

# Deep-sea Caprellidea (Crustacea, Amphipoda) from Azores with the description of three new species

**José M. GUERRA-GARCÍA**

Laboratorio de Biología Marina, Departamento de Fisiología y Zoología,  
Facultad de Biología, Universidad de Sevilla, Avda Reina Mercedes 6, E-41012 Sevilla (Spain)  
jmgueerra@us.es

P  
R  
O  
O  
F

Guerra-García J. M. 2004. — Deep-sea Caprellidea (Crustacea, Amphipoda) from Azores with the description of three new species. *Zoosystema* 26 (2) : ●●●●●●.

## ABSTRACT

The caprellidean fauna of deep-sea waters from Azores is investigated based on the material collected during the expedition BIAÇORES 1971 on board the vessel *Jean Charcot* (29 September-20 November 1971). The collection contained four species: *Liropus azorensis* n. sp., *Protoaeginella paraspinipoda* n. sp., *Protoaeginella verrucosa* n. sp. and *Pseudoprotella phasma* (Montagu, 1804). The three new species are described and illustrated in detail, and a key to the world species of *Liropus* Mayer, 1890, *Protoaeginella* Laubitz & Mills, 1972 and *Pseudoprotella* Montagu, 1804 is included. *Liropus azorensis* n. sp. is the only species in the genus with pereopods 3 and 4 two-articulate and the appendages well developed, being two-articulate in males. *Protoaeginella paraspinipoda* n. sp. is very close to *P. spinipoda* Laubitz & Sorbe, 1996 but can be distinguished mainly by the two-segmented abdomen and the abdominal appendages with three to five apical teeth. *Protoaeginella verrucosa* n. sp. differs from the remaining species of the genus mainly by the presence of two pairs of abdominal appendages. The present study enlarges the deep range known for *Pseudoprotella phasma* to 2450 m.

## KEY WORDS

Crustacea,  
Amphipoda,  
Caprellidea,  
deep-sea,  
Azores,  
new species.

**RÉSUMÉ**

*Caprellidea* (Crustacea, Amphipoda) des eaux profondes des Açores avec description de trois nouvelles espèces.

La faune des amphipodes Caprellidea des eaux profondes des Açores a été étudiée à partir du matériel collecté lors de l'expédition BIAÇORES 1971 à bord du *Jean Charcot* (29 septembre-20 novembre 1971). La collection renfermait quatre espèces : *Liropus azorensis* n. sp., *Protoaeginella paraspini-poda* n. sp., *Protoaeginella verrucosa* n. sp. et *Pseudoprotella phasma* (Montagu, 1804). Les trois nouvelles espèces sont décrites et illustrées en détail et une clé des espèces du monde de *Liropus* Mayer, 1890, *Protoaeginella* Laubitz & Mills, 1972 et *Pseudoprotella* Montagu, 1804 est fournie. *Liropus azorensis* n. sp. est la seule espèce du genre avec des péréiopodes 3 et 4 bi-segmentés et des appendices abdominaux bien développés, bi-articulés chez les mâles. *Protoaeginella paraspini-poda* n. sp. est très proche de *P. spinipoda* Laubitz & Sorbe, 1996 mais s'en distingue principalement par l'abdomen bi-segmenté et les appendices abdominaux à trois à cinq dents apicales. *Protoaeginella verrucosa* n. sp. diffère des autres espèces du genre surtout par la présence de deux paires d'appendices abdominaux. La présente étude accroît la profondeur connue pour *Pseudoprotella phasma* jusqu'à 2 450 m.

**MOTS CLÉS**

Crustacea,  
Amphipoda,  
Caprellidea,  
eaux profondes,  
Açores,  
nouvelles espèces.

**INTRODUCTION**

The Azores Archipelago is located in the middle north Atlantic region (Fig. 1) and represents an interesting area from the biogeographical point of view. The amphipods have been poorly studied in the Azores, although they may constitute the most abundant group of macrobenthic invertebrates in the archipelago (Lopes *et al.* 1993). This lack of knowledge mainly applies to the suborder Caprellidea.

The first studies dealing with the amphipods from Azores were conducted by Guerne (1889), Stebbing (1906) and Chevreux & Fage (1925), who studied samples taken in the littoral zones of the islands to more than 3000 m deep. Additionally, Mateus & Afonso (1974) and Afonso (1976, 1977) provided more information on amphipods from Azores. Lopes *et al.* (1993) reviewed the available literature on Azores amphipods and studied several collections sampled during 1988 and 1989 at the islands of S.

Miguel and Faial and provided a list of 122 species from 29 families. A significant part of the data given by Lopes *et al.* (1993) consisted of the results from two oceanographic expeditions, *L'Hirondelle* (Chevreux 1900) and *Prince Albert 1<sup>er</sup> de Monaco* (Chevreux 1935). So far, seven species of the Caprellidea have been reported from shallow waters (0-130 m depth) of Azores (Lopes *et al.* 1993; Wirtz & Vader 1996; Krapp-Schickel & Vader 1998; Wirtz 1998): *Caprella acanthifera* Leach, 1814, *C. andreae* Mayer, 1890, *C. equilibra* Say, 1818, *C. penantis* Leach, 1814, *C. stella* Krapp-Schickel & Vader, 1998, *Pseudoprotella phasma* (Montagu, 1804) and *Phisica marina* Slabber, 1749. *Caprella stella* and *Phisica marina* have been recorded in association with the echinoderm *Holothuria tubulosa* (Gmelin, 1788), and the starfish *Ophidiaster ophidianus* (Lamarck, 1816) and *Hacelia attenuata* (Gray, 1840) at Faial Island (Wirtz & Vader 1996; Krapp-Schickel & Vader 1998; Wirtz 1998).

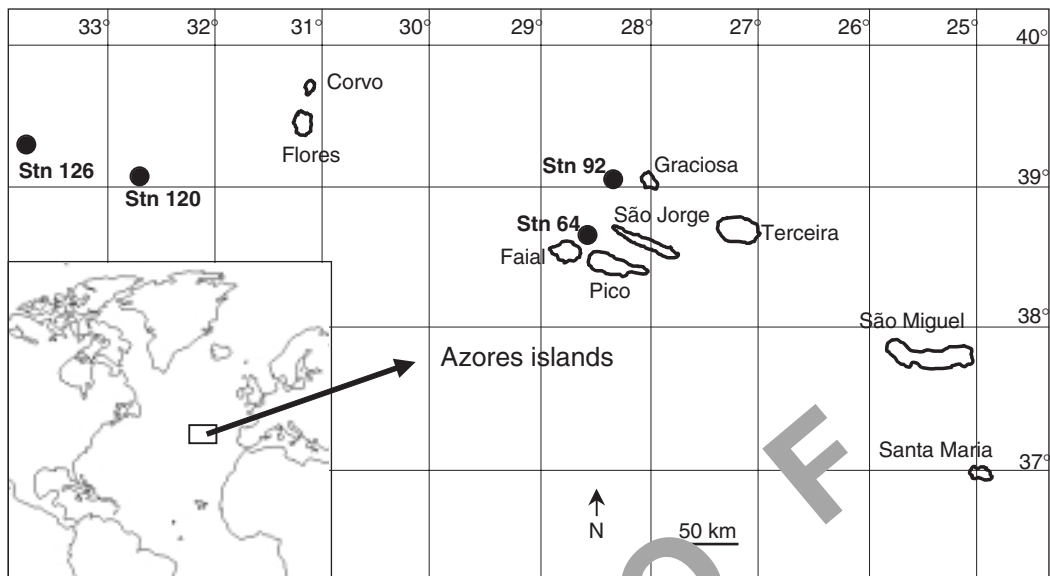


FIG. 1. — Map of the study area showing the sampled stations.

During a visit at the Muséum national d'Histoire naturelle, Paris (MNHN), the author studied a small collection of deep-sea caprellids. The samples were collected from the Azores Archipelago during the expedition BIAÇORES 1971 on board the vessel *Jean Charcot* (29 September–20 November 1971). Family classification of the Caprellidea used in the present study follows Takeuchi (1993). All the caprellid specimens are deposited in the MNHN.

#### LIST OF STATIONS (see Fig. 1)

Expedition BIAÇORES 1971, *Jean Charcot* (29.IX–20.XI.1971).

Stn 64, 38°43'N, 28°29'W, 1240–1200 m deep, NE Faial Island, 14.X.1971, muddy sands, epibenthic trawl.

Stn 92, 39°03.5'N, 28°27.5'W, 2450 m deep, W Graciosa Island, 17.X.1971, muddy sands, epibenthic trawl.

Stn 120, 39°03.5'N, 32°43.5'W, W Flores Island, 2100 m deep, 22.X.1971, fine sands, epibenthic trawl.

Stn 126, 39°19.5'N, 33°47'W, W Flores Island, 3360 m deep, 23.X.1971, globigerine sands, epibenthic trawl.

#### SYSTEMATICS

Suborder CAPRELLIDEA Leach, 1814

Family CAPRELLIDAE Leach, 1814

Genus *Liropus* Mayer, 1890

*Liropus azorensis* n. sp.

(Figs 2–5)

TYPE MATERIAL. — Holotype: Stn 64, ♂ (MNHN-Am 5259). Allotype: Stn 64, ♀ (MNHN-Am 5260). Paratypes: Stn 64, 4 ♂♂, 2 ♀♀ (MNHN-Am 2949), and 5 ♂♂, 4 ♀♀, 4 juveniles (MNHN-Am 2956).

ETYMOLOGY. — Named *azorensis* alluding to Azores Islands, the place where the species was found.

DISTRIBUTION. — So far, only known from the Azores.

#### DESCRIPTION

*Holotype, male* (6.7 mm)

**Lateral view (Fig. 2A).** Body dorsally smooth. Head rounded; eyes without distinguishable ommatidia. Pereonite 1 fused with head, suture present. Pereonites 3 and 4 subequal. Pereonite 5 the longest. Pereonite 7 the shortest.

**Gills (Fig. 2A).** Present on pereonites 3-4, elongate, length about four times width.

**Mouthparts.** Upper lip (Fig. 3A) symmetrically bilobate, with minute setulae apically. Mandibles (Fig. 3D, E) with three-articulate palp; distal article of palp with a row of five plumose setae, and another two setae displaced from the row, a very small one distally and another longer one proximally, both smooth; mandibular molar present, bordered by teeth; left mandible (Fig. 3E) with incisor five-toothed, lacinia mobilis five-toothed followed by two plumose setae; incisor of right mandible (Fig. 3D) five-toothed, lacinia mobilis deeply serrate, followed by two plumose setae; molar flake absent. Lower lip (Fig. 3B) inner and outer lobes well demarcated, without setae; inner lobes rectangular, with a medial cleft. Maxilla 1 (Fig. 3F) outer lobe carrying six robust setae; distal article of the palp with four apical setae and a medial seta. Maxilla 2 (Fig. 3G) inner lobe rectangular, carrying five distal setae; outer lobe rectangular, 1.7 times as long as inner lobe, with five apical setae. Maxilliped (Fig. 3C) inner plate rectangular carrying four setae and a nodular seta; outer plate oval, 2.2 times as long as inner plate, with a seta apically and three smaller setae laterally; palp four-articulate, second article with three setae and third article with five setae.

**Antennae.** Antenna 1 (Fig. 4A) about two fifth of body length; proximal article of peduncle without projection; flagellum broken in holotype (nine-articulate in male paratype). Antenna 2 (Fig. 4B) about one half length of antenna 1; proximal peduncular article with acute projection distally; swimming setae absent; flagellum two-articulate.

**Gnathopods.** Gnathopod 1 (Fig. 4C) basis 1.2 times longer than ischium to carpus combined; propodus palm with a pair of grasping spines proximally; grasping margin of propodus palm with small setulae. Gnathopod 2 (Fig. 4D) inserted on the anterior half of pereonite 2 (Fig. 2A); basis as long as pereonite 2; ischium rectangular; merus rounded; carpus short and triangular; propodus oval, as long as basis; palm with proximal projection provided with a single spine,

followed by serrate margin and small U-notch; dactylus with smooth margin.

**Pereopods.** Pereopod 3 (Fig. 5A) and 4 (Fig. 5B) two-articulate; proximal article twice as long as distal one, provided with a distal seta; distal article with three setae. Pereopod 5 (Fig. 5C) two-articulate, attached at the middle of pereonite 5; proximal article twice as long as distal one, with two distal setae; distal article with three setae. Pereopod 6 (Fig. 5D) attached to the posterior end of the pereonite 6, six-articulate, basis without carina, ischium short and rectangular, propodus palm carrying row of plumose setae, with two plumose setae on a proximal projection. Pereopod 7 (Fig. 5E) slightly larger than pereopod 6.

**Penes.** Penes (Fig. 5F) situated laterally, oval, length about 1.2 times width.

**Abdomen.** Abdomen (Fig. 5G) with a pair of appendages, a pair of lateral lobes and a single dorsal lobe. Appendages well developed, two-articulate; proximal article rectangular with three setae; distal article almost tabicated into two articles, with two proximal setae and one seta and a strong spine distally. Dorsal lobe with two plumose setae.

*Allotype, female (5.8 mm)*

Oostegites setose on pereonite 3 and slightly setose on pereonite 4 (Fig. 2B). Genital papillae (Fig. 2B) setose. Abdomen (Fig. 5G) with appendages one-articulate provided with a lateral setae and a distal strong spine.

REMARKS

The specimens of *Liropus azorensis* n. sp. are in agreement with the diagnosis of the genus apart from the pereopods 3 and 4, which are two-articulate instead of one-articulate. This characteristic enlarges the generic diagnosis and can be used to distinguish *L. azorensis* n. sp. from the remaining species in the genus. In the described species of the genus *Liropus* the abdominal appendages are small, being one-articulate or very reduced, even degenerated into setae. The abdomen of *L. azorensis* n. sp. differs from the abdomen of the remaining species mainly by the

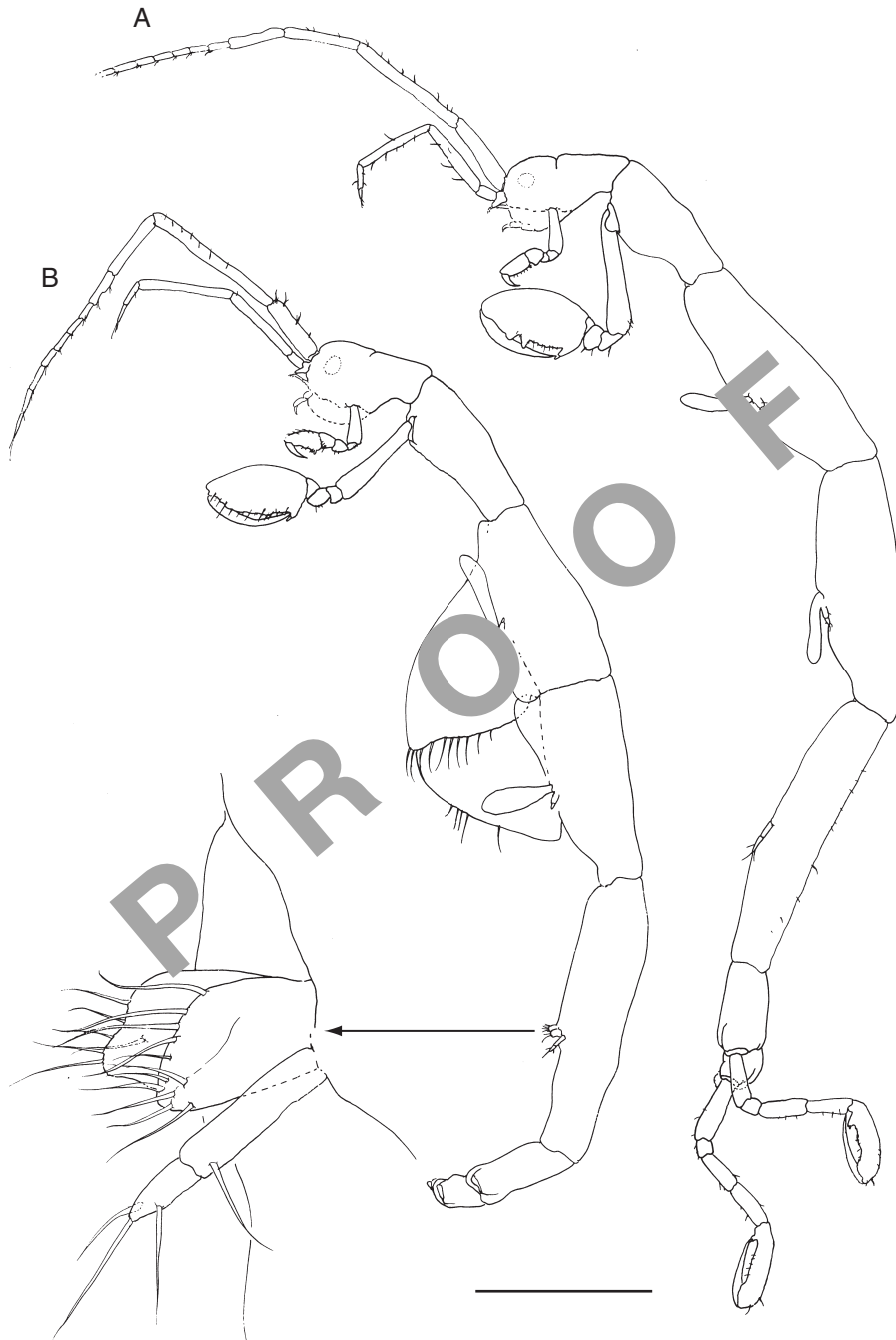


FIG. 2. — *Liropus azorensis* n. sp., lateral view; **A**, male; **B**, female showing a detail of genital papillae and pereopod 5. Scale bar: 1 mm.

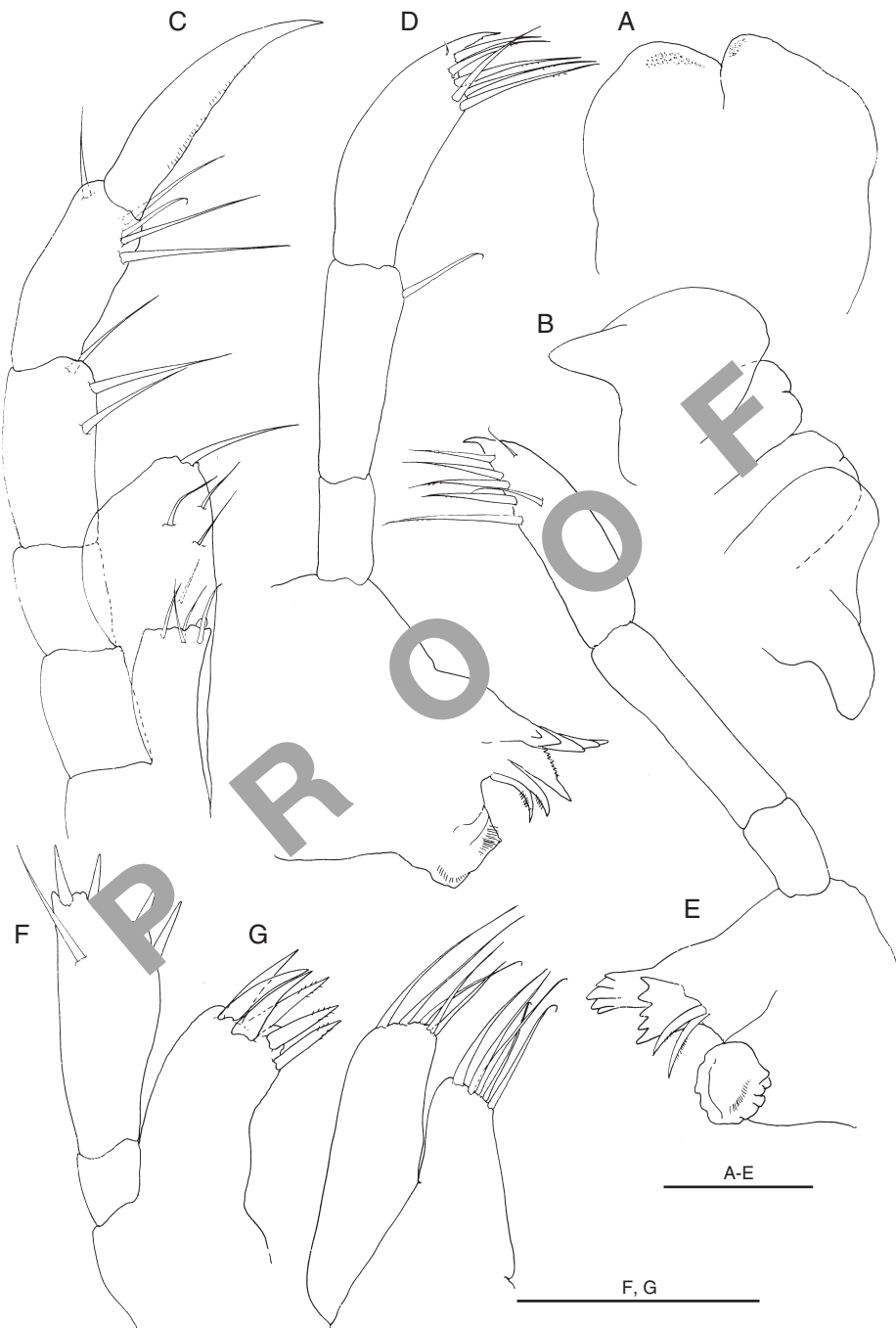


FIG. 3. — *Liropus azorensis* n. sp., male mouthparts; **A**, upper lip; **B**, lower lip; **C**, maxilliped; **D**, right mandible; **E**, left mandible; **F**, maxilla 1; **G**, maxilla 2. Scale bars: 0.05 mm.

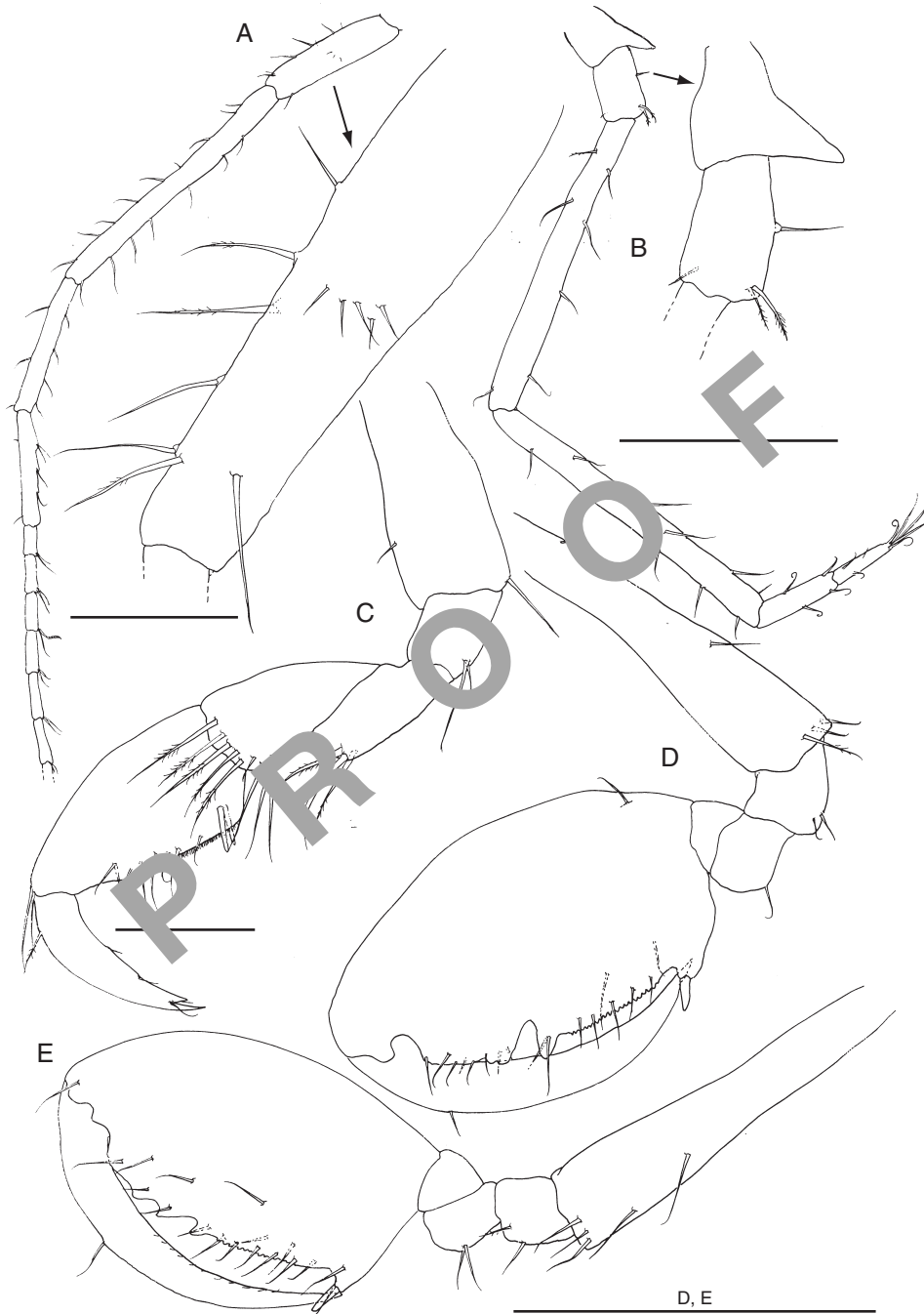


FIG. 4. — *Liropus azorensis* n. sp.; **A-D**, male; **A**, antenna 1 with detail of basal article; **B**, antenna 2 with detail of basal articles; **C**, gnathopod 1; **D**, gnathopod 2; **E**, female gnathopod 2. Scale bars: A, B, D, E, 0.5 mm; C, 0.1 mm.

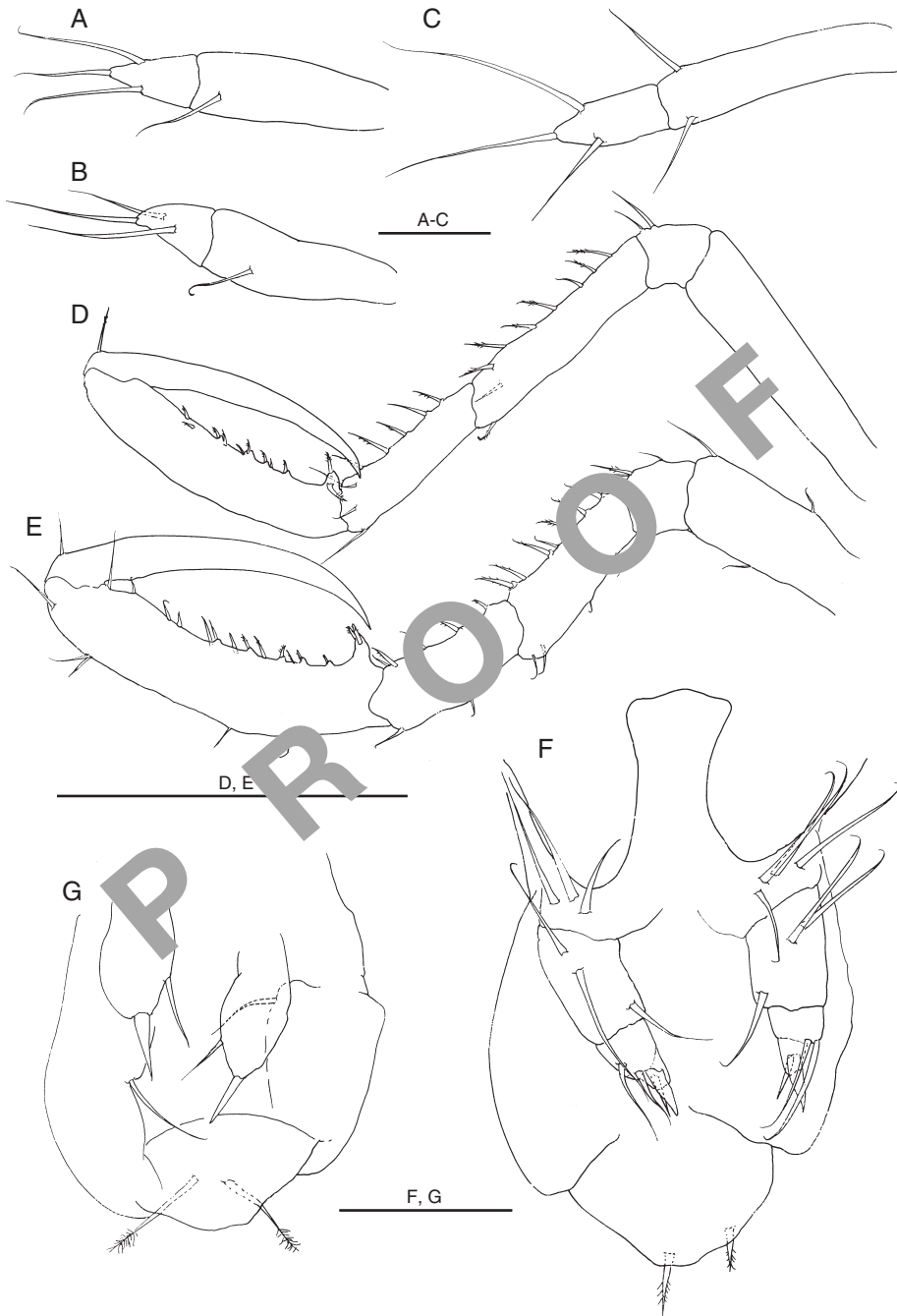


FIG. 5. — *Liropus azorensis* n. sp.; **A-F**, male; **A**, pereopod 3; **B**, pereopod 4; **C**, pereopod 5; **D**, pereopod 6; **E**, pereopod 7; **F**, abdomen; **G**, female abdomen. Scale bars: A-C, F, G, 0.05 mm; D, E, 0.5 mm.



presence of large appendages which are two-articulate (almost three-articulate) in males.

The body length measured for the males of *L. azorensis* n. sp. was  $5.03 \pm 0.77$  mm (mean  $\pm$  standard deviation) (range 4.13-6.70 mm). For the females it was  $4.27 \pm 0.78$  mm (3.59-5.80 mm). In connection with the intraspecific variation, most of the morphological characters are constant in all the specimens examined although small differences were found in the mouthparts. The number of setae following the lacinia mobilis varies, being two or three depending on the specimen. The cleft of the inner lobes

is very marked in some specimens and almost absent in other specimens.

Regarding the geographic distribution, *L. africanus* Mayer, 1920, *L. gracilis* Chevreux, 1927, and *L. azorensis* n. sp. have been recorded in the North Atlantic (McCain & Steinberg 1970) while *L. nelsonae* Guerra-García, 2003 was found in the South Atlantic (Guerra-García 2003). *Liropus elongatus* Mayer, 1890, and *L. minimus* Mayer, 1890 are, so far, Mediterranean endemics (Krapp-Schickel 1993) and *L. japonicus* Mori, 1995 extended the distribution of the genus to the Pacific Ocean (Mori 1995).

#### KEY TO THE WORLD SPECIES OF *LIROPUS* MAYER, 1890

1. Pereopods 3 and 4 two-articulate ..... *L. azorensis* n. sp.  
— Pereopods 3 and 4 one-articulate..... 2
2. Pereopod 5 three-articulate ..... *L. nelsonae*  
— Pereopod 5 two-articulate ..... 3
3. Flagellum of antenna 1 two-articulate ..... *L. japonicus*  
— Flagellum of antenna 1 more than two-articulate ..... 4
4. Head with anterodorsal projections looking like a rostrum ..... 5  
— Head without projections ..... 6
5. Propodus of pereopods 6 and 7 with row of setae along palm ..... *L. gracilis*  
— Propodus of pereopods 6 and 7 with one grasping spine proximally ..... *L. africanus*
6. Propodus of pereopods 6 and 7 with row of setae along palm. Gnathopod 2 basis with a basal constriction ..... *L. minimus*  
— Propodus of pereopods 6 and 7 with one grasping spine proximally. Gnathopod 2 basis with parallel margins ..... *L. elongatus*

Genus *Protoaeginella* Laubitz & Mills, 1972

*Protoaeginella paraspini-poda* n. sp.  
(Figs 6-9)

TYPE MATERIAL. — Holotype: Stn 120, ♂ (MNHN-Am 5257). Allotype: Stn 120, ♀ (MNHN-Am 5258).

Paratypes: Stn 120, 9 ♂♂, 5 ♀♀ (MNHN-Am 2948), and 16 ♂♂, 19 ♀♀ (MNHN-Am 2961).

ETYMOLOGY. — The specific name *paraspini-poda* refers to the species similarity to *P. spini-poda* Laubitz & Sorbe, 1996.

DISTRIBUTION. — So far, only known from the Azores.

## DESCRIPTION

*Holotype, male (10.1 mm)*

**Lateral view (Fig. 6A).** Head and pereonites with small tubercles. Eyes absent. Pereonite 1 fused with head although the suture between them is very distinct. Pereonites 2 to 5 increasing in length. Pereonite 7 the shortest.

**Gills (Fig. 6A).** Present on pereonites 3-4, elongate, length about five times width. A seta present near the base of the gills.

**Mouthparts.** Upper lip (Fig. 7E) symmetrically bilobate, with a row of minute setulae apically. Mandibles (Fig. 7A, B) with three-articulate palp; distal article of palp with a row of five plumose setae following the formula 1-3-1; mandibular molar present, strong; incisor and lacinia mobilis five-toothed; left mandible (Fig. 7A) with three plumose setae near lacinia mobilis and right mandible (Fig. 7B) with two plumose setae; molar flake present on right mandible, rectangular. Lower lip (Fig. 7D) inner and outer lobes well demarcated, with setulae; inner lobes rounded. Maxilla 1 (Fig. 7F) outer lobe carrying seven spiniform setae; distal article of the palp with five robust setae apically and two medial setae. Maxilla 2 (Fig. 7G) inner lobe oval, carrying five setae distally; outer lobe rectangular, 1.3 times as long as inner lobe, with 11 apical setae. Maxilliped (Fig. 7C) inner plate carrying two nodular setae (short and robust like a tooth), two simple setae and five plumose setae, one of them small and robust and placed on the inner margin; outer plate oval, 1.8 times as long as inner plate, with four nodular setae, two distal apical simple setae and one lateral simple seta; palp four-articulate, second and third article setose.

**Antennae.** Antenna 1 (Fig. 8A) about one sixth of body length; distal article of the peduncle provided with a small accessory flagellum which carries two distal setae; flagellum six-articulate. Antenna 2 (Fig. 8B) without swimming setae; proximal peduncular article with acute projection distally; flagellum two-articulate.

**Gnathopods.** Gnathopod 1 (Fig. 8C) basis as long as ischium to carpus combined; propodus palm with a pair of grasping spines proximally; grasping margin of propodus palm with small

setulae on the anterior end; dactylus serrate. Gnathopod 2 (Fig. 8D) inserted on the anterior half of pereonite 2 (Fig. 6A); basis 0.8 times as long as pereonite 2; ischium rectangular; merus rounded; carpus short and triangular; propodus elongate, as long as basis; palm with proximal projection provided with a single spine, followed by rows of small setulae and serrate margin on distal half; dactylus with smooth margin, provided with a row of tiny setulae.

**Pereopods.** Pereopod 3, 4 and 5 absent; a small knob with a single setae instead of pereopod 5. Pereopod 6 and 7 missing in male holotype (Fig. 6A) described from the female allotype (Fig. 6B).

**Penes (Fig. 9C).** Penes large and elongate, twice as long as width.

**Abdomen (Fig. 9C).** Abdomen with indistinct dorsal suture line, apparently two-segmented. A pair of appendages well developed, one-articulate, with two small seta medially and ending with five long teeth.

*Allotype, female (7.3 mm)*

Oostegites not setose (Fig. 6B). Genital papillae (Fig. 6B) with a distal seta. Palm of gnathopod 2 not serrated distally (Fig. 8E). Pereopod 6 (Fig. 9A) attached to the posterior end of the pereonite 6 (Fig. 6B), six-articulate, basis without carina, ischium short and rectangular; merus, carpus and propodus palm carrying row of short setae. Pereopod 7 (Fig. 9B) similar to pereopod 6. Abdomen (Fig. 9D) with a pair of small appendages one-articulate carrying a small distal seta.

## REMARKS

The genus *Protoaeiginella* was established by Laubitz & Mills (1972) based on the species *P. muricata* Laubitz & Mills, 1972, collected from the Gay Head-Bermuda transect (North Atlantic) at 1330-4970 m. Recently, Laubitz & Sorbe (1996) described the second species of the genus, *P. spinipoda* from Bay of Biscay (North Atlantic) at 2990-3070 m. With the present study, so far, four species are known in the genus *Protoaeiginella*: *P. muricata*, *P. spinipoda* and the

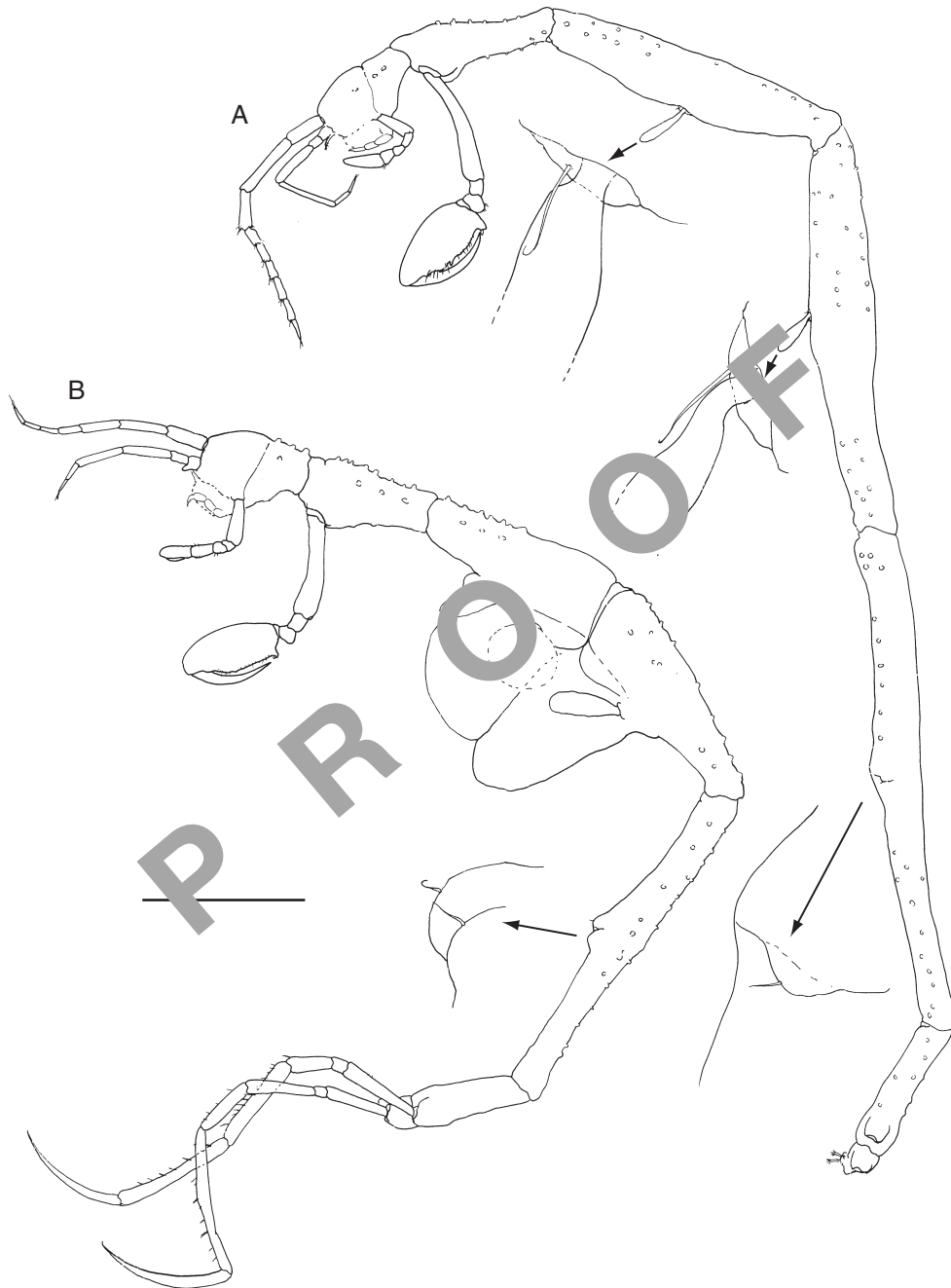


FIG. 6. — *Protoaeginella paraspinipoda* n. sp., lateral view; **A**, male showing details of base of the gills and pereonite 5; **B**, female showing a detail of genital papillae. Scale bar: 1 mm.



FIG. 7. — *Protoaeginella paraspiniipoda* n. sp., male mouthparts; **A**, left mandible; **B**, right mandible; **C**, maxilliped; **D**, lower lip; **E**, upper lip; **F**, maxilla 1; **G**, maxilla 2. Scale bars: 0.05 mm.

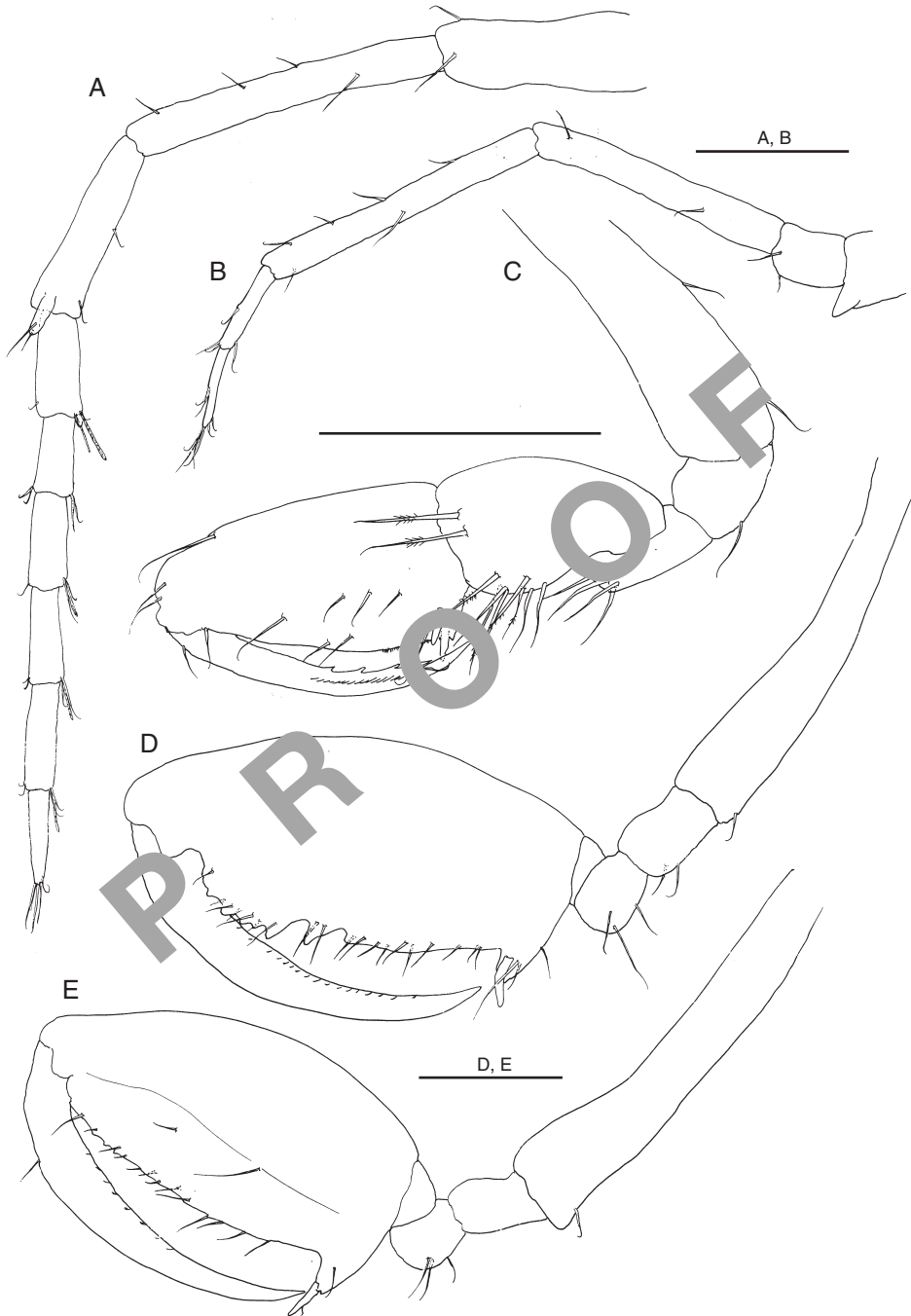


FIG. 8. — *Protoaeginella paraspinipoda* n. sp.; A-D, male; A, antenna 1; B, antenna 2; C, gnathopod 1; D, gnathopod 2; E, female gnathopod 2. Scale bars: 0.2 mm.

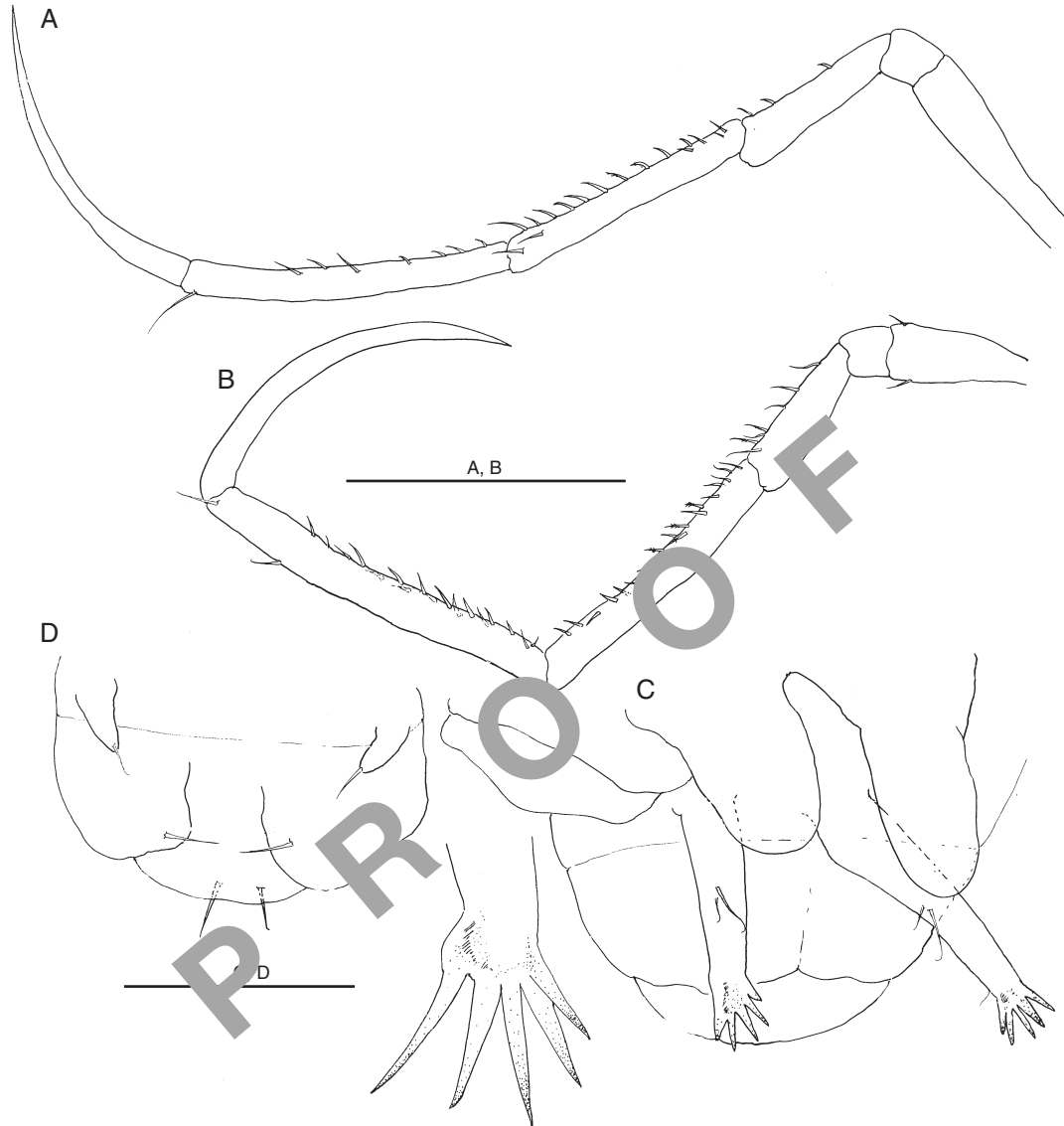


FIG. 9. — *Protoaeginella paraspinipoda* n. sp.; **A**, female pereopod 6; **B**, female pereopod 7; **C**, male abdomen; **D**, female abdomen. Scale bars: A, B, 0.5 mm; C, D, 0.1 mm.

new species *P. paraspinipoda* n. sp. and *P. verrucosa* n. sp., described in this paper.

The body length measured for the males of *P. paraspinipoda* n. sp. was  $7.61 \pm 1.33$  mm (mean  $\pm$  standard deviation) (range 5.45-10.10 mm). For the females it was  $6.27 \pm 0.61$  mm (5.09-7.30 mm). In connection with the intraspecific variation, the

morphological characters of antennae, mouthparts, gnathopods, pereopods and abdomen are constant in all the specimens examined, except for the lacinia mobilis in the right mandible, which can be five- or six-toothed, and the number of distal teeth in the appendages of the male abdomen which ranges from three to five.

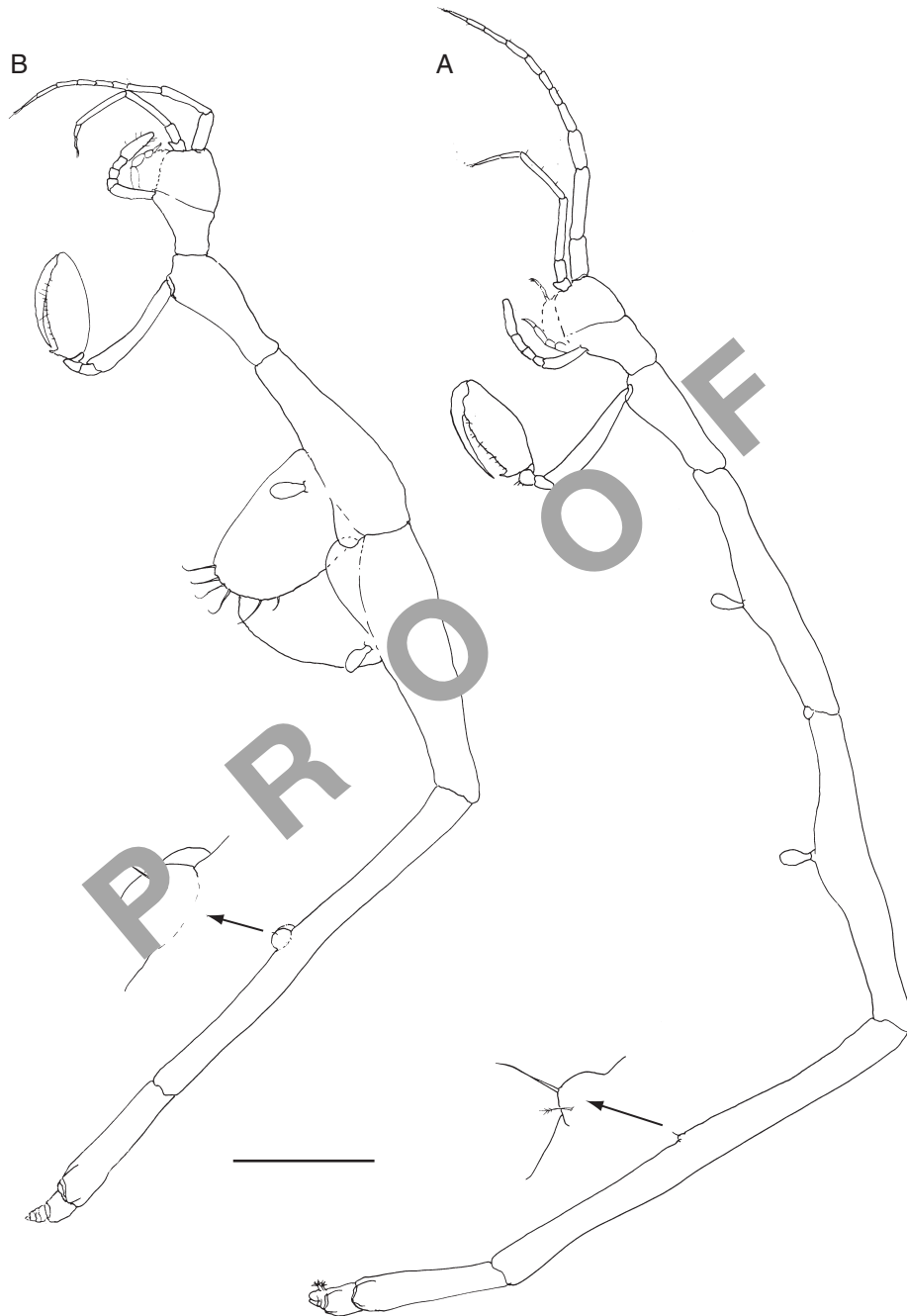


FIG. 10. — *Protoaeginella spinipoda* Laubitz & Sorbe, 1996, lateral view; **A**, male showing a detail of pereonite 5; **B**, female showing a detail of genital papillae. Scale bar: 1 mm.

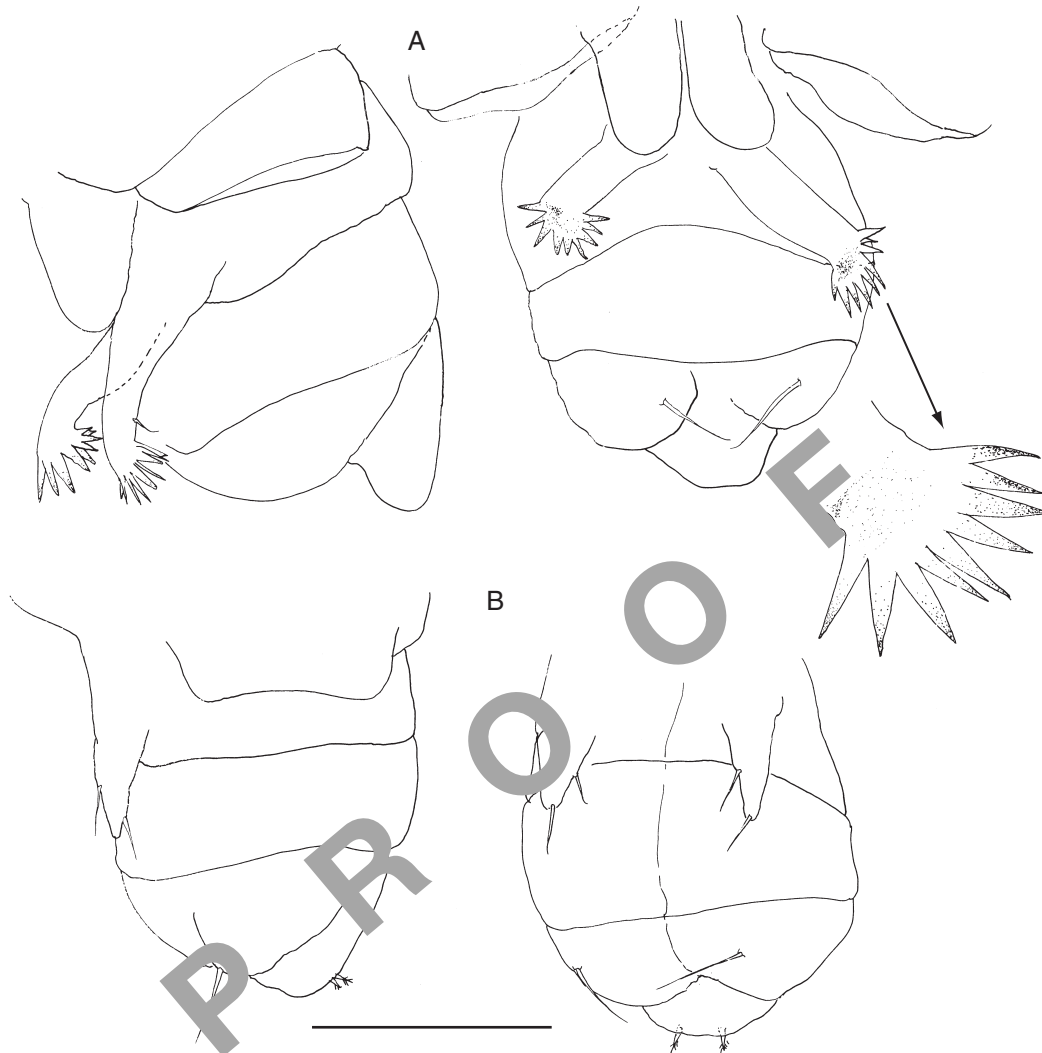


FIG. 11. — *Protoaeginella spinipoda* Laubitz & Sorbe, 1996; **A**, male abdomen; **B**, female abdomen. Scale bar: 0.1 mm. (Left: lateral view; Right: ventral view).

Although the description and figures of Laubitz & Sorbe (1996) for *P. spinipoda* are clear and detailed, taking into account that *P. paraspini-*  
*poda* n. sp. is very close to *P. spinipoda*, the type material of *P. spinipoda*, deposited in the MNHN, have been consulted for comparison (holotype ♂ [MNHN-Am 4835], allotype ♀ [MNHN-Am 4836] and paratypes, 8 ♂♂ and 6 ♀♀ [MNHN-Am 4837]). Both species,

*P. spinipoda* and *P. paraspini-*  
*poda* n. sp. are similar in the feature of the antennae, gnathopods and body proportions but can be distinguished mainly on the basis of the following characteristics, which are constant in all the specimens examined: 1) the body of *P. spinipoda* is almost smooth, without marked tubercles (Fig. 10), whereas *P. paraspini-*  
*poda* n. sp. has small tubercles dorsally and laterally on the body



(Fig. 6); 2) the abdomen is three- to four-segmented in *P. spinipoda* (Fig. 11), whereas it is indistinctly two-segmented in *P. paraspinipoda* n. sp. (Fig. 9C, D); and 3) the male appendages of the abdomen have nine or 10 apical teeth in *P. spinipoda* (Fig. 11A) and three to five apical teeth in *P. paraspinipoda* n. sp. (Fig. 9C).

*Protoaeginella verrucosa* n. sp.  
(Figs 12-15)

**TYPE MATERIAL.** — Holotype: Stn 64, ♂ (MNHN-Am 5254). Allotype: Stn 64, ♀ (MNHN-Am 5255). Paratypes: Stn 126, 1 ♀ (MNHN-Am 2947), and stn 64, 4 ♂♂, 9 ♀♀ (MNHN-Am 5256).

**ETYMOLOGY.** — The specific name is descriptive of the numerous small tubercles on the body.

**DISTRIBUTION.** — So far, only known from the Azores.

**DESCRIPTION**

*Holotype, male (6.9 mm)*

**Lateral view (Fig. 12A).** Body densely covered with numerous small tubercles. Eyes absent but there is an indistinct ocular spot. Pereonite 1 fused with head although the suture between them is very distinct. Pereonites 2 to 5 increasing in length. Pereonites 4 and 5 curved. Pereonite 7 the shortest.

**Gills (Fig. 12A).** Present on pereonites 3-4, elongate, length about four times width.

**Mouthparts.** Upper lip (Fig. 13E) symmetrically bilobate, without setae apically. Mandibles (Fig. 13B, C) with three-articulate palp; distal article of palp with a row of five setae on left mandible (Fig. 13C) and three setae on the right mandible (Fig. 13B); mandibular molar present, strong; incisor five-toothed in both mandibles; left mandible with lacinia mobilis five-toothed followed by a row of three setae; right mandible with lacinia apparently four-toothed, although irregularly dentate, followed by two plumose setae; molar flake present in right mandible, elongate. Lower lip (Fig. 13D) inner and outer lobes well demarcated, without setulae; inner lobes rounded. Maxilla 1 (Fig. 13F) outer lobe carrying seven spiniform setae; distal article of

the palp with four robust setae apically and one plumose seta medially. Maxilla 2 (Fig. 13G) inner lobe rectangular, carrying five setae distally; outer lobe rectangular, 1.2 times as long as inner lobe, with eight apical setae. Maxilliped (Fig. 13A) inner plate carrying two nodular setae (short and robust, like a tooth), and four plumose setae; outer plate oval, 1.8 times as long as inner plate, with two or three nodular setae, one distal apical simple seta and one simple lateral seta; palp four-articulate, second and third article setose.

**Antennae.** Antenna 1 (Fig. 14A) about one sixth of body length; distal article of the peduncle provided with a small accessory flagellum which carries two distal setae; flagellum seven-articulate. Antenna 2 (Fig. 14B) without swimming setae; proximal peduncular article with acute distal projection; flagellum two-articulate, setose.

**Gnathopods.** Gnathopod 1 (Fig. 14C) basis a little longer than ischium to carpus combined; propodus palm with a pair of grasping spines proximally; grasping margin of propodus palm with small setulae on the anterior half; dactylus serrate. Gnathopod 2 (Fig. 14D) inserted on the anterior half of pereonite 2 (Fig. 12A); basis 0.7 times as long as pereonite 2, with rows of tubercles; ischium rectangular; merus rounded; carpus short and triangular; propodus elongate, almost as long as basis; palm with proximal projection provided with a single spine, followed by another projection medially and scarcely serrate margin on distal half; dactylus with smooth margin, provided with a row of tiny setulae.

**Pereopods.** Pereopod 3, 4 and 5 absent; a tiny knob without setae instead of the pereopod 5 (Fig. 12A). Pereopod 6 and 7 missing in male holotype (Fig. 12A) described from a male paratype (MNHN-Am 5256). Pereopod 6 (Fig. 15A) attached to the posterior end of the pereonite 6, six-articulate, basis without carina, ischium short and rectangular; merus and carpus palm carrying row of fine setae; propodus palm with a row of robust acute setae. Pereopod 7 (Fig. 15B) similar to pereopod 6.

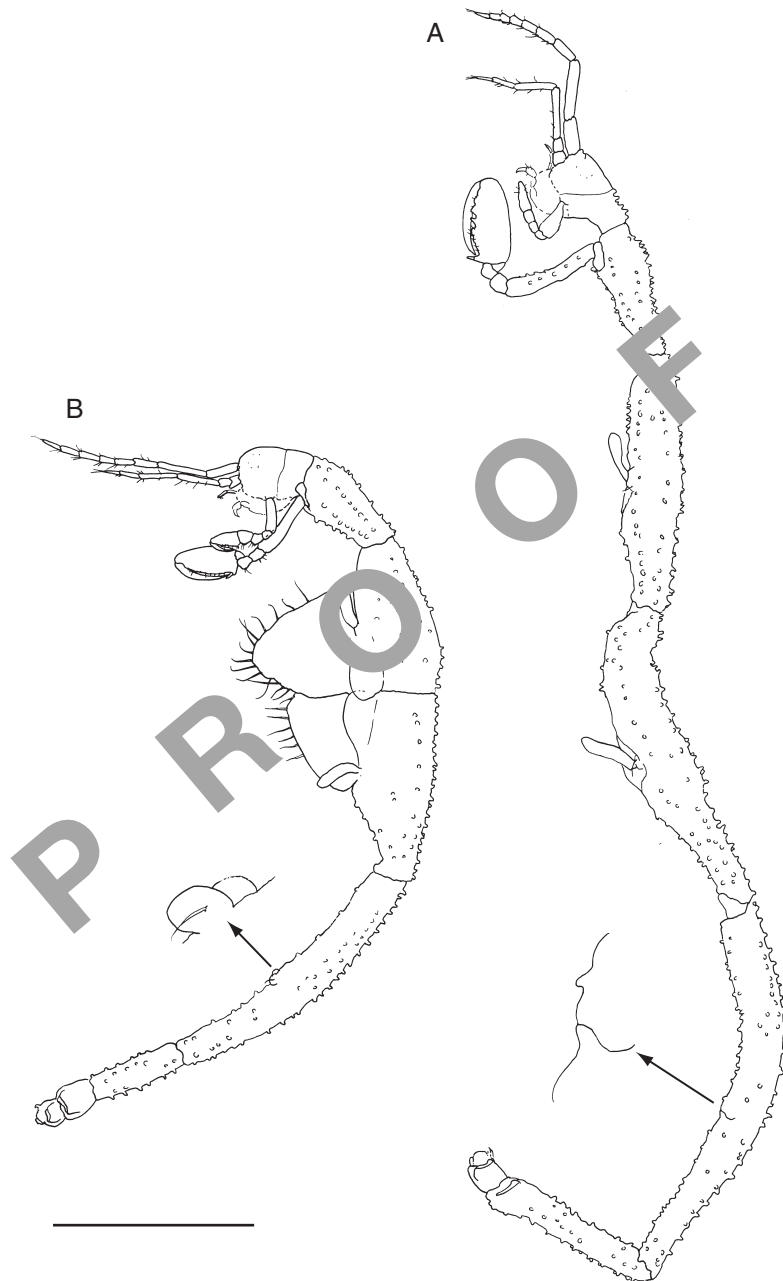


FIG. 12. — *Protoaeginella verrucosa* n. sp., lateral view; **A**, male showing a detail of base pereonite 5; **B**, female showing a detail of genital papillae. Scale bar: 1 mm.

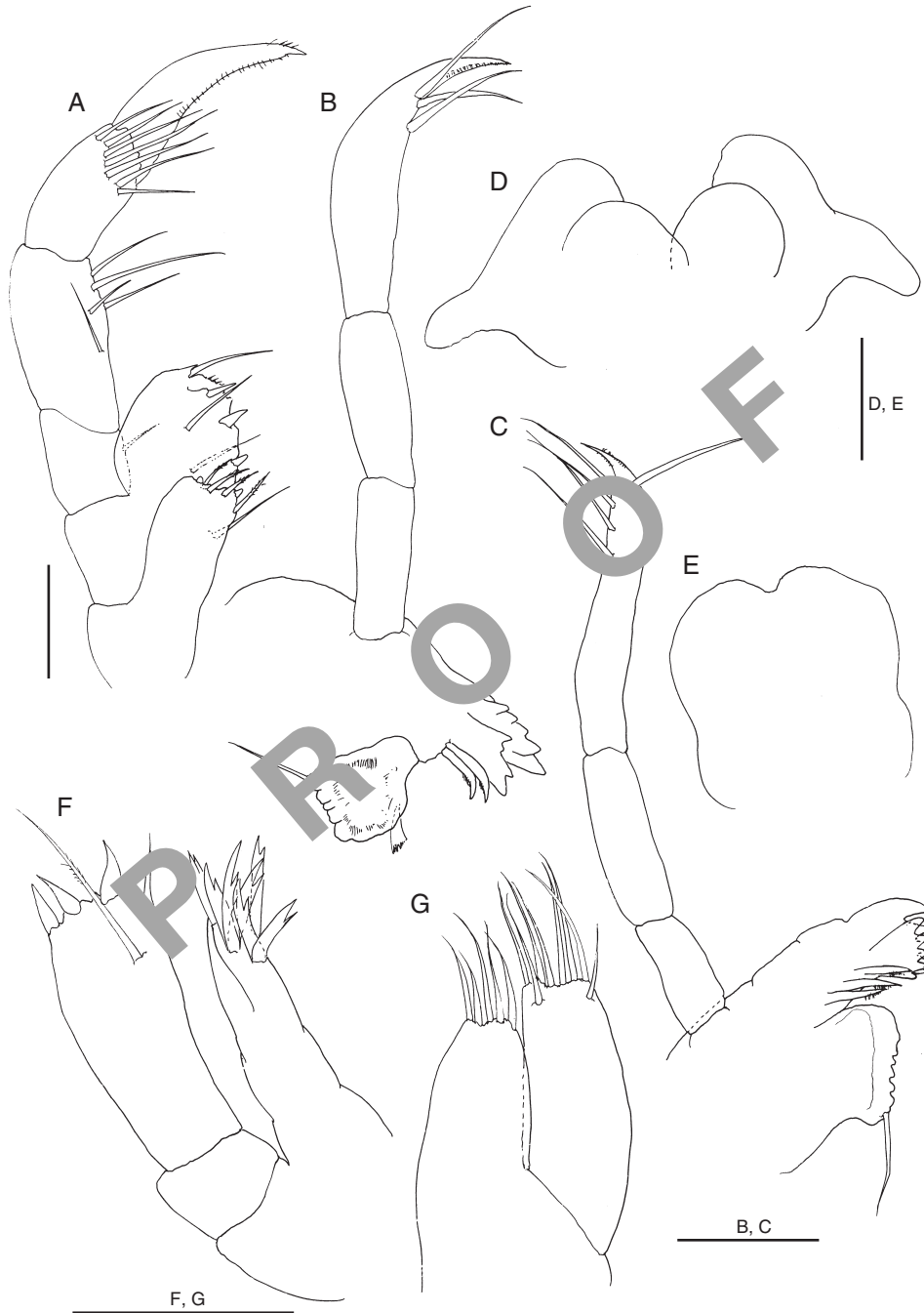


FIG. 13. — *Protoaeginella verrucosa* n. sp., mouthparts; **A**, maxilliped; **B**, right mandible; **C**, left mandible; **D**, lower lip; **E**, upper lip; **F**, maxilla 1; **G**, maxilla 2. Scale bars: 0.05 mm.

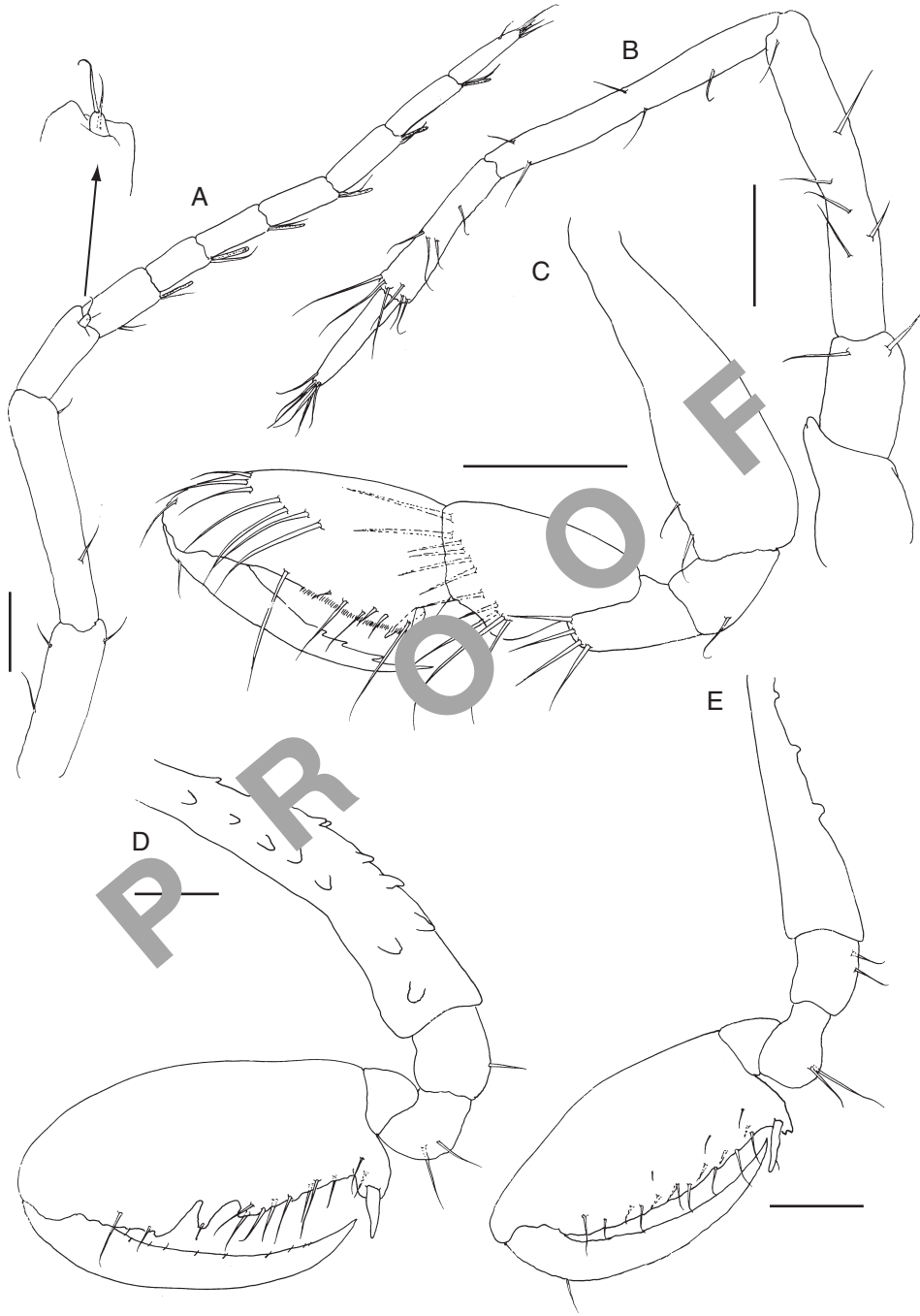


FIG. 14. — *Protoaeginella verrucosa* n. sp.; **A-D**, male; **A**, antenna 1 showing a detail of the accessory flagellum; **B**, antenna 2; **C**, gnathopod 1; **D**, gnathopod 2; **E**, female gnathopod 2. Scale bars: 0.1 mm.

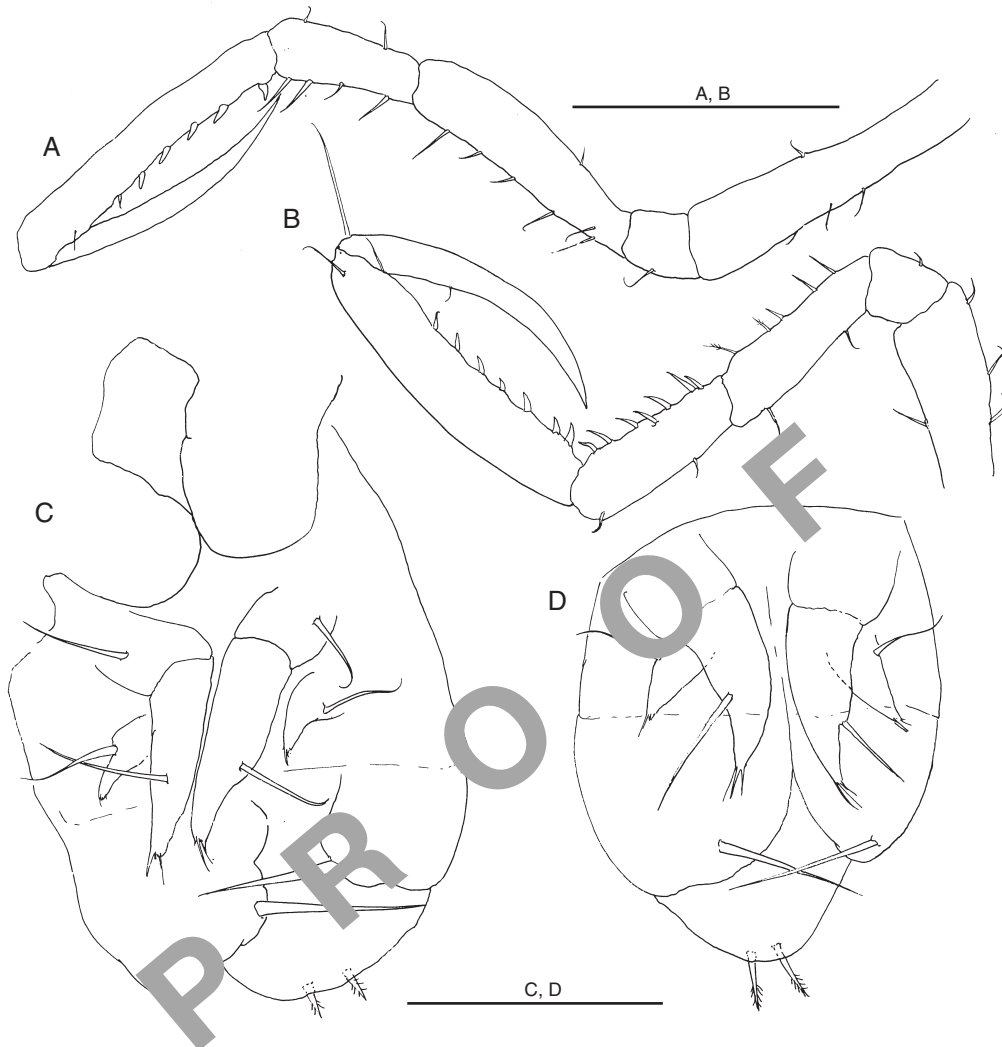


FIG. 15. — *Protoaeginella verrucosa* n. sp.; **A**, male pereopod 6; **B**, male pereopod 7; **C**, male abdomen; **D**, female abdomen. Scale bars: A, B, 0.3 mm; C, D, 0.05 mm.

**Penes (Fig. 15C).** Penes large and wide, almost as long as wide, situated laterally.

**Abdomen (Fig. 15C).** Abdomen with indistinct dorsal suture line, apparently two-segmented. Two pair of appendages. The first pair apparently two-articulate; distal article three times as long as the proximal article, with a seta medially and ending in minute spines. Second pair of appendages smaller, one-articulate, with one medial seta and ending in minute spines. Lateral

lobes with a big seta and dorsal lobe with two plumose setae.

*Allotype, female (4.8 mm)*

Oostegites 3 and 4 setose (Fig. 12B). Genital papillae (Fig. 12B) with a seta medially. Basis of gnathopod 2 with few tubercles; palm of gnathopod 2 without the projection medially and not distally serrated (Fig. 12E). Abdomen (Fig. 15D) also with two pairs of appendages, as in the male.

## REMARKS

The body length measured for the males of *P. verrucosa* n. sp. was  $6.50 \pm 0.54$  mm (mean  $\pm$  standard deviation) (range 5.83-7.21 mm). For the females it was  $4.58 \pm 0.32$  mm (4.00-5.01 mm). In connection with the intraspecific variation, the morphological characters of antennae, mouthparts, gnathopods, pereopods and abdomen are constant in all the specimens examined, except for the setal formula of the mandibular palp (1-x-1) where "x" can be 1, 2 or 3. Furthermore, the number of robust setae distally in the palp of the maxilla 1 can be three or four.

The new species *Protoaeginella verrucosa* n. sp. superficially resembles *P. muricata* described by Laubitz & Mills (1972); the lateral view is extremely similar due to the presence of abundant small tubercles on the body. Nevertheless, both species can be easily distinguished by checking the abdomen which is very different in both species. The abdomen is five-segmented in *P. muricata*, bearing only a pair of minute appendages (Laubitz & Mills 1972), whereas it is two-segmented in *P. verrucosa* n. sp., bearing two pairs of appendages. According to the pres-

ence of two pairs of appendages in the male and female abdomen, we could justify the erection of a new genus for *P. verrucosa* n. sp., since the remaining species of *Protoaeginella* have only one pair of appendages. However, although the abdomen of *P. muricata* and *P. spinipoda* are different enough to consider two different genera, Laubitz & Sorbe (1996) preferred to consider both species in the same genus based on the similarities in antennae, pereonites, pereopods and mouthparts. In the case of *P. verrucosa* n. sp. we have also considered it in the genus *Protoaeginella* mainly based on the presence of accessory flagellum in antenna 1 and absence of pereopods 3, 4 and 5. As far as it is known, there are only two other caprellid genera which have the accessory flagellum on antenna 1, *Parvipalpina* Stephensen, 1944 and *Procallina* Stephensen, 1944. In these two genera, pereopod 5 is present (although very reduced in *Parvipalpina*) whereas it is absent in *Protoaeginella* (Stephensen 1944).

Up to far, the genus *Protoaeginella* is restricted to deep waters of the North Atlantic (Laubitz & Mills 1972; Laubitz & Sorbe 1996; present study).

KEY TO THE WORLD SPECIES OF *PROTOAEGINELLA* LAUBITZ & MILLS, 1972

1. Abdomen with two pairs of abdominal appendages. Basis of the male gnathopod 2 with abundant tubercles ..... *P. verrucosa* n. sp.  
— Abdomen with a pair of abdominal appendages. Basis of the male gnathopod 2 without tubercles ..... 2
2. Abdomen five-segmented, with minute appendages. Body densely tuberculate ..... *P. muricata*  
— Abdomen less than five-segmented, with appendages well developed, those of the male with several large apical teeth. Body smooth or with sparse tubercles ..... 3
3. Abdomen three- to four-segmented. Abdominal appendages of the male with nine to 10 apical teeth. Body smooth ..... *P. spinipoda*  
— Abdomen two-segmented. Abdominal appendages of the male with three to five apical teeth. Body with tubercles ..... *P. paraspinipoda* n. sp.

Genus *Pseudoprotella* Montagu, 1804

*Pseudoprotella phasma* (Montagu, 1804)  
(Figs 16-18)

*Cancer phasma* Montagu, 1804: 66, pl. 6, fig. 3.

*Caprella quadrispinis* Grube, 1864: 63.

*Protella phasma* Mayer, 1882: 29, pl. 1, fig. 2, pl. 4, figs 1-8, 34-37, pl. 5, figs 19-21.

*Pseudoprotella phasma* – Chevreux & Fage 1925: 437-439, fig. 423. — Cavedini 1981: 527. — Krapp-Schickel 1993: 811-813, figs 552, 553. — Guerra-García & Takeuchi 2002: 705, 706.

MATERIAL EXAMINED. — Stn 92, 1 ♀ (MNHN-Am 2959).

DISTRIBUTION. — Type locality: south coast of Devonshire, England (McCain & Steinberg 1970). Other localities: North Sea from Norway to British Isles; Eastern Atlantic from British Isles to Cape Verde, including Azores and Canary Islands; Mediterranean, Adriatic, Black and Red Seas (McCain & Steinberg 1970; Krapp-Schickel 1993).

#### REMARKS

*Pseudoprotella phasma* is a common species in Mediterranean waters, widely distributed along the Mediterranean Sea and Atlantic Ocean. The

studied collection contained only one female specimen which is figured in detail in this paper. *Pseudoprotella phasma* was redescribed by Cavedini (1981) and Krapp-Schickel (1993) based on Mediterranean specimens. The examined female is in agreement with these descriptions except for the number of spiniform setae on the outer lobe of the maxilla 1 (six in the present specimen and five in the previous records).

The present study enlarges the depth range known for *P. phasma*. The species had been recorded previously from Azores at 130 m deep and McCain (1966) reported a maximum depth of 753 m for the species. The female studied here have been collected at 100 m, the greatest depth recorded so far for this species.

Three species of *Pseudoprotella* have been described so far: *P. phasma* (Montagu, 1804), *P. inermis* Chevreux, 1927, redescribed by Guerra-García & Takeuchi (2000) and *P. bogisa* (Mayer, 1903), which have been recently transferred from the genus *Noculacia* to *Pseudoprotella* (Guerra-García 2002). The three species are morphologically compared in Guerra-García (2002).

#### KEY TO THE WORLD SPECIES OF *PSEUDOPROTELLA* MONTAGU, 1804

1. Body smooth ..... *P. inermis*  
— Body with dorsal projections ..... 2
2. Proximal article of pereopods 3 and 4 clearly shorter than distal article. A pair of lateral projections on pereonites 2 and 3 ..... *P. phasma*  
— Proximal article of pereopods 3 and 4 clearly longer than distal article. A pair of lateral projections on pereonites 2, 3 and 4 ..... *P. bogisa*

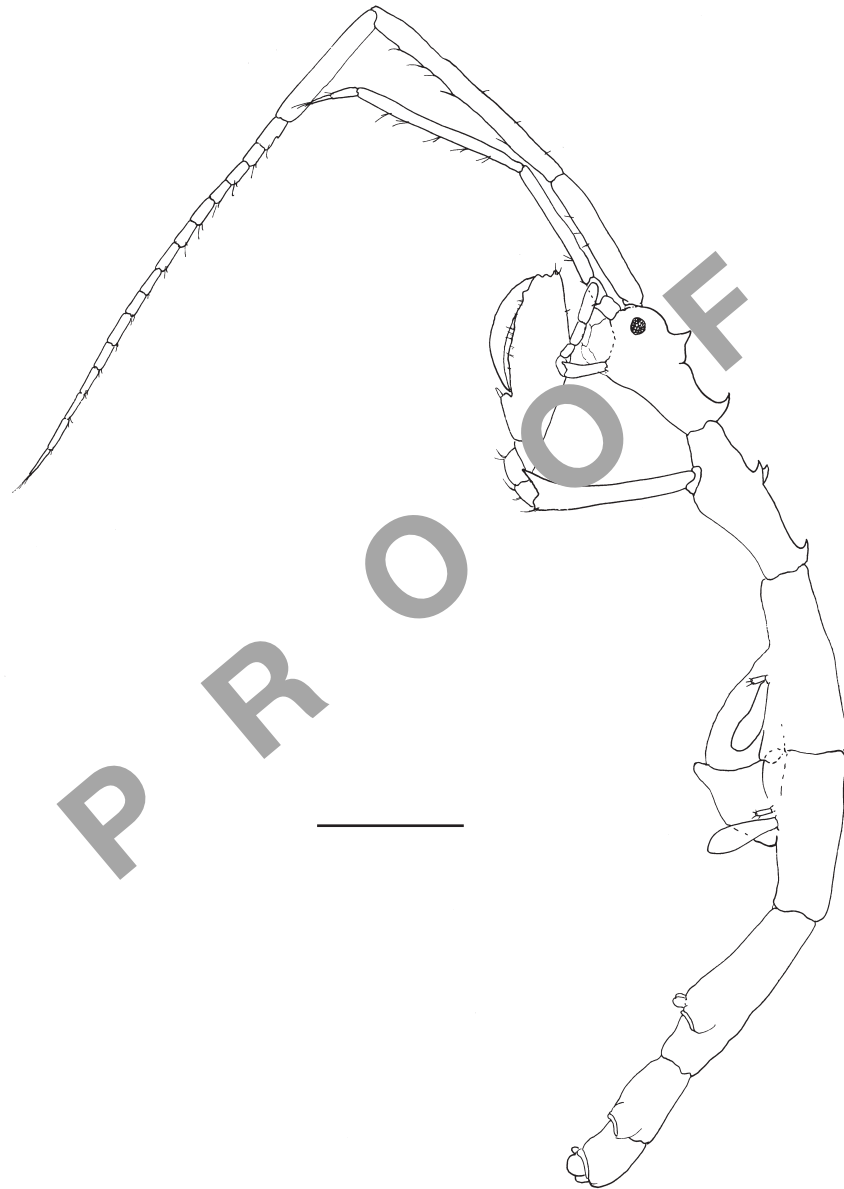


FIG. 16. — *Pseudoprotella phasma* (Montagu, 1804), female lateral view. Scale bar: 1 mm.



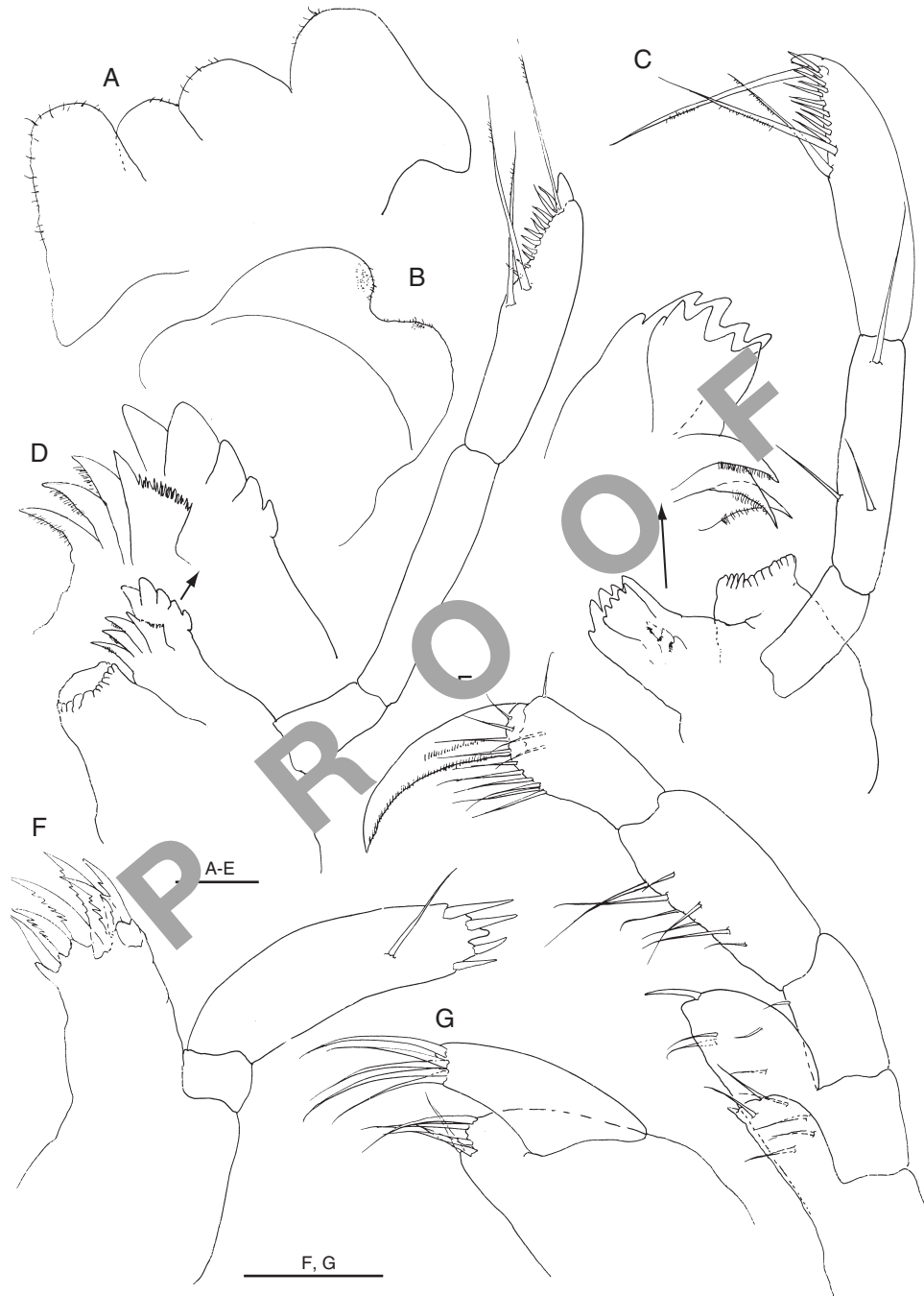


FIG. 17. — *Pseudoprotella phasma* (Montagu, 1804), female mouthparts; **A**, lower lip; **B**, upper lip; **C**, left mandible; **D**, right mandible; **E**, maxilliped; **F**, maxilla 1; **G**, maxilla 2. Scale bars: 0.05 mm.

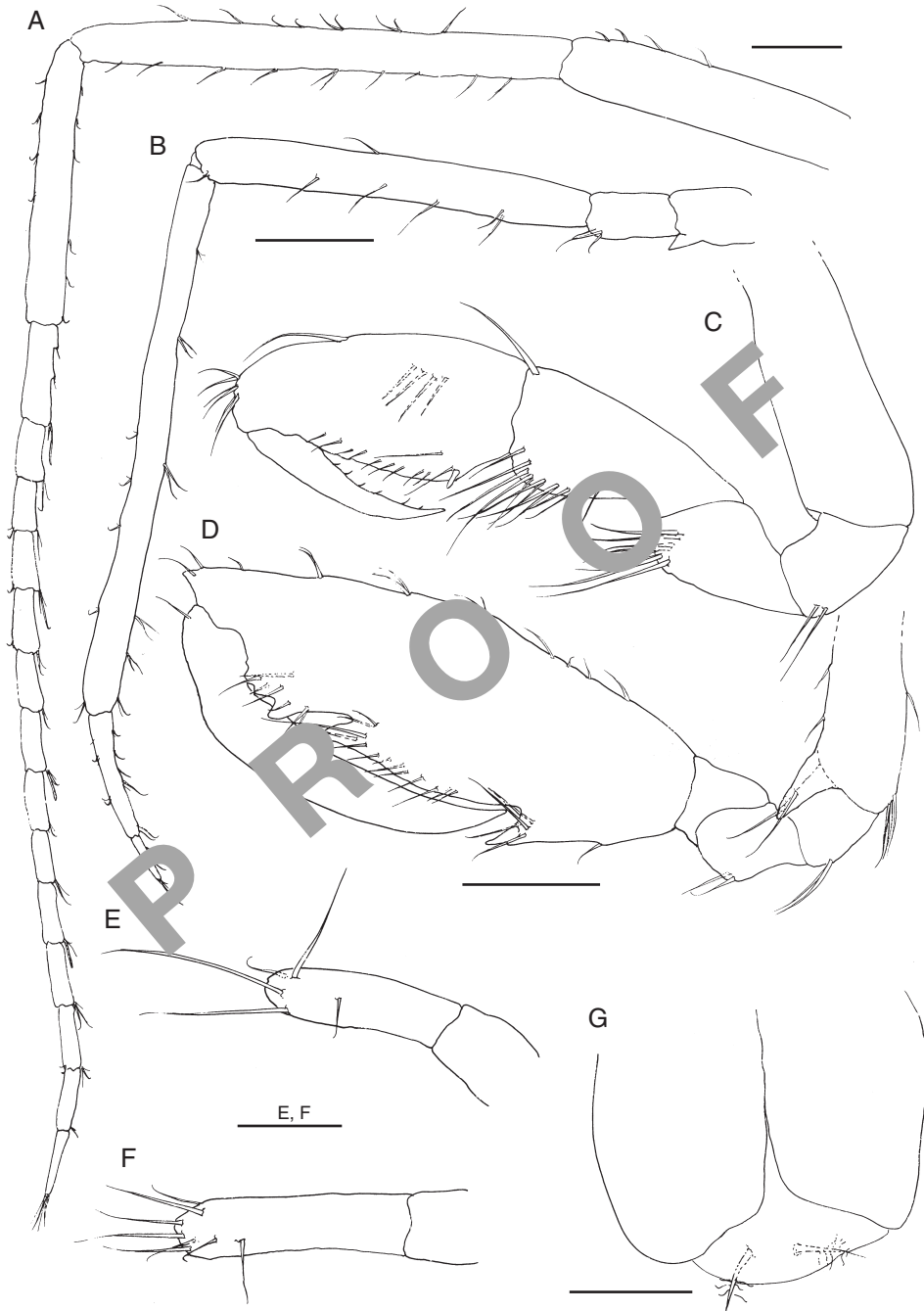


FIG. 18. — *Pseudoprotella phasma* (Montagu, 1804), female; **A**, antenna 1; **B**, antenna 2; **C**, gnathopod 1; **D**, gnathopod 2; **E**, pereopod 3; **F**, pereopod 4; **G**, abdomen. Scale bars: A-D, 0.3 mm; E-G, 0.05 mm.

### Acknowledgements

I am very grateful to Dr D. Defaye for making the collections available for study and for her help and hospitality during my stay at the MNHN. Thanks are also due to Dr Ngoc-Ho (MNHN), and M. Machado (Universidade do Algarve, Portugal), for their kindness, friendship, and encouragement during the present study. The stay at the MNHN was supported by COLPARSYST resources, through the programme "Improving human potential: access to research infrastructure" (IHP/ARI) provided by the European Community.

### REFERENCES

- AFONSO O. 1976. — Amphipoda des Açores recueillis par scaphandrier autonome (avec la description d'une nouvelle espèce). *Publications de l'Institut zoologique Dr « Augusto Nobre »* 130: 9-38.
- AFONSO O. 1977. — Contribution à l'étude des Amphipodes des Açores. Description d'une nouvelle espèce. *Publications de l'Institut zoologique Dr « Augusto Nobre »* 135: 11-32.
- CAVEDINI P. 1981. — Contributo alla conoscenza dei Caprellidi del Mediterraneo (Crustacea, Amphipoda). *Bollettino del Museo civico di storia naturale di Verona* 8: 493-531.
- CHEVREUX E. 1900. — Amphipodes provenant des campagnes de L'Hirondelle (1885-1888). *Bulletin de la Société zoologique de France* 16: 1-196.
- CHEVREUX E. 1935. — Amphipodes provenant des campagnes scientifiques par Albert I<sup>er</sup> Prince Souverain de Monaco. *Résultats des Campagnes scientifiques Albert I<sup>er</sup>* 10: 1-208.
- CHEVREUX E. & FAGE L. 1925. — *Faune de France*. Volume 9: *Amphipodes*. Lechevalier, Paris, 488 p.
- GRUBE A. E. 1864. — Über die Crustaceenfauna des Adriatischen und Mittelmeeres. *Jahres-Bericht der Schelesischen Gesellschaft für vaterländische Cultur* 1863: 59-64.
- GUERNE J. 1889. — Les amphipodes de l'intérieur et du littoral des Açores. *Bulletin de la Société zoologique de France* 14: 353-360.
- GUERRA-GARCÍA J. M. 2002. — Revision of the genus *Noculacia* Mayer, 1903 (Crustacea: Amphipoda: Caprellidea) with the description of two new species. *Organisms, Diversity and Evolution* 2, *Electronic Supplement* 7: 1-26.
- GUERRA-GARCÍA J. M. 2003. — Two new species of deep-water caprellids (Crustacea: Amphipoda) from northeastern Brazil. *Cahiers de Biologie marine* 44: 171-184.
- GUERRA-GARCÍA J. M. & TAKEUCHI I. 2000. — Redescription of *Pseudoprotella inermis* Chevreux, 1927, a rare species of caprellidean amphipod (Crustacea) from Ceuta, North Africa. *Proceedings of the Biological Society of Washington* 113: 980-988.
- GUERRA-GARCÍA J. M. & TAKEUCHI I. 2002. — 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. *Journal of Natural History* 36: 675-713.
- KRAPP-SCHICKEL T. 1993. — Suborder Caprellidea, in RUFFO S. (ed.), *The Amphipoda of the Mediterranean*, *Mémoires de l'Institut océanographique de Monaco* 13: 773-809.
- KRAPP-SCHICKEL T. & VADER W. 1998. — What is, and what is not, *Caprella acanthifera* Leach, 1814 (Amphipoda, Caprellidea)? Part I: the *acanthifera*-group. *Journal of Natural History* 32: 949-967.
- LAUBITZ D. & MILLS L. 1972. — Deep-sea Amphipoda from the western North Atlantic Ocean. Caprellidea. *Canadian Journal of Zoology* 50: 371-380.
- LAUBITZ D. & TORBE J. C. 1996. — Deep-water caprellids (Amphipoda: Caprellidea) from the Bay of Biscaya: new species and a new locality record. *Journal of Crustacean Biology* 16: 626-632.
- LOPES M. F. R., MARQUES J. C. & BELLAN-SANTINI D. 1993. — The benthic amphipod fauna of the Azores (Portugal): an up-to-date annotated list of species, and some biogeographic considerations. *Crustaceana* 65: 204-217.
- MATEUS E. & AFONSO O. 1974. — Étude d'une collection d'amphipodes des Açores avec la description d'une nouvelle espèce. *Publications de l'Institut zoologique Dr « Augusto Nobre »* 126: 9-39.
- MAYER P. 1882. — Die Caprellideen des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. *Fauna und Flora des Golfes von Neapel* 6: 1-201.
- MCCAIN J. C. 1966. — *Abyssicaprella galathea*, a new genus and species of abyssal caprellid (Amphipoda, Caprellidae). *Galathea Report* 8: 91-95.
- MCCAIN J. C. & STEINBERG J. E. 1970. — Pars 2. Amphipoda 1, Caprellidea 1. Family Caprellidae, in GRUNER H.-E. & HOLTHUIS L. B. (eds), *Crustaceorum Catalogus*. Junk, Den Haag: 1-78.
- MONTAGU G. 1804. — Description of several marine animals found on the south coast of Devonshire. *Transactions of the Linnean Society of London* 7: 61-85.
- MORI A. 1995. — A new species of *Liropus* (Crustacea: Amphipoda: Caprellidea) from off Minabe, Kii Peninsula, Central Japan. *Publications of the Seto Marine Biology Laboratory* 36: 329-337.
- STEBBING T. R. 1906. — Amphipoda 1: Gammaridea. *Tierreich* 21: 1-806.
- STEPHENSON K. 1944. — Malacostraca 8, Amphipoda 4. *The Danish Ingolf Expedition* 3: 1-51.

Guerra-García J. M.

TAKEUCHI I. 1993. — Is the Caprellidea a monophyletic group? *Journal of Natural History* 27: 947-964.  
WIRTZ P. 1998. — Caprellid (Crustacea)-holothurian (Echinodermata) associations in the Azores. *Arquipélago* 16A: 53-55.

WIRTZ P. & VADER W. 1996. — A new caprellid-starfish association: *Caprella acanthifera* s.l. (Crustacea: Amphipoda) on *Ophidiaster ophidianus* and *Hacelia attenuata* from the Azores. *Arquipélago* 14A: 17-22.

*Submitted on 17 March 2003;  
accepted on 3 September 2003.*

PROOF