. pilosa* Lindström, 1855, *B. pelagica* (see Elkaïm, 1974; Bayed, 1991) and *B. elegans* Watkin, 1938 (see Elkaïm, 1976a). *B. guilliamsoniana, B. pelagica* and *B. pilosa* have been recorded almost all along the Moroccan coast, from Tanger to Tarfaya, whilst *B. elegans* has been recorded from the Bou Regreg estuary only. However, the accuracy of these identifications is highly questionable, except for the boreolusitanian *B. guilliamsoniana*, which has been collected by ourselves.

Until recently most *Bathyporeia* species were known by so poor and incomplete descriptions that it was impossible to carry out any serious (i.e. critical) identification in such insufficiently investigated areas. In other words it was often impossible to decide if the material at hand belonged to already described species or to new ones. As shown in the present paper, such new species indeed exist, and some of them are so closely related to European ones that confusions almost undoubtedly resulted in the past. On the other hand, there is no literature record of the group *tenuipes*, off North Africa. Since that group of ill-defined *Bathyporeia* species had been recorded both further north and further south, its occurrence off the North-African coast seemed likely. And indeed we have found a few such specimens, although specific identification has not yet been possible. Furthermore due to the scanty character of the current investigations in the warm-temperate Eastern Atlantic, it is not ruled out that additional new *Bathyporeia* species do exist in North Africa or even in the south of the Iberian

Peninsula. That problem should always be borne in mind when carrying out identifications of specimens from that area. Actually, it is currently impossible to draw even a general picture of the warm-temperate Atlantic *Bathyporeia* fauna. However that negative picture could soon belong to the past, as a consequence of ongoing field investigations and increasing descriptive effort.

On the other hand, the abundance of *B. pelagica* and *B. sarsi* along the European Atlantic coasts down to the Iberian Peninsula (d'Udekem d'Acoz, in press) and their absence in the Mediterranean (Bellan-Santini, 1989) as well as the lack of reliable data from Morocco (they were not present in any of our own samples) suggest the existence of a physical boundary, preventing the dispersal of those species towards the Mediterranean Sea and the Moroccan Atlantic coast. The Mediterranean too includes some fairly common *Bathyporeia* species such as *B. phaiophthalma*, which have not been recorded in the Atlantic (Bellan-Santini, 1989) and are possible Mediterranean endemics. Some physico-chemical studies such as those of Lacombe (1971) and Fiuza et al. (1982) and biological analysis (Almaça, 1985; Menioui & Ruffo, 1988; Menioui, 1992) have indeed demonstrated the existence of a true biogeographical barrier (Cape Sines in southwestern Portugal) limiting the dispersal of Mediterranean and Moroccan species northwards, and inversely the southwards dispersal of a number of northern species. Of course, each species has its own physiological tolerance and therefore the limits of range may vary from species to species even within the same biogeographical group. However the Southwest of Portugal is clearly a zone of faunistical divergence (d'Udekem d'Acoz, 1999), and Marques & Bellan-Santini (1990) consider the Portuguese coast as a transition zone between the Mediterranean and the north-western European faunal assemblages. The same papers (and many others) have also stressed the existence of a second biogeographical threshold just north of the Mauritanian boundary, i.e. far south from the area where our new species have been collected. On the basis of those physico-chemical and biological data, it is currently impossible to make precise assumptions concerning the geographical range of the three new *Bathyporeia* species, and the genuine southern range extension of most European species also remains to be determined with precision.

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