The Caprellidea (Crustacea: Amphipoda) from Ceuta, North Africa, with the description of three species of Caprella, a key to the species of Caprella, and biogeographical discussion

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The caprellidean fauna of Ceuta, located on the North African side of the Strait of Gibraltar, was studied with regard to species composition and biogeographical characteristics. A new species, Caprella ceutae n. sp. is described and compared with the closest species of this genus, C. equilibra and C. fretensis. Furthermore, two species, C. tuberculata and C. liparotensis are redescribed in detail. Of the nineteen species collected, three are recorded for the first time in the Mediterranean Sea, i.e. C. fretensis, C. erethizon and C. tuberculata. With regard to biogeographical distribution, the Strait of Gibraltar has a very high proportion of endemic species of the Caprellidea, contributing 30.8% of the Mediterranean endemisms. A key to the 13 species of Caprella from the region of Ceuta is also provided.

KEYWORDS: Amphipoda, Caprellidea, Caprella, taxonomy, biogeography, Ceuta.

Introduction

Although the caprellidean amphipods are considered to be very important as secondary and tertiary producers in benthic marine communities, they have not been sufficiently studied in the Mediterranean Sea. Most general amphipod studies have been focused mainly on gammarids and only little supplementary information is given about caprellids (Nicolaidou and Karakiri, 1989; Conradi et al., 1997; Procaccini and Scipione, 1992; Conradi and López-González, 1999). Moreover the amphipod fauna of the North African coast has still been relatively unexplored, except for scarce and very fragmented data. Following research on North African

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amphipods conducted up to the beginning of the twentieth century (Lucas, 1849; Chevreux, 1888, 1910, 1911; Schellenberg, 1928, 1936) and Mayer's monographs (Mayer, 1890, 1903), a long interval ensued until the recent work of Bakalem and Dauvin (1995), carried out on the Argelian coast, and our previous work on Ceuta (Guerra-García and Takeuchi, 2000).

Material and methods

This study was conducted at Ceuta (Northern Africa), during the summers of 1998 and 1999. Caprellids, together with their natural substrata, mainly algae and hydroids, were collected by SCUBA diving at 23 localities along different depths (A, 5–15 m; B, 20–25 m; C, 30–35 m; D, 40–45 m) (figure 1). These substrata were collected in plastic bags containing seawater. In addition to SCUBA diving collection, soft bottom samples were taken with box-core and Van Veen grabs at 10 localities (figure 1). The sediment samples were sieved using a 0.5 mm mesh. Caprellids were separated, sorted, preserved in a 10% seawater-formol solution and then identified to species level and counted.

Results

A total of 1051 specimens was examined and grouped into 19 different species of caprellids (table 1).

The dominant species collected from the hard bottom samples were
Table 1. Species composition of the Caprellidea from Ceuta and number of specimens studied.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hard bottom</th>
<th>Soft bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Caprella acanthifera Leach, 1814</td>
<td>91</td>
<td>9.7</td>
</tr>
<tr>
<td>C. cavedinae Krapp-Shickel and Vader, 1998</td>
<td>5</td>
<td>0.6</td>
</tr>
<tr>
<td>C. eutae n. sp (present study)</td>
<td>5</td>
<td>0.6</td>
</tr>
<tr>
<td>C. danilevskii Czerniavski, 1868</td>
<td>136</td>
<td>14.5</td>
</tr>
<tr>
<td>C. dilatata Kröyer, 1843</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>C. erethizon Mayer, 1901</td>
<td>29</td>
<td>3.1</td>
</tr>
<tr>
<td>C. fretensis Stebbing, 1878</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>C. grandimana Mayer, 1882</td>
<td>3</td>
<td>0.3</td>
</tr>
<tr>
<td>C. hirsuta Mayer, 1890</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>C. liparotensis Haller, 1879</td>
<td>11</td>
<td>1.2</td>
</tr>
<tr>
<td>C. penantis Leach, 1814</td>
<td>72</td>
<td>7.7</td>
</tr>
<tr>
<td>C. santosrosai Sánchez-Moyano et al., 1995b</td>
<td>103</td>
<td>11</td>
</tr>
<tr>
<td>C. tuberculata Bate and Westwood, 1868</td>
<td>27</td>
<td>2.9</td>
</tr>
<tr>
<td>Caprella sp (armata-group)</td>
<td>50</td>
<td>5.3</td>
</tr>
<tr>
<td>Pariambus typicus Kröyer, 1844</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Pedoculina garciagomezii Sánchez-Moyano et al., 1995a</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>Phtisica marina Slabber, 1769</td>
<td>172</td>
<td>18.4</td>
</tr>
<tr>
<td>Pseudoprotella inermis Chevreux, 1927</td>
<td>13</td>
<td>1.4</td>
</tr>
<tr>
<td>P. phasma (Montagu, 1804)</td>
<td>212</td>
<td>22.6</td>
</tr>
</tbody>
</table>

†Mainly composed of the seaweeds Cystoseira usnoides, Asparagopsis armata, Cladostephus verticillatus, Halopteris scoparia and the hydroid Sertularella gayi.

Pseudoprotella phasma Montagu, with 22.6% of total individuals, followed by Phtisica marina Slabber (18.4%), Caprella danilevskii Czerniavski (14.5%), Caprella santosrosai Sánchez-Moyano et al. (11%) and Caprella acanthifera Leach (9.7%). The soft bottoms provided only two species of Caprellidea, i.e. Pariambus typicus Kröyer (86.9%) and Phtisica marina Slabber (13.1%).

Systematics

Caprella acanthifera Leach, 1814


Caprella hystrix: Kröyer, 1843: 585, pl. 8, figures 20–26.

Caprella calva: Bate, 1856: 60, figure 57.

Caprella aspera: Heller, 1866: 55, pl. 4, figures 20–21.

Caprella elongata: Haller, 1880: 409, figure 45.

Caprella acanthifera forma typica: Mayer, 1890: 44; Chevreux and Fage, 1925: 446–449, figures 427–428.

Caprella acanthifera intermedia: Monterosso, 1915, figures 1–2.

Material examined. 1A: two males, two females, two ovigerous females; 2A: one male; 2B: one male, two females, two ovigerous females; 3A: six males, four females, four ovigerous females, four juveniles; 4A: one male; 5A: three males, one ovigerous female; 6A: one male; 7A: two males, two females; 11A: one female; 12B: one female; 13A: four males, two females, one juvenile; 15A: three males, one female; 15B: three
males, two females, one juvenile; **18A**: one male, one ovigerous female; **18C**: three female, one ovigerous female; **19A**: nine males, 13 females, four juveniles.

**Caprella cavediniae** Krapp-Schickel and Vader, 1998


**Material examined.** 1C: one female; 23A: three males, one female.

**Caprella ceutae** n. sp. (figures 2–5)

**Material examined.** 15D: five males.

**Diagnosis**


**Etymology**

The specific name *ceutae* was chosen to dedicate this species to Ceuta, the locality where specimens were collected.

**Type material**

**Holotype** male from hydroid *Sertularella gayi* Lamouroux. Depth 40 metres, August 1999, coll. Juan Rodriguez. **Paratypes:** four adult males found together with holotype. Holotype and two paratypes are deposited in the Museo Nacional de Ciencias Naturales de Madrid, Spain (No. MNCN 20.06/4647). The other two paratypes are in the Laboratorio de Biología Marina, Universidad de Sevilla, Spain.

**Type locality**

Ceuta, North Africa, Mediterranean (35°54′N, 5°16′35″W).

**Description**

**Holotype male**

- **Body length.** 8.9 mm
- **Lateral view.** Body slender. Head with a well-developed rostrum. Pereonite 2 elongated. Peronites 3, 4 and 5 subequal. Pereonite 6 with a pair of acute dorsolateral projections close to the coxae.
- **Gills.** Oval, length ca twice width.
- **Antennae.** Antenna 1 about half of body length, with 14 articles in the flagellum; the third peduncular article bearing dense, plumose setae on its inferior surface. Antenna 2 about half length of antenna 1; peduncular articles 3 and 4 carrying nine pairs of long serrated setae; flagellum two-articulate, setose.
- **Mouthparts.** Upper lip symmetrically bilobed, pubescent apically. Inner lobe of the lower lip round, outer lobe round apically; both inner and outer lobe pubescent apically. Mandibular process strong; incisor and lacinia mobilis of both left and
Fig. 2. *Caprella ceutae*, new species. Male lateral view. Scale bar: 1 mm.
Fig. 3. *Caprella ceutae*, new species. Male. a, lower lip; b, upper lip; c, maxilliped; d, left mandible; e, right mandible; f, maxilla 1; g, maxilla 2. Scale bars: 0.1 mm.

Right mandibles five-toothed. Left mandible with a row of three pectinated setae, right with two. Maxilla 1 outer lobe carrying seven serrated spines on its end; article 2 of palp with five robust apical setae and five lateral slender setae. Maxilla 2 inner
lobe rounded, a little shorter than outer, which is slender; both inner and outer lobe with 15 marginal setae. Maxilliped inner plate rectangular, carrying two teeth, and one simple and seven plumose setae on the apical margin; outer plate, twice as large as inner, with four teeth and five simple setae; palp four-articulate, articles 2 and 3 with long setae on inner margin; article 4 with two rows of setulae on grasping margin.

Gnathopods. Gnathopod 1 setose; ischium round, merus and carpus each with marginal row of seven setae posteriorly; propodus posterior margin with two proximal grasping spines. Gnathopod 2 inserted near to the distal end of pereonite 2; basis one-quarter length of pereonite 2, with a strong lateral ridge which bears several small tubercles; ischium round; merus length ca 1.5 times ischium, with an acute projection on its ventral margin; carpus very short; propodus palm slightly convex, proximally with a robust tooth and one spine, distally with a large rectangular process; dorsal surface profusely setose.
Pereopods. Pereopods 5, 6 and 7 increasing in length; pereopods 5–7 basis with a developed carina; carpus and merus with a dorsal row of four setae; palm of propodus concave with two proximal grasping spines.

Abdomen. With a pair of large appendages, a pair of lateral lobes and a single dorsal lobe. Abdominal appendage two-articulate; basal article about twice longer than distal one, length ca 1.5 times width; distal segment round, carrying a lateral seta and a distal one or two. Dorsal lobe with two plumose setae. Penes medial, length ca twice width.

Remarks

The genus Caprella is the largest genus in the suborder Caprellidea. The species closest to Caprella ceutae, n. sp. are C. equilibra Say 1818 and C. fretensis Stebbing, 1878. Specimens of C. equilibra and C. fretensis belonging to the private collection of the senior author (JMGG) collected along the Atlantic and Mediterranean coasts of southern Spain, were examined with the purpose of comparison. The characteristics of C. equilibra from Southern Spain are in complete agreement with those included in the description of Krapp-Schickel (1993). Caprella ceutae is distinguished...
from *C. equilibra* as follows: (1) in *C. caeuteae* the prominent ventral spine between the second gnathopod, present in *C. equilibra*, is lacking; (2) *C. caeuteae* lacks a pair of tubercles anteriorly on pereonite 5, however these tubercles are characteristic of *C. equilibra*; (3) the inferior margin of the third peduncular article of antenna 1 and the dorsal surface of gnathopod 2 have fine and dense setae in *C. caeuteae*. These setae are lacking in *C. equilibra*.

*Caprella caeuteae* is also close to the Atlantic *C. fretensis*, also found in Ceuta (although only two damaged specimens). A detailed comparison between *C. caeuteae* from Ceuta and undamaged specimens of *C. fretensis* collected by JMGG from Huelva (Atlantic coast of southern Spain) reflected several constant differences between them. In *C. fretensis* the inferior surface of the second and third peduncular articles of antenna 1 bears rows of short fine setae and the propodus of gnathopod 2 is entirely covered with dense setae. These characteristics, present in specimens from Southern Spain, are in agreement with descriptions and figures of *C. fretensis* from the coasts of England and Ireland, included in Chevreux and Fage (1925) and Harrison (1944). Together with these differences in antenna 1 and gnathopod 2 propodus, we have observed that in *C. fretensis* from Southern Spain the tubercles on the lateral ridge of gnathopod 2 basis and the acute dorsolateral projections on pereonite 6 are lacking. Furthermore, the abdominal appendages are different; in *C. fretensis* the proximal article is ca one-quarter as long as the distal one and half as long as wide. Moreover, the distal article is clearly serrated distally whereas it is smooth in *C. caeuteae*.

The present specimens of *C. caeuteae* were collected from hydroids in an area of high transparency; visibility is ca 10–30 m. depending on the weather. The area, which is located near the top of the Ceuta Peninsula, is exposed to the strong effects of local currents. *Caprella caeuteae* lives together with *Pseudoprotella inermis* Chevreux, 1927, *Caprella santosrosai* Sánchez-Moyano *et al.*, 1995b, and the Atlantic species *C. erethizon* Mayer, 1901 and *C. tuberculata* Bate and Westwood, 1868.

**Caprella danilevskii** Czerniavski, 1868

(figure 6)

*Caprella Danilevskii* Czerniavski, 1868: 92, pl. 6, figures 21–34; Mayer, 1890: 58, pl. 5, figure 44; pl. 7, figures 12–13.

*Caprella Danilevskii*: Chevreux and Fage, 1925: 454, figure 432.


**Material examined.** 1A: 53 males, 34 females, four ovigerous females, 36 juveniles; 3A: one male, one female; 4A: one male, one ovigerous female; 6A: two males; 15A: two males, one female.

**Caprella dilatata** Kroyer, 1843

*Caprella dilatata* Kroyer, 1843: 585, pl. 8, figures 1–9; McCain, 1968: 38; McCain and Steinberg, 1970: 17; Cavedini, 1982: 499.

*Caprella acutifrons*: Mayer, 1882: 48, pl. 1, figure 9; pl. 2, figures 12–22; pl. 4, figures 26–28; pl. 5, figures 15, 22–23.

*Caprella acutifrons* forma *typica*: Mayer, 1890: 54, pl. 2, figure 34; pl. 4, figures 62–63; pl. 7, figures 16–17; Chevreux and Fage, 1925: 452.

*Caprella acutifrons* forma *minor*: Mayer 1890: 54, pl. 2, figure 35; pl. 4, figures 54, 64.


Fig. 6. *Caprella danilevskii* Czerniavski, 1868. Lateral view: a, male; b, female. Scale bar: 1 mm.

Material examined. 17A: one male.

*Caprella erethizon* Mayer, 1901

(figure 7)

Material examined. **2B**: three males; **7D**: one male; **15D**: 12 males, 12 females, one juvenile.

Remarks

*Caprella erethizon* Mayer has been considered, as well as *C. tuberculata*, a rare species (Chevreux and Fage, 1925). The original description of Mayer (1901) was poor, with only the female described. Chevreux and Fage (1925) redescribed the
female and described the juvenile male of *C. erethizon* with very schematic figures. Bertrand (1941) found an adult male of *C. erethizon* but he added little information about its morphological characteristics. Boquet and Peltier (1963) finally gave a precise redescription of this species. The specimens of *C. erethizon* found in Ceuta, North Africa are identical to those described by these authors from Roscoff (Atlantic French coasts). This species was previously recorded on Atlantic coasts of England and France and only one specimen has been found on the Atlantic Portuguese coast (Marques and Bellan-Santini, 1985).

**Caprella fretensis** Stebbing, 1878

*Caprella fretensis* Stebbing, 1878: 31–4, pls. 5, figure 1; Stebbing, 1879: 521; Mayer, 1882: 58; Mayer, 1890: 62–63, pl. 4, figures 38–39; pl. 5, figures 41–42; Chevreux and Fage, 1925: 457–459, figure 435; Toulmond and Truchot, 1964: 36.

**Material examined.** 2A: one male; 5A: one male.

**Caprella grandimana** Mayer, 1882

*Caprella grandimana* Mayer, 1882: 43, pl. 1, figure 5; pl. 2, figures 23–29; pl. 4, figures 29–31; Cavedini, 1982: 501, figure 2.

*Caprella acanthifera* var. *grandimana*: Mayer, 1890: 47.

*Caprella hirsuta f. longimana*: Chevreux, 1913: 5, figure 1; McCain and Steinberg, 1970: 23.

**Material examined.** 2B: two males, one juvenile.

**Caprella hirsuta** Mayer, 1890

*Caprella hirsuta* Mayer, 1890: 77, pl. 2, figure 19; pl. 4, figures 26–29; Chevreux and Fage, 1925: 449, figure 429; McCain and Steinberg, 1970: 23; Cavedini, 1982: 503.

**Material examined.** 15A: one male; 17A: one male.

**Caprella liparotensis** Haller, 1879

*Caprella liparotensis* Haller, 1879: 232; Haller, 1880: 404, pl. 23, figures 41–42; Mayer, 1890: 57; Mayer, 1903: 114, pl. 8, figure 23; Chevreux and Fage, 1925: 452, figure 431; Fiorencis, 1940: 15, figure 6; McCain and Steinberg, 1970: 29; Cavedini, 1982: 504.

*Caprella dentata*: Haller, 1880: 744, figures 4–9; Mayer, 1882: 50, pl. 1, figure 8; pl. 3, figures 1–9; pl. 4, figure 33.

**Material examined.** 17A: 10 males, one female.

**Diagnosis**

Head with developed rostrum. A pair of lateral spines anteriorly on pereonites 2, 3 and 4 in male; in female only on pereonite 3. In male two pairs of dorsal tubercles on pereonite 5, one pair on pereonite 6 and two pairs of small tubercles on pereonite 7. These two pairs on pereonite 7 are lacking in female. Peduncular articles 2–3 of antenna 1 with dense plumose setae on ventral margin. Basis of gnathopod 2 very short, about one-fifth of pereonite 2, with carina.
Fig. 8. *Caprella liparotensis* Haller, 1879. Lateral view: a, male; b, female. Scale bar: 1 mm.
Material examined

Male ‘a’ from the seaweed *Cystoseira tamariscifolia* Papenfuss. Depth 10 metres, June 1999, coll. José Manuel Guerra-García. Female ‘b’ found together with male
Fig. 10. *Caprella liparotensis* Haller, 1879. a–d, male. a, antenna 1; b, antenna 2; c, gnathopod 1; d, gnathopod 2. e, female gnathopod 2. Scale bars: 0.5 mm.
Fig. 11. *Caprella liparotensis* Haller, 1879. a–d, male. a, pereopod 5; b, pereopod 6; c, pereopod 7; d, abdomen (ventral view). e, female abdomen (ventral view). Scale bars: a–c: 0.5 mm; d, e: 0.1 mm.

‘a’. Other specimens studied: nine males collected together with male ‘a’ and female ‘b’. Male ‘a’, female ‘b’ and three more specimens are deposited in the Museo Nacional de Ciencias Naturales de Madrid, Spain (No. MNCN 20.06/4648). The
other six specimens are in the Laboratorio de Biología Marina, Universidad de Sevilla, Spain.

Locality
Ceuta, North Africa, Mediterranean (35°53'30"N, 5°17'00"W).

Redescription
Male ‘a’

Body length. 8.2 mm

Lateral view. Head with a well developed rostrum. A pair of lateral spines anteriorly on pereonites 2–4. Two pairs of dorsal tubercles on pereonite 5 and 7, one pair on pereonite 6.

Gills. Rounded. Length ca 1.3 times width.

Antennae. Antenna 1 shorter than cephalon (head + pereonite 1) and pereonite 2 together; peduncular articles 1 and 2 slightly widened; articles 2 and 3 carrying dense plumose setae on ventral margin and very short fine setae on dorsal surface; flagellum 14-articulate. Antenna 2 a little longer than antenna 1 peduncle; peduncular articles 3 and 4 carrying ten pairs of long serrated setae; flagellum two-articulate; basal article with seven pairs of plumose setae.

Mouthparts. Upper and lower lip similar to those in Caprella ceutae n. sp. Mandibular molar process strong, bordered by teeth. Pars incisiva and lacinia mobilis with five teeth on each; left mandible with three pectinated setae, right with only two; a row of short and fine setae between these pectinated setae and the molar process. Maxilla 1 outer lobe carrying seven serrated spines apically; article 2 of the palp with 11 marginal setae and 13 lateral ones disposed along the surface. Maxilla 2 inner lobe with 12 apical setae, outer lobe with nine setae. Inner plate of maxilliped nearly as large as the outer plate; inner plate with nine plumose setae and three teeth; outer plate with long simple seta and five teeth; articles 2 and 3 of palp carrying many long setae on inner margin; article 4 shorter than article 3, with rows of setulae on its grasping margin.

Gnathopods. Gnathopod 1 setose; ischium to merus with many ventral setae; propodus with two proximal grasping spines, palm shallowly convex. Gnathopod 2 inserted near distal end of pereonite 2, as in Caprella ceutae n. sp.; basis short, about one-fifth of pereonite 2, with a very developed carina; ischium round; merus length ca twice ischium, with an acute projection on ventral margin as in Caprella ceutae n. sp.; propodus longer than basis to ischium combined; length ca 2.5 times width; palm concave with one projection bearing a tooth and spine halfway from proximal end, another projection one-quarter length from distal end, followed by ‘U’ notch distally.

Pereopods. Pereopods 5, 6 and 7 increasing in length; basis with carina on posterior margin; merus and carpus carrying three setae on outer margin; carpus with several pairs of strong setae on the anterior margin; palm of propodus concave with two proximal grasping spines and two anterior rows of short and wide setae.

Abdomen. With a pair of two-articulate appendages, a pair of lateral lobes and a single dorsal lobe which carries two plumose setae. Penes short, length about 1.2 times width.
Female ‘b’.

Body length 6.8 mm. A pair of lateral spines anteriorly on pereonite 3. Pereonite 7 without dorsal tubercles. Gnathopod 2 inserted on the anterior half of pereonite 2; length of propodus ca 1.5 times width. Brood lamellae of pereonite 3 setose on the posterior margin; brood lamellae on pereonite 4 not setose. Abdomen with a pair of lateral lobes and a dorsal lobe carrying 2 plumose setae.

Remarks

Although Chevreux and Fage (1925) and Krapp-Schickel (1993) provided detailed descriptions of *Caprella liparotensis* from Cette (France) and Napoli (Italy) respectively, we have included complete drawings of antennae, mouthparts and abdomens based on the newly collected specimens from Ceuta. The comparison reveals several differences between the previous descriptions and present specimens from Ceuta: (1) female from Ceuta carries a pair of lateral spines on pereonite 3, while in *C. liparotensis* from Napoli the female lacks lateral spines on pereonites 2 and 3 (Krapp-Schickel, 1993); (2) males from Ceuta bear two pairs of tubercles on pereonite 7 while those from Napoli lack these tubercles (Krapp-Schickel, 1993); (3) the specimens of *C. liparotensis* from Ceuta possess three teeth on the inner plate of the maxilliped and four to six teeth on the outer plate. Chevreux and Fage (1925) reported that the maxilliped of *C. liparotensis* was similar to that in *C. acutifrons*. They described for *C. acutifrons* (old complex of *C. penantis*, *C. andreae*, *C. dilatata* and other close species) an inner plate with two large teeth and an outer plate with seven to eighth teeth. Nevertheless these differences are not enough to consider these specimens from Ceuta as a new species.

*Caprella penantis* Leach, 1814

(figures 12)

*Caprella Penantis* Leach, 1814: 404.
*Caprella acutifrons f. testudo*: Chevreux and Fage, 1925: 452, figure 430.

Material examined. 2A: one female; 3A: three females, two juveniles; 6A: five males, two females, one ovigerous female, two juveniles; 13A: one male; 15A: three males, three females, three juveniles; 17A: 14 males, 14 females, three ovigerous females, 15 juveniles.

*Caprella santosrosai* Sánchez-Moyano *et al.*, 1995

(figures 13–16)


Material examined. 7D: two males, two females; 14A: six males, two females, one ovigerous female, three juveniles; 15A: one male; 15D: 42 males, 22 females, five ovigerous females, 17 juveniles.

Remarks

The record of *Caprella santosrosai* on the coast of Ceuta represents the first for this species since its original description (Sánchez-Moyano *et al.*, 1995b). Although
Fig. 12. *Caprella penantis* Leach, 1814. Lateral view: a, male; b, female. Scale bar: 1 mm.
Fig. 13. *Caprella santosrosai* Sánchez-Moyano *et al*., 1995. Lateral view: a, male; b, female. Scale bar: 1 mm.
Fig. 14. *Caprella santosrosai* Sánchez-Moyano et al., 1995. Male. a, lower lip; b, upper lip; c, maxillipede; d, left mandible; e, right mandible; f, maxilla 1; g, maxilla 2. Scale bars: 0.05 mm.

This species was fully described, we have included complete figures because several differences have been found between specimens from southern Spain and northern Africa. The general lateral view is very similar. However, the mouthparts and
Fig. 15. Caprella santosrosai Sánchez-Moyano et al., 1995. a–d, male. a, antenna 1; b, antenna 2; c, gnathopod 1; d, gnathopod 2. e, female gnathopod 2. Scale bars: a: 0.5 mm; b: 0.3 mm; c: 0.5 mm; d: 0.2 mm; e: 0.3 mm.
Fig. 16. *Caprella santosrosai* Sánchez-Moyano et al., 1995. a–d, male. a, pereopod 5; b, pereopod 6; c, pereopod 7; d, abdomen (ventral view). e, female abdomen (ventral view). Scale bars: a–c: 0.5 mm; d, e: 0.1 mm.
abdomen are different: (1) in specimens collected from Ceuta the outer lobe of the maxilliped has four teeth and the inner lobe three, while in the specimens from southern Spain it has three and two respectively; (2) specimens from Ceuta have no plumose seta on the outer lobe of maxilla 1, while this seta, which is rare among species of *Caprella*, is present in specimens from southern Spain; (3) the most remarkable differences are found in the male abdomen; while specimens from Ceuta have the first pair of pleopods clearly biarticulate, no distinct articulation was found in the specimens from southern Spain (Sánchez-Moyano *et al*., 1995b). Furthermore, the distal article of the first pleopods is serrated on the apical margin in male specimens from Ceuta, whereas it is smooth in specimens from southern Spain.

*Caprella* sp (belonging to the *armata*-group, see Krapp-Schickel and Vader, 1998)

**Material examined.** 15A: three males, four females, one juvenile; 16A: four males, one ovigerous female; 17A: four males, three females, three juveniles; 17B: three males, one female, one ovigerous female, three juveniles; 20A: two males, one female; 22A: five males, three females, two ovigerous females, three juveniles; 23A: two males, one female.

**Remarks**

The specimens studied are very similar to those described as *Caprella acanthifera discrepans* (Krapp-Schickel, 1993). They are characterized by the presence of an axillary spine near the coxa of gnathopod 2. The taxa with this spine, belonging to the *armata*-group, are still awaiting revision (Krapp-Schickel and Vader, 1998)

*Caprella tuberculata* Bate and Westwood, 1868

(figures 17–20)

*Caprella tuberculata* Guérin, 1836, pl. 28, figure 1; Goodsir, 1842: 188–189, pl. 3, figures 6–7; Bate and Westwood, 1868: 68–70; Mayer, 1882: 56–57, figures 15–16; Chevreux and Fage, 1925: 460–461, figure 437; Schellenberg, 1942: 230–239, figure 199.

*Caprella acanthifera*: Bate, 1862: 366, pl. 57, figure 2.

**Material examined.** 2B: five males, six females; 15D: four males, six females, four ovigerous females, two juveniles.

**Diagnosis**

Head with a short and acute rostrum in males, and small round protuberance in females. Except the first, all body pereonites with strong and numerous dorsal tubercles. Males with a pair of lateral tubercles on pereonite 5. Pereonites 1 and 2 elongated in male, pereonite 2 with plumose setae in males. Palm of the propodus of gnathopod 2 in males with large thumb-like protuberance defining the palm, and with long and dense, plumose setae. Anterior surface of basis and propodus also with plumose setae. Pereopods 5 and 6 with a pair of proximal grasping spines. Pereopod 7 with four grasping spines in males (in clusters of 2-1-1) and three in females (2-1).

**Material examined**

Male ‘a’ from the hydroid *Sertularella gayi* Lamouroux (35°55′20″N, 5°22′W). Depth 28 metres, July 1999, coll. Jose Manuel Guerra-García. Female ‘b’ found
Fig. 17. *Caprella tuberculata* Bate and Westwood, 1868. Lateral view: a, male; b, female. Scale bar: 1 mm.

together with male ‘a’. Other specimens: four males, five females collected together with male ‘a’; four males, ten females and two juveniles on seaweed *Dilophus spiralis* Hamel (35°54’N, 5°16’35”W), August 1999, coll. Juan Rodríguez. Male ‘a’, female
Fig. 18. *Caprella tuberculata* Bate and Westwood, 1868. Male. a, lower lip; b, upper lip; c, maxilliped; d, left mandible; e, right mandible; f, maxilla 1; g, maxilla 2. Scale bars: 0.05 mm.

‘b’ and another three specimens are deposited in the Museo Nacional de Ciencias Naturales de Madrid, Spain (No. MNCN 20.06/4649), the remaining specimens are in the Laboratorio de Biologia Marina, Universidad de Sevilla, Spain.
Fig. 19. *Caprella tuberculata* Bate and Westwood, 1868. a–d, male. a, antenna 1; b, antenna 2; c, gnathopod 1; d, gnathopod 2. e, female gnathopod 2. Scale bars: a,b: 0.5 mm; c: 0.2 mm; d: 0.5 mm; e: 0.2 mm.
Fig. 20. *Caprella tuberculata* Bate and Westwood, 1868. a–d, male. a, pereopod 5; b, pereopod 6; c, pereopod 7; d, abdomen (ventral view). e–f, female. e, pereopod VII; f, abdomen (ventral view). Scale bars: a–c, e: 0.5 mm; d, f: 0.05 mm.
Locality
Ceuta, North Africa, Mediterranean (35°55′20″N, 5°22′W; 35°54′N, 5°16′35″ W).

Redescription.

Male ‘a’

Body length. 5.9 mm.

Lateral view. Head with a short, acute and curved rostrum. Except the first one, all pereonites with tubercles following the formula 0-2.1-2.1-1.2-1-2(lateral).2.2-4.2. Pereonites 1 and 2 elongated; pereonite 2 bearing long plumose setae dorsally and ventrally.

Gills. Oval, length ca twice width.

Antennae. Antenna 1 with the same length as cephalon and pereonite 2 together; peduncular articles setose; flagellum with 11 articles. Antenna 2 about half length of antenna 1; peduncular articles 3 and 4 carrying six pairs of long, serrated setae; flagellum two-articulate, setose.

Mouthparts. Upper and lower lip similar to those in Caprella ceutae n. sp. Pars incisiva and lacinia mobilis with five teeth on each; left mandible with three pectinate setae and the right with two; a row of short and fine setae between the pectinate setae and the molar process. Maxilla 1 outer lobe with seven serrated spines distally; article 2 of palp with eight distal setae and a row of four lateral setae. Inner lobe of maxilla 2 shorter than outer, with 12 apical setae; outer lobe with nine apical setae. Inner plate of maxilliped shorter and a little wider than outer plate, with seven plumose setae and two teeth; outer plate with long simple setae and three teeth; article 2 and 3 of palp with long setae; article 4 with rows of setulae on grasping margin.

Gnathopods. Merus and carpus of gnathopod 1 with row of four setae on posterior margin; propodus with a pair of proximal grasping spines; palm of propodus with a few setae; dactylus partially serrated on the inner margin. Gnathopod 2 inserted on the posterior part of the pereonite; basis one-third length of pereonite 2, with carina and several plumose setae on anterior surface; ischium, merus and carpus rounded; merus about 1.5 times larger than ischium; carpus very short, length ca one-fifth of merus; palm of propodus defined proximally by a large, thumb-like protuberance and distally by a round projection; between these two projections, the palm of the propodus is very concave, covered with a mixture of dense fine plumose and simple setae; dorsal surface of propodus also with plumose setae; dactylus with medial protuberance and plumose setae.

Pereopods. Pereopods 5, 6 and 7 increasing in length respectively; palm of propodus concave; a pair of proximal grasping spines on pereopods 5, 6 and 7; on pereopod 7, two additional grasping spines, four in total.

Abdomen. With a pair of appendages, a pair of lateral lobes and a single dorsal lobe; appendage two-articulate, the two articles of each appendage rounded and approximately the same size; both articles carrying three setae; distal article serrated on the apical margin; lateral lobes carrying four simple setae and dorsal lobe with two plumose setae. Penes median, slender, length ca three times width.

Female ‘b’

Body length. 4.1 mm. Head with a short dorsal protuberance in the middle. Pereonite 1 and 2 not elongated; tubercle formula on pereonites 0-1.2.1-2-1.2.1-2-4-2.2; pereonite 5 lacking lateral tubercles; pereonite 2 without setae. Peduncular
articles of antenna 1 scarcely setose; flagellum of antenna 1 with eight articles. Gnathopod 2 inserted on anterior half of pereonite 2; palm defined by two small teeth instead of thumb-like protuberance, without distal projection at the dactylar hinge; basis, propodus and dactylus without fine, plumose setae. Pereopod 7 propodus with three grasping spines. Anterior brood lamellae setose all round, posterior pair not setose. Abdomen with a pair of lateral lobes which carry two setae and a dorsal lobe with two plumose setae.

Remarks
As McCain and Steinberg (1970) pointed out, the nomenclature of this species is one of the most confused among the caprellid species. Indeed, Mayer (1882) considered that the specimens described by Guérin (1836) and Goodsir (1842) were not *C. tuberculata*. Stebbing (1888) mentioned that Guérin’s *C. tuberculata* could be a synonym of *C. scaura*. The description of *C. tuberculata* given by Guérin (1836) is quite brief.

The specimens found in Ceuta are in agreement with the description of *C. tuberculata* given by Bate and Westwood (1868) for Atlantic specimens. However, we have observed several differences. Following the descriptions of Bate and Westwood (1868), Chevreux and Fage (1925) and Harrison (1944) the most striking difference between *C. tuberculata* of Bate and Westwood and *C. tuberculata* found at Ceuta is the size; males of *Caprella tuberculata* from Ceuta do not exceed 5.9 mm (although we have observed only nine adult males), while specimens from British and French coasts (Bate and Westwood, 1868) usually reach 15 mm at adulthood. *Caprella tuberculata* from Ceuta is also distinguished from Atlantic specimens as follows: (1) males from Ceuta have a short and round rostrum on the head while Atlantic specimens have a very short, central, dorsal spine; (2) male ‘a’ and female ‘b’ from Ceuta have tubercles following the formula (0-2.1-2.1-2.1-2.2-(lateral)2.2-4.2.2 in male, and 0-1.2.1-2.1-2.1-2.0-2.2 in female). These tubercles are always present in the other specimens examined but some small tubercles may occur depending on the individuals. There is no specific formula for tubercles in descriptions of Atlantic specimens; (3) in *C. tuberculata* from Ceuta the propodus of pereopod 7 has four grasping spines in males and three in females, while there is only a single pair of grasping spines in Atlantic specimens (both male and females); (4) the posterior brood lamella are not setose on the posterior edges in females from North Africa; a setose margin is present in Atlantic specimens.

Before this study, *Caprella tuberculata* had been found on the British and French coast but also at Santander, northern Spain (Chevreux and Fage, 1925). Marques and Bellan-Santini (1985) also reported 27 specimens of *C. tuberculata* from between Peniche and Arrabida (Portuguese Atlantic coast). An extensive comparative study between Atlantic individuals of *C. tuberculata* and the specimens of the Strait of Gibraltar would be necessary in order to elucidate whether the above differences are intra-specific or inter-specific. Recently, a detailed comparison has been successfully conducted for the species complex *Caprella acanthifera* (Krapp-Schickel and Vader, 1998) collected from Atlantic and Mediterranean waters.

**Pariambus typicus** Kroyer, 1844
*Podalirius typicus* Kröyer, 1844: 283, pl. 3, figure 1; Mayer, 1882: 75, figures 30–31; pl. 4, figure 14; Mayer, 1890: 92, pl. 4, figures 7–8; pl. 5, figures 62–64; pl. 6, figure 17; Mayer, 1903: 63, pl. 7, figures 46–47; pl. 10, figures 4–9.
**Pariambus typicus**: Chevreux and Fage, 1925: 441, figure 425; McCain and Steinberg, 1970: 62.

*Material examined.* I: four males, eight females; III: one male; IV: 13 males, 36 females, 12 juveniles, V: three males, three females, VI: three males, two females; VII: two males, five females, one juvenile; VIII: one male, one female, one ovigerous female; IX: one male; X: one male, two females.

**Pedoculina garciagomezi** Sánchez-Moyano *et al.*, 1995


*Material examined.* 16A: one male; 18D: one male.

**Phtisica marina** Slabber, 1769

*Phtisica marina* Slabber, 1769: 77, pl. 10; Chevreux and Fage, 1925: 434, figure 422; Fiorencis, 1940: 11, figure 1, pl. 1, figures 1–2; Costa, 1960: 99; McCain, 1968: 91, figures 46–47; McCain and Steinberg, 1970: 65.


*Proto ventricosa*: Mayer, 1882: 22, pl. 1, figure 1; pl. 3, figures 16–29; pl. 4: figures 12–13; pl. 5: figures 1–5; Mayer, 1890: 12, pl.3, figures 4–6; pl. 5, figures 3–6; pl. 6, figure 1; pl. 7, figure 1; Mayer, 1903: 20, pl. 6, figure 23; Monterosso, 1915: 3.

*Material examined.* 1A: nine males, one female; 1C: two males, five females; 2A: two males, one female, one juvenile; 2B: five males, seven females, two ovigerous females, three juveniles; 3A: five males, three females, one ovigerous female, seven juveniles; 5A: two males, one female, one ovigerous female; 7A: two males; 7B: one male, two females; 8A: one ovigerous female; 9A: four males, three females, one ovigerous female, two juveniles; 10A: one male; 11A: ten males, four females, three juveniles; 12A: one male, two ovigerous females, one juvenile; 12B: four males; 13A: one juvenile; 14A: two males, one female; 15A: one male; 15B: four males, one female, one ovigerous female, one juvenile; 15D: two males, one female, three juveniles; 16A: one male, one female, one juvenile; 17B: five males, one female; 17C: ten males, four females, four ovigerous females, four juveniles; 18C: two males, one female; 19A: two males, one female, one juvenile; 20A: two males, two females; 21A: two males; 22A: five males, three females, one ovigerous female, one juvenile; IV: one male; VI: three males, three females, three juveniles; VII: four males, one female.

**Pseudoprotella inermis** Chevreux, 1927


*Material examined.* 15D: seven males, two females, four juveniles.

**Pseudoprotella phasma** (Montagu, 1804)

*Cancer Phasma* Montagu, 1804: 66, pl. 6, figure 3.

*Caprella quadrispinis*: Grube, 1864: 63.

*Protella phasma*: Mayer, 1882: 29, pl. 1, figure 2; pl. 4, figures 1–8, figures 34–37; pl. 5, figures 19–21.


*Material examined.* 1A: three males, three females; 1C: one female; 1D: four males, three females, two ovigerous females, one juvenile; 2B: 26 males, 20 females, seven ovigerous females, 22 juveniles; 5A: eight males, five females, one ovigerous...
female, ten juveniles; 7A: one male, one female, one ovigerous female, one juvenile; 7B: two males, one female, one juvenile; 7C: one male, one female, one juvenile; 12B: one male, one female, one juvenile; 14A: one ovigerous female; 15B: one male, one female, one juvenile; 15D: seven males, six females, one juvenile; 17B: three males, two females, one female carrying juveniles, 17C: nine males, nine females, two ovigerous females, eight juveniles; 18C: six males, two females; 19D: five males, five females, one ovigerous female, four juveniles; 20A: two males; 21A: one male; 22A: one male; 23A: one male, two females carrying juveniles.

Key to species of Caprella from Ceuta
The key is based primarily on gnathopod 2 of adult males, following Takeuchi (1995).

1 Basis of gnathopod 2 clearly shorter than one-third of pereonite 2 ............. 2
   - Basis of gnathopod 2 longer than one-third of pereonite 2 ............. 5
2 Propodus of gnathopod 2 profusely setose ............. 3
   - Propodus of gnathopod 2 scarcely setose ............. 4
3 Propodus of gnathopod 2 entirely covered with fine plumose setae. Articles 2 and 3 of antenna 1 with dense plumose setae on the posterior margin ....... C. fretensis
   - Propodus of gnathopod 2 profusely setose only proximally. Only article 3 of antenna 1 with dense setae posteriorly ............. C. ceutae n. sp (figures 2–5)
4 Head without rostrum. Pereopods without grasping spines .... C. danilevskii (figure 6)
   - Head with rostrum. Pereopods with grasping spines .... C. liparotensis (figures 8–11)
5 Antennae 2 with short setae posteriorly ............. 6
   - Antennae 2 with long setae posteriorly ............. 9
6 Body with dorsal tubercles ............. C. acanthifera
   - Body without dorsal tubercles ............. 7
7 Body with a few rounded humps ............. C. cavediniae
   - Body smooth ............. 8
8 Propodus of gnathopod 2 round with dense, long setae dorsally; basis about half of pereonite 2 ............. C. hirsuta
   - Propodus of gnathopod 2 with sparse, short setae dorsally; basis as long as pereonite 2 ............. C. grandimana
9 Pereonite 1 shorter than head ............. 10
   - Pereonite 1 longer than head ............. 11
10 Gnathopod 2 with distal poison tooth ............. C. dilatata
   - Gnathopod 2 with proximal poison tooth ............. C. penantis (figure 12)
11 All the body pereonites with dorsal acute projections ............. C. erethizon (figure 7)
   - Body pereonites with tubercles ............. 12
12 Head with a central dorsal projection. Propodus of gnathopod 2 setose on posterior surface. Acute ventral projections on pereonites 2–4 .... C. santosrosai (figures 13–16)
   - Head with a short acute rostrum. Propodus of gnathopod 2 setose on anterior and posterior surface. Acute ventral projections lacking ............. C. tuberculata (figures 17–20)

Discussion
Ceuta is located on the North African side of the Strait of Gibraltar. The Strait of Gibraltar is a very important geographical-geological formation formed in the final phases of the Pliocene period. It is the boundary for the Mediterranean region (to the east), the Lusitanian region (to the northeast) and the Mauretanian region.
The Caprellidea from Ceuta, North Africa

(to the southeast). The Strait is a zoogeographical area, especially from the point of view of the interchange of the species between the Atlantic and the Mediterranean, and the European and African faunas. Thus, the Strait has attracted the attention of marine taxonomists in latter years and several biogeographical studies have been published (e.g. bryozoans: López de la Cuadra and García-Gómez, 1995; sponges: Carballo et al., 1997; ascidians: Naranjo et al., 1998; molluscs: Gofas, 1998).

A recent cladistic analysis by Bellan-Santini and Ruffo (1998) indicates that the Mediterranean and Atlantic fauna of amphipods are very close and that a large proportion of Mediterranean amphipods could be of Atlantic origin. Recently, the benthic Gammaridea fauna of Algeciras Bay (Iberian side of the Strait of Gibraltar) has been studied (Conradi and López-González, 1999). In this case, all species collected, except Urothoe hesperiae which was described as a new species (Conradi et al. 1995), had been found in Mediterranean waters in previous studies. Thus, Algeciras Bay can be considered a typical Mediterranean locality despite being situated within the Strait of Gibraltar.

In the Mediterranean Sea, 33 species of caprellids have been recorded so far including the present study (table 2, figure 21). Of these species, 13 (39.4%) have been collected only in Mediterranean waters and they can be considered as Mediterranean endemic. On the coast of Ceuta, which is only about 20 kilometres long we have collected 19 of these 33 species; four of them (Caprella ceutae, Caprella santosrosai, Pedoculina garciagomezi and Pseudoprotella inermis) are, so far, endemic to the Strait of Gibraltar. Thus, 30.8% of Mediterranean endemic species are endemic to the Strait of Gibraltar. Caprella fretensis, C. erethizon and C. tuberculata had previously been collected only on Atlantic coasts (Chevreux and Fage, 1925, Harrison, 1944, Marques and Bellan Santini, 1985). With the present work the distributions of these species are extended to Mediterranean waters. The species Caprella santosrosai and Pedoculina garciagomezi are recorded for the first time on the coast of north Africa, demonstrating that these species inhabit both sides of the Strait of Gibraltar.

The percentage of caprellid endemism in the Mediterranean (39.4%) is only a little higher than the 37% reported by Bellan-Santini and Ruffo (1998) for caprellids and gammarids combined. Both values are higher than the 26.6% calculated by Fredj et al. (1992) for all of the Mediterranean fauna taken together. As indicated by Bellan-Santini and Ruffo (1998), further researches along the Atlantic coast of North Africa and the Iberian Peninsula would likely reduce the number of amphipods that are considered endemic to the Mediterranean. For example, Caprella hirsuta and C. grandimana, considered as Mediterranean endemics in Krapp-Schickel (1993), have been recently reported on the Atlantic African coasts from Cape Spartel to Cape Blanc (Bellan-Santini and Ruffo, 1998). A similar change in biogeographic distribution was found for Caprella rapax Mayer, 1890, which was collected recently on the Atlantic Iberian coast (Bellan-Santini and Ruffo, 1998). Although Parvipalpus major Carausu, 1941 was considered as an endemic species by Bellan-Santini and Ruffo (1998), specimens of this species were collected in the Bay of Biscay (Laubitz and Sorbe, 1996) so this species also extends to Atlantic waters and is not a Mediterranean endemic.

Nevertheless, more extensive researches are necessary to expand our understanding of the biogeography of the caprellid fauna of African coasts, not only northern Africa but also Atlantic coasts of Africa, and especially the African coasts of the Indian Ocean. The caprellid fauna on the Indian coast has a special taxonomic
### Table 2. Caprellids cited in Mediterranean waters.

<table>
<thead>
<tr>
<th>Name of species</th>
<th>ME</th>
<th>SGE</th>
<th>Presence on North African coast</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Caprella acanthifera</em></td>
<td></td>
<td></td>
<td>Algeria: Cherchell, Bou Ismail (Bakalem and Dauvin, 1995); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (Present study)</td>
</tr>
<tr>
<td><em>Caprella andreae</em></td>
<td></td>
<td></td>
<td>Algeria (McCain, 1968)</td>
</tr>
<tr>
<td><em>Caprella cavediniae</em></td>
<td></td>
<td></td>
<td>Ceuta (Present study) (see Krapp-Schickel and Vader, 1998)</td>
</tr>
<tr>
<td><em>Caprella ceutae, n. sp.</em></td>
<td>+</td>
<td>+</td>
<td>Ceuta (present study)</td>
</tr>
<tr>
<td><em>Caprella danilevskii</em></td>
<td></td>
<td></td>
<td>Algeria: Alger, Cherchell (Chevreux and Fage, 1925); Algeria: Alger, Bou Ismail (Bakalem and Dauvin, 1995); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (Present study)</td>
</tr>
<tr>
<td><em>Caprella dilatata</em></td>
<td></td>
<td></td>
<td>Algeria (McCain and Steinberg, 1970); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
</tr>
<tr>
<td><em>Caprella equilibra</em></td>
<td></td>
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<td>Egypt: Port Said (Schellenberg, 1928); Algeria: Cherchell, Bou Ismail (Bakalem and Dauvin, 1995)</td>
</tr>
<tr>
<td><em>Caprella erethizon</em></td>
<td></td>
<td></td>
<td>Ceuta (present study)</td>
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<tr>
<td><em>Caprella fretensis</em></td>
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<td></td>
<td>Ceuta (present study)</td>
</tr>
<tr>
<td><em>Caprella grandimana</em></td>
<td></td>
<td></td>
<td>Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
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<td></td>
<td>Tunisia: La Galite; Algeria: Cherchell (Chevreux and Fage, 1925); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
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<td><em>Caprella lilliput</em></td>
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<tr>
<td><em>Caprella liparotensis</em></td>
<td></td>
<td></td>
<td>Egypt: Abu Qir (Schellenberg, 1936); Algeria: Cherchell (Chevreux and Fage, 1925); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
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<td><em>Caprella mitis</em></td>
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<td>Algeria (Bakelem and Dauvin, 1995)</td>
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<td><em>Caprella penantis</em></td>
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<td></td>
<td>Egypt: Abu Qir (Schellenberg, 1936); Algeria: Alger (Mayer, 1890); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
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<td><em>Caprella rapax</em></td>
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<td><em>Caprella santosrosai</em></td>
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<td></td>
<td>Ceuta (present study)</td>
</tr>
<tr>
<td><em>Caprella sp (armata-group)</em></td>
<td></td>
<td>+</td>
<td>Ceuta (present study)</td>
</tr>
<tr>
<td><em>Caprella telarpax</em></td>
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<tr>
<td><em>Caprella tuberculata</em></td>
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<td>Deutella shiecki</td>
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<tr>
<td><em>Liropus elongatus</em></td>
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<td><em>Partiambus typicus</em></td>
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<td>+</td>
<td>Algeria: Alger (Chevreux and Fage, 1925); Algeria: Bou Ismail, Alger (Bakalem and Dauvin, 1995); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
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<td><em>Parvipalpus linea</em></td>
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<td>Not collected at North African coast</td>
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<tr>
<td><em>Parvipalpus major</em></td>
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<td></td>
<td>Not collected at North African coast</td>
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<tr>
<td><em>Pedoculina bacescui</em></td>
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<td>+</td>
<td>Not collected at North African coast</td>
</tr>
<tr>
<td><em>Pedoculina garciagomezii</em></td>
<td>+</td>
<td></td>
<td>Ceuta (present study)</td>
</tr>
<tr>
<td><em>Phtisica marina</em></td>
<td></td>
<td>+</td>
<td>Algeria: Bou Ismail, Alger, Bejaia (Bakalem and Dauvin, 1995); Ceuta (present study)</td>
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Table 2. (Continued).

<table>
<thead>
<tr>
<th>Name of species</th>
<th>ME</th>
<th>SGE</th>
<th>Presence on North African coast</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pseudolirius kroyeri</em></td>
<td>+</td>
<td></td>
<td>Algeria: Bou Ismail, Alger, Bejaia, Annaba (Bakalem and Dauvin, 1995)</td>
</tr>
<tr>
<td><em>Pseudoprotella inermis</em></td>
<td>+</td>
<td>+</td>
<td>Spain: Cádiz (Chevreux, 1927); Ceuta (Guerra-García and Takeuchi, 2000; present study)</td>
</tr>
<tr>
<td><em>Pseudoprotella phasma</em></td>
<td></td>
<td></td>
<td>Egypt: Abu Qir (Schellenberg, 1936); Algeria: Bou Ismail (Bakalem and Dauvin, 1995); Morocco (Bellan-Santini and Ruffo, 1998); Ceuta (present study)</td>
</tr>
</tbody>
</table>

Sources: Krapp-Schickel (1993) for all species except *Caprella cavedinia* (Krapp-Schickel and Vader, 1998), *Caprella linearis* (Bakalem and Dauvin, 1995), *Caprella santosrosai* (Sánchez-Moyano et al., 1995b), *Pedoculina garciagomezi* (Sánchez-Moyano et al., 1995a), *Pseudoprotella inermis* (Chevreux, 1927; Guerra-García and Takeuchi, 2000), *Caprella ceutae*, n. sp. (present study) and the Atlantic species *C. erethizon*, *C. fretensis* and *C. tuberculata* (present study).

ME: Mediterranean endemic, SGE: Strait of Gibraltar endemic. Presence on North African coast is indicated. The asterisk (*) after species names indicates that specimens of these species have been found on the coast of Ceuta. More detailed information about biogeographical distribution of the species is included in Bellan-Santini and Ruffo (1998).

![Map of the Caprellidea in North Atlantic and Mediterranean areas.](image)

**Fig. 21.** Number of species of the Caprellidea in North Atlantic and Mediterranean areas.

interest since it is situated between distribution centres of the Atlantic and Pacific (Takeuchi, 1993).

Among the species of *Caprella* from Ceuta we can differentiate a group of species by the short length of the gnathopod 2 basis, i.e., *C. danilevskii*, *C. liparotensis*, *C. fretensis* and *C. ceutae*. Clinging behaviour has been studied in *C. danilevskii* by Takeuchi and Hirano (1995), who report that the short basis in this species allows the parallel posture to be adopted more easily.

The species with a longer gnathopod 2 basis can be separated into two subgroups. One is composed of species which have no long setae on antenna 2, i.e. *C. acanthifera*, *C. cavedinia*, *C. hirsuta* and *C. grandimana*. The other two species, *Caprella penantis*
and *C. dilatata*, develop a setose ventral surface of antenna 2. These two species can be easily distinguished from the remaining species of *Caprella* from Ceuta in that they have a very short pereonite 1 of the cephalon. *Caprella penantis* has been recorded under several species or subspecies names from the temperate regions of the world (McCain and Steinberg, 1970) and there is need of further studies to determine its nomenclatural status at each locality (McCain, 1968; Laubitz, 1972; Takeuchi and Hirano, 1995). As well as *C. danilevskii, C. penantis* also displays the ‘parallel posture’ (Takeuchi and Hirano, 1995). The remaining species of *Caprella* from Ceuta, *C. erethizon, C. tuberculata* and *C. santosrosai* can be easily differentiated by ornamental characteristics (tubercles and acute projections) along their bodies. These three species seem to be very close, sharing morphological characteristics. Probably *C. santosrosai* known only in the Strait of Gibraltar so far, will soon be found on Atlantic coasts living together with *C. erethizon* and *C. tuberculata*. We also consider it possible that this species could be the Mediterranean vicariant of the Atlantic species *Caprella septentrionalis* Kröyer.

*Caprella tuberculata, C. erethizon, C. santosrosai* and *C. ceutae* n. sp. have been found together on similar substrata, and at localities on the littoral of Ceuta with similar ecological characteristics. How can they coexist and avoid competition? Perhaps they have different life-cycles through the year. It would be interesting to undertake rearing experiments in the laboratory with these species using Takeuchi’s methodology (Takeuchi and Hirano, 1991, 1992) and to study the clinging behaviour on the substratum. The short gnathopod basis in *C. ceutae* could enable it to adopt a more parallel posture, categorized by Takeuchi and Hirano (1995). These four species have, until now, a restricted distribution. *Caprella ceutae* could have evolved from the ancestor of the cosmopolitan *C. equilibra*, adapting to particular ecological characteristics present in the Strait of Gibraltar.

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