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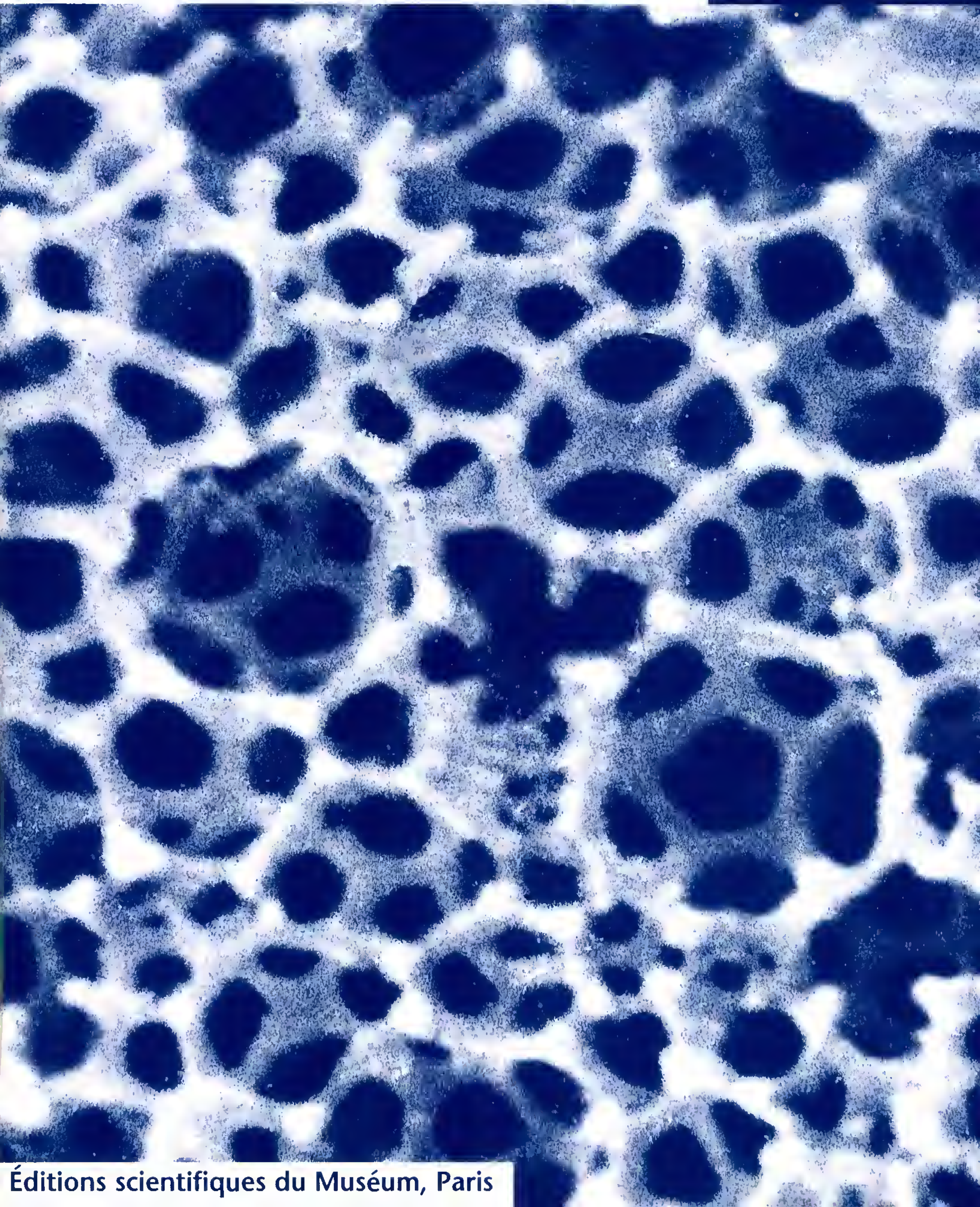

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Two new genera and species of sponges (Porifera, Demospongiae) without skeleton from a Mediterranean cave

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ABSTRACT
Two new genera and species of Demospongiae are described from a north-western Mediterranean littoral cave characterized by cold homothermy, which shelters deep-sea invertebrates. The two new sponges have neither mineral nor fibrous skeleton. Their cytology is described using transmission electron microscopy. *Thymosiopsis cuticulatus* n.g. n.sp. (Chondrillidae) shares some characters with *Thymosia* Topsent, but lacks the diagnostic spongin fibres. *Myceliospongia araneosa* n.g. n.sp. has unusual anatomy, cytology, and mode of growth. No clear relationship with any order of the Demospongiae is indicated and the sponge is classified as *incertae sedis* within the Demospongiae.

KEY WORDS
Porifera, taxonomy, Mediterranean, new genera and species, cave.

RÉSUMÉ
Deux nouveaux genres et espèces d'éponges (Porifera, Demospongiae) sans squelette d'une grotte méditerranéenne. Deux nouveaux genres et espèces de Demospongiae sont décrits d'une grotte littorale de la Méditerranée nord-occidentale, qui est caractérisée par une homothermie froide et abrite des invertébrés de mers profondes. Les deux nouvelles éponges sont dépourvues de squelette minéral ou fibreux. Leur cytologie est décrite en microscopie électronique. *Thymosiopsis cuticulatus* n.g. n.sp. (Chondrillidae) a des affinités avec *Thymosia* Topsent, mais ne possède pas les fibres de spongine distinctives. *Myceliospongia araneosa* n.g. n.sp. est très inhabituelle par son anatomie, sa cytologie et son mode de croissance. Aucune relation ne peut être établie avec un ordre de Demospongiae et l'éponge est classée comme *incertae sedis* dans les Demospongiae.

MOTS CLÉS
Porifera, taxonomie, Méditerranée, nouveaux genres, nouvelles espèces, grotte.

INTRODUCTION

Sponges without skeleton, whose taxonomy is especially difficult in the absence of the conventional diagnostic characters, display a remarkable abundance and variety in Mediterranean submarine caves. Representatives of all the described genera: *Oscarella* Vosmaer, 1884 and *Pseudocorticium* Boury-Esnault *et al.*, 1995 (Homoscleromorpha, Plakinidae), *Chondrosia* Nardo, 1847 (Tetractinomorpha, Chondrillidae), *Hexadella* Topsent, 1896 (Ceractinomorpha, Darwinellidae), and *Halisarca* Dujardin, 1838 (Ceractinomorpha, Halisarcidae) are present in Mediterranean caves, either in semi-obscure zones near the cave entrance or in darkest recesses. Recent studies have shown that at least four different species of *Oscarella* could be present in a single cave (Muricy *et al.* 1996), two of them known exclusively from dark caves. The recently described genus *Pseudocorticium* is as yet known only from caves (Boury-Esnault *et al.* 1995). This abundance of sponges without skeleton in caves probably reflects the situation on vertical and overhanging surfaces of steep cliffs in bathyal environments, with which caves have faunistic similarities (Harmelin *et al.* 1985; Vacelet *et al.* 1994). The species which are known only from caves most likely also live on the continental slope, especially in steep canyons where they are as yet unrecorded due to the obvious difficulties in observation and sampling.

These sponges usually have close relatives which have a skeleton, so their taxonomic position is seldom disputed. An exception, however, is the genus *Halisarca*, with no known skeletonized relatives and an unusual anatomy. After having been classified for a long time either as *incertae sedis* or in the order Dendroceratida, the genus has finally been isolated in the new order Halisarcida (Bergquist 1996).

We describe here, two new sponges without skeleton from the dark zones of a cave which shelters an unusually high number of deep-sea invertebrates, due to a stable homothermic regime around 13 to 14.5 °C, similar to that of the deep Mediterranean (Vacelet *et al.* 1994). The new sponges, which are unrecorded in caves with temperature variations similar to those of the littoral zone, are probably representatives of the undescribed sessile fauna of the deep-Mediterranean canyons. They belong to two new genera, one of which has uncertain affinities. Their description includes data on ultrastructural cytology, which are particularly important in the absence of the conventional taxonomic characters of the skeleton.

MATERIALS AND METHODS

Field observations and sampling

The specimens were observed *in situ* in the "3PP" cave near La Ciotat (43°09.47'N - 05°36.01'E) with an underwater magnifying lens (Mladenov & Powell 1986) and photographed with a close-up lens. Pieces of specimens were collected, either by scraping sponges from the substratum or by detaching fragments of the cave walls. Specimens, except those used for detailed microscopy (see below) were fixed in formalin and stored in alcohol.

A general description of the cave is given in Vacelet *et al.* (1994) and Vacelet (1996). Temperature recordings were made over two years using Deep-Sea Sealoggers thermographs (Vacelet 1996; Harmelin 1997).

Cytology

For light and transmission electron microscopy (TEM), the specimens were fixed *in situ* in glutaraldehyde 2.5% in a mixture of 0.4 M cacodylate buffer and sea water (4 vol.: 5 vol.). They were maintained in the fixative for 24 hours and post-fixed 2 hours in 2% osmium tetroxide in sea water. Specimens were decalcified in 10% RDO (Du Page Kinetic Lab) in sea water in order to remove the underlying substratum, dehydrated through an alcohol series and embedded in Araldite. Semi-thin sections were stained with toluidine blue. Thin sections, contrasted with uranyl acetate and lead citrate, were observed under a Zeiss EM 912 transmission electron microscope.

SYSTEMATICS

Order CHONDROSIDA
Boury-Esnault *et* Lopes, 1985
Family Chondrillidae Gray, 1872

Thymosiopsis n.g.

Type species. — *Thymosiopsis cuticulatus* n.sp.

Etymology. — The genetic name is derived from *Thymosia*, a genus of the same family and the suffix *-ops* (in Greek: with the aspect of).

Diagnosis

Encrusting Chondrillidae. General organization similar to that of the genus *Thymosia*, having a smooth surface, a superficial cuticle and pore-sieves, a marked cortex enriched with fibrillar collagen, but lacking spongin fibres.

Thymosiopsis cuticulatus n.sp.
(Figs 1-3)

Type material. — **North-Western Mediterranean.** La Ciotat, 3PP cave. — 50 m from cave opening, 16 m in depth, 7.VII.1996: holotype, 1 fragment (MNHN D JV 59). — 30 m from cave opening, 20 m in depth, 3.III.1997: paratype, 2 fragments (MNHN D JV 60).

Etymology. — The species name refers to the presence of a cuticle (from *cuticula*, Latin, thin skin).

Locality and habitat. — Known only from 3PP cave, 1.2 km south-west of La Ciotat on the French Mediterranean coast (43°09.47'N - 05°36.01'E). The sponge has been found on vertical or overhanging walls, 16 to 22 m deep, 30 to 80 m from the cave opening, in a trapped body of water whose temperature varies from 13 to 14.5 °C year round (Vacelet *et al.* 1994). The sponge is not very common in the cave and only a few large specimens have been observed.

Description

Shape and size

The sponge is encrusting, up to 15/20 cm, and 3 to 5 mm thick in the centre, thinner on the edges which are irregular (Fig. 1A). The sponge is firmly attached to the substratum by its whole undersurface, and insinuates into small cavities such as empty serpulid tubes.

Colour

The *in situ* colour is white or yellowish white. A faint brown tinge due to a thin, inconstant deposit of iron and manganese oxides on the cuticle, is visible in places, especially on ridges corresponding to the irregularities of the substratum. Thinner parts of the sponge, mostly on the edges, are greyish due to the black underlying rock seen through the transparent tissue. After fixation in formalin, the alcohol-preserved specimens are whitish.

Surface

The surface is smooth, but irregular as the sponge closely follows the irregularities of the substratum. Small apertures, approximately 0.6 mm in diameter (measurements from underwater close-up photographs of non-contracted specimens) are gathered in oval or circular depressions with an elevated outline, 5 to 15 mm in diameter (Fig. 1A). Most of the depressions are probably inhalant pore-sieves. Superficial canals, visible below the ectosome especially on the thin zones at the periphery of the sponge, converge towards the larger of these depressions, which may be composite oscules. Single oscules have not been observed, neither *in situ* nor on collected specimens. The holotype, which was living relatively near the cave entrance (30 m), was covered by various encrusting sponges, bryozoans and didemnids, which were loosely attached on the surface between the pore-sieves. Most of the specimens, however, were free of macroepibionts.

Texture

The consistency is quite cartilaginous, although easy to tear.

Skeleton

There is neither spicule nor spongin fibre skeleton. A small amount of foreign material is frequently included in the choanosome.

Anatomy and cytology

Ectosome and choanosome are clearly distinct (Fig. 1B), although the ectosome is not detachable. The ectosome is 40-50 µm deep and is lined on the outer surface by a thin, non-cellular cuticle, which appears, in sections observed with the light microscope, as a wrinkled layer, 2 µm in thickness. This cuticle is covered in most places by a mucous layer metachromatically stained by toluidine blue. In TEM (Fig. 2A), the surface appears to be covered by a wavy dense layer, 0.15 µm in thickness, in direct contact with the collagen fibrils of the underlying tissue, without any pinacoderm. This thin layer is covered by a zone of very dark, irregular granules, which are probably deposits of iron and manganese oxides, frequent in caves (Harmelin *et al.* 1985; Bianchi *et al.* 1986). The oxide deposit, visible as a brownish coloration in some areas of the sponge surface, and the presence of epibionts on some specimens

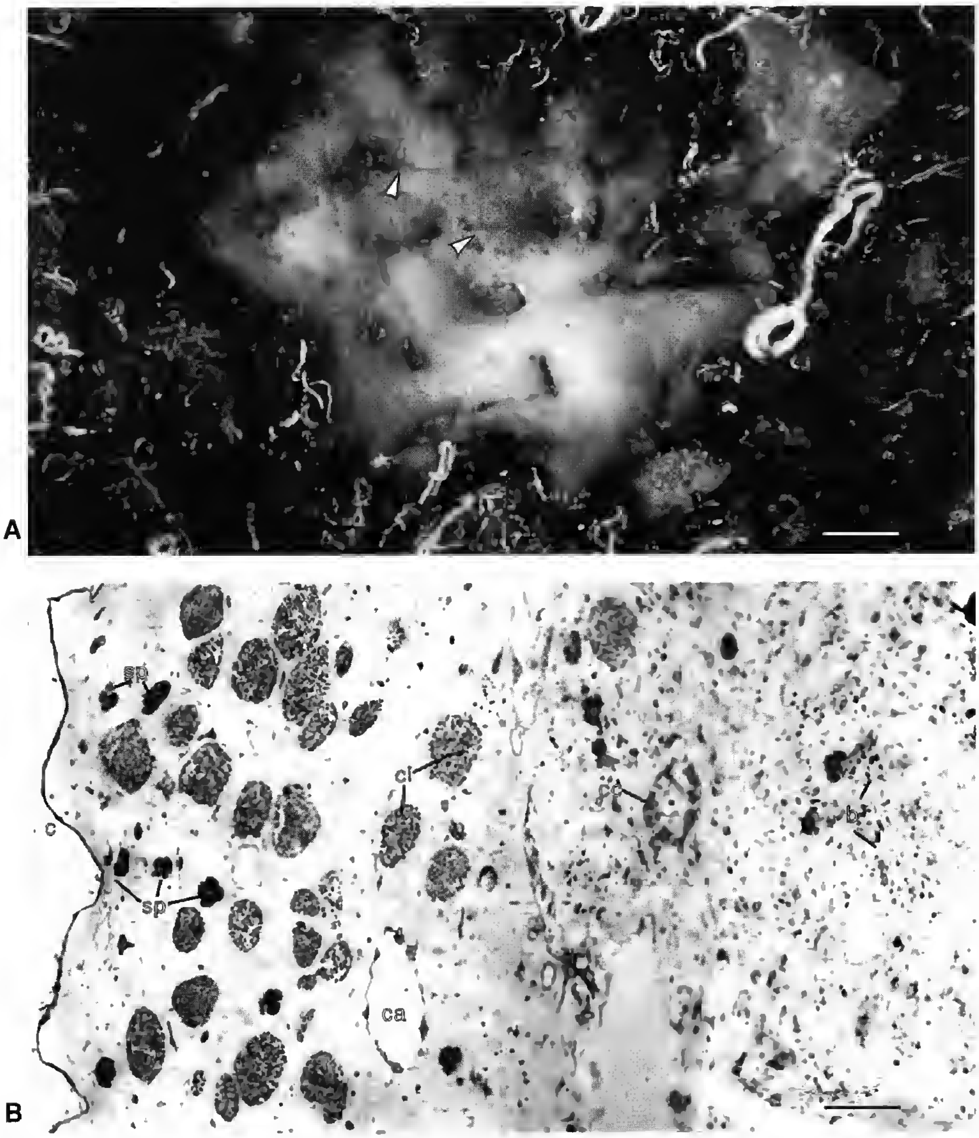


Fig. 1. — *Thymosiopsis cuticulatus* n.g. n.sp., **A**, specimen *in situ*, arrow head: pore-sieves; top right, the sponge with superficial canals is *Diplastrella bistellata*; **B**, semi-thin section showing the tissue organization. **b**, extracellular bacteria; **c**, cuticle; **ca**, canal; **cc**, choanocyte chamber; **ci**, cells with inclusion Types 1 and 2; **sp**, spherulous cells Type 3. Scale bars: A, approximately 13 mm; B, 16 µm.

both indicate that the cuticle is not transient, but remains stable for at least several months. This layer is covered by a fibrillar area, 1.5 to 2 µm in thickness, having the appearance of a mucous sheath. An empty space is often present between the wavy dark layer and the other layers.

The ectosome contains bundles of collagen fibrils, most of which are parallel to the surface. The fibrillar bundles are thin (1-3 µm), not very densely packed, and the ectosome is considerably thinner and less specialized than in sponges with a true cortex, such as *Chondrosia* or *Tethya*. The ectosome also contains spherulous cells (Type 3, described below), large cells with irregular, small granules (Types 1 and 2), and extracellular bacteria.

In the choanosome, collagen fascicles are less dense. Choanocyte chambers occur in relatively low density. Most of the choanosome volume is occupied by Types 1 and 2 cells, closely pressed together in places, and by a high number of extracellular symbiotic bacteria.

Exopinacocytes were not observed. They are absent in the areas lined by the cuticle, and are probably found only in the pore-sieves, for which we have no good sections. Endopinacocytes are not flagellated (Fig. 2B).

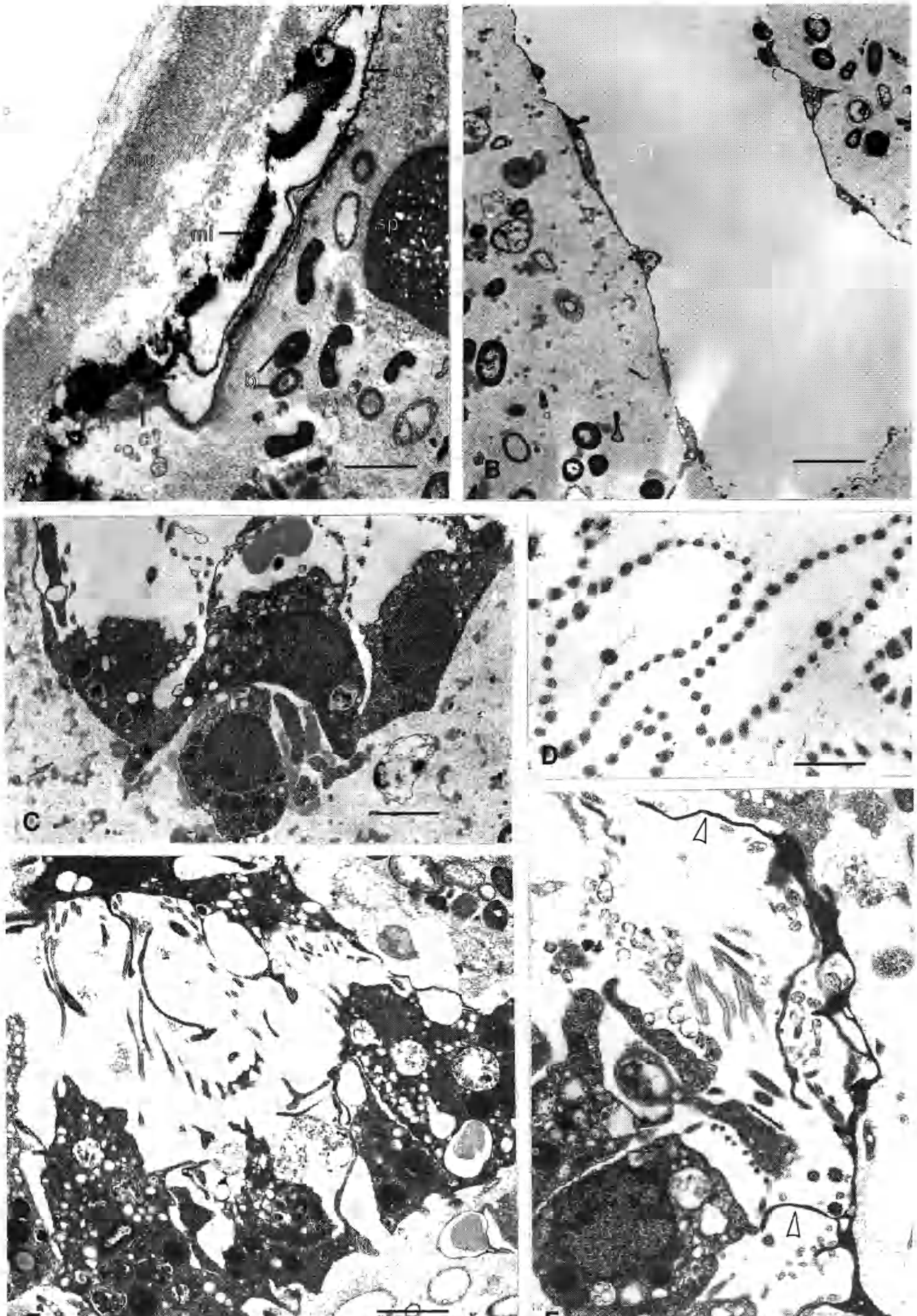
Choanocyte chambers (Figs 1B, 2C-F) are eurypylous and spherical, 15 to 30 µm diameter. Two aspects have been observed. In some chambers (Fig. 2C), choanocytes are cylindrical or pyramidal, 3 to 4 µm in size with a nucleus approximately 2 µm in diameter, spherical or pyriform, rarely nucleolated, and a cytoplasm containing few phagosomes. In other chambers (Fig. 2E, F), choanocytes are very irregular, and their cytoplasm contains a larger number of phagosomes. In both cases, the collar is 3.6 µm in diameter and made up of thirty-two to thirty-four microvilli (Fig. 2D). There is no periflagellar sleeve. The flagellum possesses two thin lateral extensions, which are faintly visible on some transverse sections and which may be interpreted as poorly preserved flagellar vanes (Afzelius 1961; Mehl & Reiswig 1991). Conventional apopylar (or cone) cells (Boury-Esnault *et al.* 1984; Langenbruch *et al.* 1985; De Vos *et al.* 1990) and central cells (Reiswig & Brown 1977) were not observed. The choanocyte base is flat or displays a few short pseudopodia anchoring the cell in the underlying mesohyl, usually without a pinacocyte lining. However, in certain chambers with irregularly-shaped choanocytes, very dense fusiform cells line the choanocyte base and extend long, thin lamellipodia which insinuate between the choanocyte bodies and ramify into the chamber cavity. Lamellipodia are in close contact with the choanocyte collar or flagellum (Fig. 2F). These cells, which are remarkable in the density of their cytoplasm, seem to be pinacocytes lining the choanocyte base, as observed in some demosponges, but in this case possibly having a role in the regulation of the water flow by extending pseudopodia into the chamber lumen.

Four distinct types of cells with inclusions are present:

Type 1. (Fig. 3A) Large cells, 15 to 18 µm in diameter, containing numerous granules enclosed in clear vesicles delineated by a thin sheet of cytoplasm. The cells have a degenerating aspect, with nucleus and organelles rarely observed. The granules, 0.5 to 1.1 µm in diameter, have a finely granular content and an irregular outline, with a cloudy aspect. They appear moderately dense to the electrons in TEM and are stained by toluidine blue in semi-thin sections. Type 1 cells are abundant by places in the choanosome and occur as dense clusters in the ectosome.

Type 2. (Fig. 3B) Large cells, approximately the same size as Type 1, with similar clear vesicles containing a dispersed fibrillar material and small rod-like inclusions, 0.1-0.2/0.45-1.1 µm, with a clear central area surrounded by an irregular dense zone. These rod-like inclusions are probably bacteria, morphologically different from the extracellular ones described below. These cells, whose cytoplasmic outline is rarely observed, appear to be advanced stages in degeneration of Type 1 cells.

Type 3. (Fig. 3C) Spherulous cells, approximately 10 µm in diameter, with two to ten large, homogeneous spherules, 1 to 4.5 µm in diameter, which occupy most of the cell volume. Spherules were occasionally observed free in the mesohyl, especially in the ectosome, after degeneration of the cell. However, these cells are not clearly secreting the intercellular matrix, as they do in some *Halisarca* or in *Chondrosia* (Vacelet & Donadey 1987).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Type 4. (Fig. 3D) Microgranular cells, most often elongated (2.5-3 µm/4.5-8 µm) with dense, ovoid inclusions, 0.3/0.9 µm in the cytoplasm. These cells are not vety abundant.

The collagen fibrils are thin, approximately 15 nm in diameter (Fig. 3B). Their periodicity is not apparent. They seem to belong to the smooth type of collagen fibrils (Garrone 1978), although this character is not well defined here. They are organized in bundles, 1 to 3 µm in diameter, especially in the ectosome. There is no disjunction between the collagen bundles and a granulo-fibrillar matrix such as is observed in some species of *Halisarca* or of Chondrillidae (Vacelet & Donadey 1987).

Symbiotic extracellular bacteria (Figs 2A, B, 3D) found in the mesohyl belong to several different morphological types, varying in size from 0.2-0.4 µm to 0.8-2.5 µm. They display the various morphologies found in demosponges having a high density mesohyl (Vacelet 1975; Vacelet & Donadey 1977; Boury-Esnault *et al.* 1995), in which the cell walls are complex and frequently display a remarkable enlargement of the periplasm. An unusual type (Fig. 2A) is a rod-like cell, 0.4 µm in diameter and at least 1.5 µm in length, with a contorted shape, dense cytoplasm and reduced nuclear area, which is rarely observed in other demosponges, although it morphologically resembles the intra- and intercellular bacteria described in the parenchymella of *Haliclona tubifera* (Woollacott 1993).

Reproduction

Not observed.

REMARKS

This sponge appears to have affinities with *Thymosia* Topsent, 1895, a monospecific genus of "keratose" sponge from the North-East Atlantic. After various allocations, the genus is presently classified in family Chondrillidae (= Chondrosiidae), as originally proposed by Topsent. The main differences between *Thymosia guernei* Topsent, 1895 as recently redescribed (Boury-Esnault & Lopès 1985; Rosell 1988; Carballo 1994), and *Thymosiopsis cuticulatus* n.sp. are the absence of the verrucose horny fibres which are highly diagnostic of *Thymosia*, and the composite nature of the oscules. The two sponges share the presence of a cuticle on most of the surface, of pore-sieves and of a specialized ectosome constituting a weakly developed cortex. The characters of the choanocyte chambers, aquiferous system and Type 3 cells with inclusions (spherulous cells) cannot provide a diagnosis, but do not contradict the supposed affinity between the two genera.

These similarities could be differently interpreted. The unusual fibres of *Thymosia guernei* have been interpreted as a hydroid skeleton (Bergquist 1980). The new sponge could be considered either as specimen of *Thymosia guernei* without the hydroid associate, or as a Mediterranean *Thymosia* – a genus never recorded from this sea – which would have lost the spongin fibres in low-energy environments such as the deep sea or a cave. Both hypotheses appear unlikely. The hydroid nature of the fibres, already ruled out by Topsent (1895) in the original description, has been contradicted by all recent records of the sponge. We have checked their genuine nature on new specimens of *Thymosia guernei* from Portugal (unpublished observations). The ultrastructure of these specimens shows that, although the general organization is rather similar, the two sponges differ clearly by the structure of cells with inclusions. Most significantly, cells with inclusions Type 1 and Type 2, which are very abundant and remarkable in *Thymosiopsis cuticulatus*, are absent in *Thymosia guernei*. These differences indicate that the two sponges belong to different species. The absence of the characteristic fibres, combined with these differences in cytology, justifies the creation of a new genus, parallel to the present classification in the Darwinellidae where the genus *Hexadella*, without skeleton, is considered distinct from *Aplysilla* and *Darwinella*.

FIG. 2. — *T. cuticulatus* n.sp., **A**, transmission electron micrograph (TEM) of the sponge surface; **b**, bacteria; **c**, cuticle; **mi**, mineral deposit; **mu**, mucous deposit; **sp**, isolated spherule of a spherulous cell. **B**, TEM of the choanosome showing a small canal; **C**, TEM of a choanocyte chamber. **D**, TEM of a choanocyte collar, note the flagellar vanes. **E**, TEM of a choanocyte chamber with irregularly-shaped choanocytes. **F**, TEM of a choanocyte chamber showing an elongate cell with dense cytoplasm extending lamellipodia in the chamber lumen (arrows). Scale bars: A, 1.6 µm; B, 2.5 µm; C, 2.0 µm; D, 1.0 µm; E, 2.0 µm; F, 1.3 µm.

The obvious differences in the development of cortex and of collagen bundles between the new sponge and the genus *Chondrosia* (Garrone *et al.* 1975) precludes its allocation to that genus. The distinction of *Thymosiopsis* from *Chondrosia* is also justified by differences in the canal system organization (Schulze 1877; Bavestrello *et al.* 1988), and by the presence of a constant cuticle and well organized pore-sieves in *Thymosiopsis.* The anatomy and cytology of the new sponge are certainly more similar to those of *Thymosia* than of *Chondrosia.*

The genus *Thymosia* is rather puzzling in the Demospongiae, where it has been diversely allo-

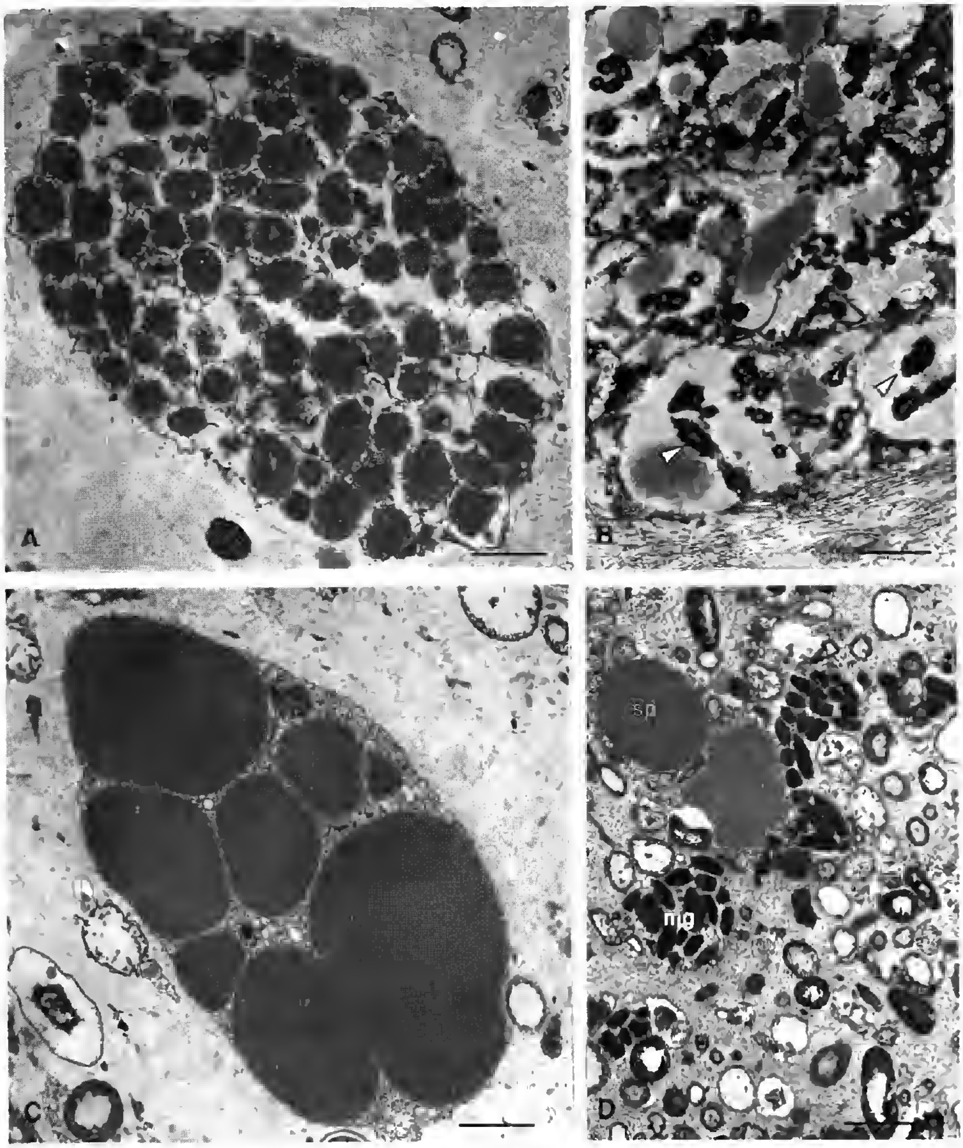


FIG. 3. — *T. cuticulatus* n.sp., **A**, TEM of a granular cell (Type 1 cell); **B**, TEM of a granular cell (Type 2 cell) with intracellular bacteria (arrows). **C**, TEM of a spherulous cell (Type 3 cell). **D**, TEM of the mesohyl showing various symbiotic bacteria, a degenerating spherulous cell (Type 3 cell, **sp**) and degenerating microgranular cells (Type 4 cell, **mg**). Scale bars: A, 1.3 µm; B, 0.8 µm; C, 1.3 µm; D, 1.6 µm.

cated (Rosell 1988). It bears unusual, nodulose spongin fibres and has cytological characters different from those of "keratose" sponges. Most authors presently classify the genus in family Chondrillidae (= Chondrosiidae), because of anatomical resemblances with the genus *Chondrosia*. These resemblances are not fully convincing, especially as the ectosome is less specialized than in *Chondrosia* or in *Chondrilla*, and does not constitute a thick cortex with dense fascicles of collagen. Furthermore, *Thymosia guernei*, which possesses pore-sieves which are considerably more organized than the cribriporal chones of the Chondrillidae (Schulze 1877; Bavestrello *et al.* 1988), does not display the disjunction between both cellular and collagen elements and a granulo-fibrillar matrix as described in Chondrillidae (Vacelet & Donadey 1987). In our opinion, the relationships of *Thymosia* and *Thymosiopsis* with the Chondrillidae remain to be confirmed; until this can be done, the genera should remain in that family.

DEMOSPONGIAE, Order *incertae sedis*
Family *incertae sedis*

Genus *Myceliospongia* n.g.

TYPE SPECIES. — *Myceliospongia araneosa* n.sp.

ETYMOLOGY. — The generic name derives from *mukês* (in Greek: fungus) and refers to the shape of the type species.

DIAGNOSIS

Demospongiae *incertae sedis* without skeleton and without cortex. Body encrusting, from which arises a reticulation of thin filaments covering the substratum. The sponge has a reduced canal system and a low number of choanocyte chambers. Exopinacocytes non flagellated, covered by a mucous sheet. Most of the cells contain granular inclusions and symbiotic bacteria.

Myceliospongia araneosa n.sp.
(Figs 4-6)

TYPE MATERIAL. — **North-Western Mediterranean.** La Ciotat, 3PP cave 60 m from cave opening, 18 m in depth. — 7.VII.1996: holotype (MNHN D JV 61). — 17.XII.1996 : paratype (MNHN D JV 62).
Holotype and paratype are fragmentary specimens.

ETYMOLOGY. — The species name derives from *araneosus* (in Latin: similar to a spider web), and refers to the shape of the margin of the sponge.

LOCALITY AND HABITAT. — Known only from 3PP cave, 1.2 km south-west of La Ciotat on the French Mediterranean coast (43°09.47'N - 05°36.01'E). The sponge lives on vertical or overhanging walls, 18 to 21 m deep, 50 to 80 m from the cave opening, in a trapped body of water whose tempetature varies from 13 to 14.5 °C year round. It seems to be absent farther in the cave, which extends up to 120 m from opening. The sponge is not very common in the cave and only a few large specimens have been observed. However, specimens may easily be overlooked as they are occasionally covered by other sponges.

DESCRIPTION

Shape and size

Sponge encrusting, approximately 1 mm in maximum thickness, composed of a "body" covering most of the surface of the substratum, although with irregular lacunae, and of filaments which extend a long distance from the body and are closely applied to the substratum (Fig. 4A). The maximum size observed is 25 cm in diameter for the body, with the filaments visible *in situ* extending at least 12 cm from the body, the total diameter of the surface colonized by the sponge thus being approximately 50 cm. The filaments decrease in diameter with the distance from the body. They can be extremely thin at their extremities: filaments 5 µm in diameter extending to 20 µm in length have been observed. They divide dichotomously or anastomose, to form an irregular reticulation. The body of some specimens is entirely covered by other sponges, predominantly *Pachastrissa pathologica* (Schmidt, 1868) or *Rhaphisia laxa* Topsent, 1892 in which case only the filaments are visible. The filaments most often cover the rocky surfaces, following the irregularities of the substratum or insinuating into small cavities such as empty serpulid worm tubes. They may also run on the surface of other sponges. They differ from the stretched filaments described in some Chondrillidae or Homoscleromorpha living under sledges, which

are elongated areas of sponge tissue stretched by the weight of a detached piece of substratum (Gaino & Pronzato 1983). The sponge is not firmly attached and can be easily removed from the substratum.
This aspect has been observed year round. Visual observations over two years and the comparison of serial underwater photographs of the same individual during a six months period from July to December (Fig. 4B, C) indicate a rather stable situation over time, with a slight increase of the surface covered by the sponge. The filaments and body maintained the same general shape over six months. Some of the filaments increased in diameter and coalesced, and a small zone which was colonized by a loose reticulation in July, was wholly covered in December. Conversely, a few filaments regressed, but this was less common. The spider-web like reticulation on the rock around the sponge consequently does not correspond to a rapid regression or a fragmentation process, but rather to a slow growth process of a sponge maintaining this special shape over long periods.

Colour
Colour is white in life. Preserved specimens are cream coloured. Some specimens, especially the holotype, have turned clear pink in alcohol after fixation in formalin.

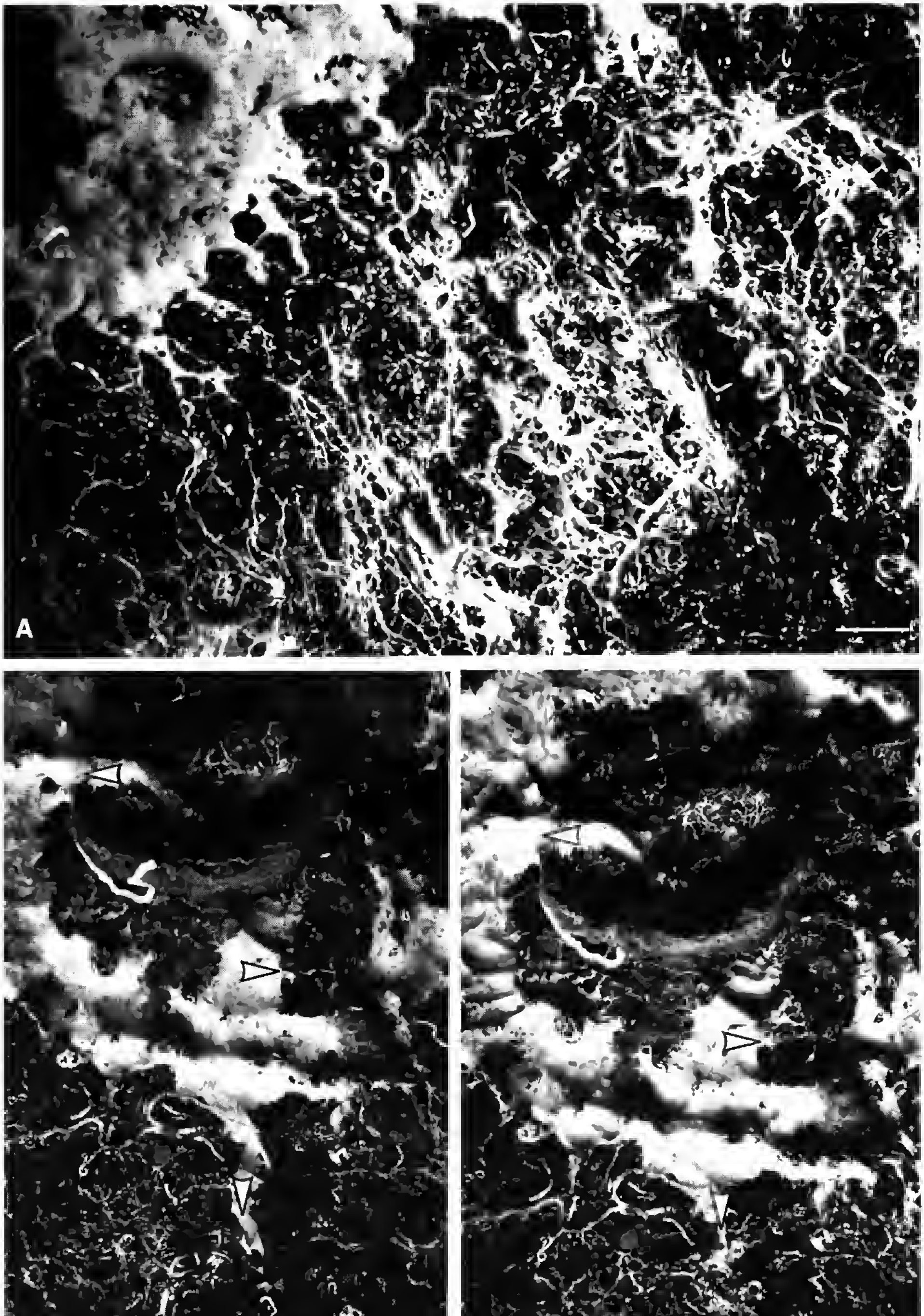
Surface
The surface is smooth, appearing sometimes irregular because the sponge closely follows the irregularities of the substratum. There is no detachable ectosome. The oscules, 0.5 to 1.2 mm in diameter (measurements from underwater close-up photographs), are rare on the body and absent from the filaments. There is no pore-sieve, and the ostia are not visible. Canals, approximately 1 mm in maximum diameter, are visible under the ectosome in the body and in the largest filaments, with only one canal in each filament.

Texture
Texture is fleshy, rather soft and fragile.

Skeleton
Spicule, spongin fibre, bundle or thick condensation of collagen fibrils are absent.

Anatomy and cytology
The dermal structure (Fig. 5A, B) consists of a thin ectosome, with a layer of T-shaped exopinacocytes and a thin cuticle, without any underlying special ectosome differentiation. Exopinacocytes have no flagellum. Their cytoplasm contains dense granules similar to those of the granular cells of the mesohyl, although smaller (0.4 to 1.1 µm) and less numerous. Vacuoles with symbiotic bacteria are absent. The lateral expansions of the exopinacocytes are frequently superposed for a few micrometres, and are linked without specialized cell junctions. The thickness of the pinacocyte expansions is variable, from very thin sheets without any inclusions to swellings, 3 to 4 µm thick, containing dense granules. The outer surface of the exopinacocytes is covered by an extremely thin cuticle, covered by a well organized fibrillar material, which is quite similar to the layer termed "glycocalyx" by Willenz (1981, 1982) in *Hemimycale columella* Burton, 1934. This outer cover of the pinacoderm, 0.12 to 0.25 µm in total thickness, is made up of a clear zone, containing fibrils mostly perpendicular to the outer cell membrane of the pinacocyte, followed by a dense zone which is covered by thin erect fibrils, which are denser at their extremities. Contrary to *Hemimycale columella* there are no bacteria fixed on this external "glycocalyx", although bacteria are occasionally engulfed. This structure is found on the outer surface of both body and filaments of the sponge. In places, the exopinacoderm displays invaginations, approximately 2 to 4 µm in diameter, leading to small canals (Fig. 5A). The canals are lined by pinacocytes which have a similar "glycocalyx", but which are more ovoid in shape and with a nucleus 2.8 to 3 µm in diameter. These

FIG. 4. — *Myceliospongia araneosa* n.g. n.sp., **A**, specimen *in situ*; **B**, *in situ* view, 11.VII.1996; **C**, same as figure B, 3.XII.1996; although the surface covered by the sponge slightly increased (horizontal arrows), most filaments remained stable, rearrangement occurred in a few places (vertical arrows). Scale bars: A, approximately 13 mm; B, approximately 12 mm; C, 12 mm.


A
B
C

openings are probably ostia, although of an unusually small size.

The undersurface in contact with the substratum is made up of ovoid basopinacocytes which are lined by a cuticle similar to that of the exopinacoderm, although it appears devoid of a "glycocalyx" layer.

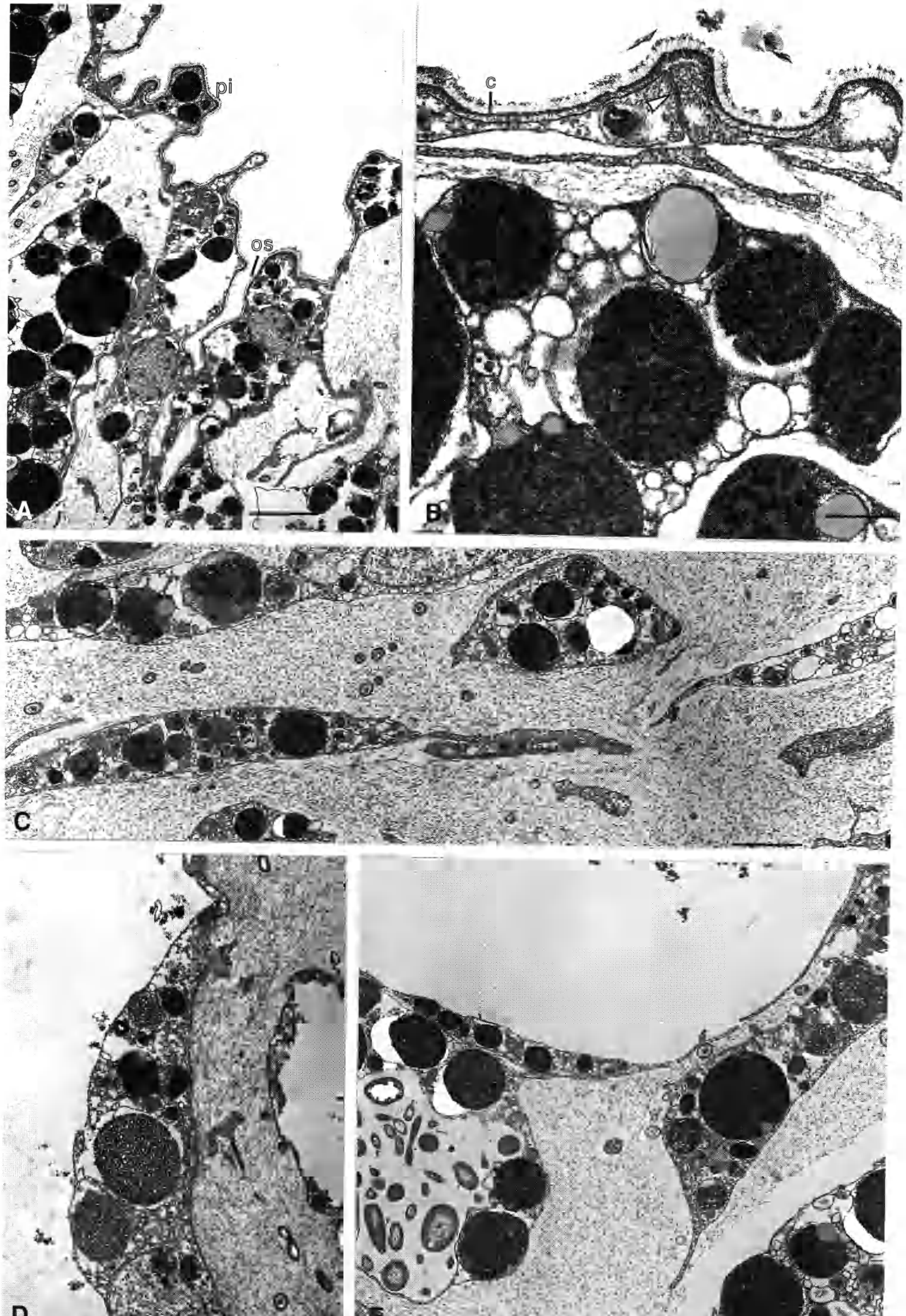
The choanosome also shows a very unusual structure. Canals and choanocyte chambers (Fig. 6A) are rare in sections. The canals visible in the *in situ* specimens are small and difficult to observe in preserved specimens, where they are probably contracted. They are lined by ovoid endopinacocytes, with a nucleus of 1.9 to 2.5 µm in diameter, without flagellum and containing dense granules similar to those of the exopinacocytes (Fig. 5D, E). The endopinacocytes are devoid of the granulo-fibrillar layer ("glycocalyx") present on the exopinacocytes. Most of the choanosomal tissue is made up of a single cell category, *i.e.* granular cells of highly diverse size and shape, containing a variable amount of dense inclusions and intracellular symbiotic bacteria. Spherulous cells are absent.

Granular cells (Fig. 5A-C, E), with a frequently nucleolated nucleus 2.4-4 µm in diameter, may be up to 40 µm in maximum diameter when ovoid or spherical. They contain a variable amount of spherical inclusions which are highly variable in size from 0.2 to 12 µm in diameter. Inclusions, which are surrounded by a membrane, contain a large mass made up of dense ovoid granules, 0.1 µm in maximum size, included in a dense matrix. This mass, usually spherical, is often deformed by a few lipid globules or irregular, myelinic-like granules. These inclusions are intensely metachromatically stained purple by toluidine blue in semi-thin sections. The large granular cells also contain symbiotic bacteria included in vacuoles of variable size, which often occupy most of the cell volume, and stain clear blue with toluidine blue (Figs 5E, 6C, D). The bacteria belong to several different morphological types, from rod-like bacteria (0.15/1.7 µm) to ovoid cells (0.8/1.7 µm, rarely up to 1/3.7 µm). They display the various morphologies found in demosponges having a high density mesohyl (Vacelet 1975; Vacelet & Donadey 1977; Boury-Esnault *et al.* 1995). Most of them have a complex cell wall. Cells of Type E (Vacelet 1975), with an enlarged periplasm bearing an indentation, are frequent.

The shape of the granular cells varies importantly according to the zone of the mesohyl, from spherical to very elongated cells. The elongated cells, which have smaller and clearer granules, no bacteria, and long pseudopodia, are usually in parallel arrangement in tracts, especially in the filaments, suggesting intense, orientated cell migrations along trails with denser and polarized collagen fibrils (Figs 5C, 6B). Intermediate stages between elongated cells and spherical cells are numerous.

Choanocyte chambers (Fig. 6A) are present in low density, and only a few of them have been observed. They are ovoid, approximately 7.5 to 15/20 to 24 µm. The choanocytes have a cylindrical (2.5 µm in maximum height) or flattened body, with a spherical, anucleolate nucleus 1.6 to 1.8 µm in diameter. Their base displays lateral lamellipodia, up to 5.6 µm long, which attach to or cover the appendages of the other choanocytes. The choanocyte chamber is thus surrounded by a thin cellular sheet formed by the choanocyte lateral appendages. The cytoplasm contains numerous clear vacuoles and some small metachromatic inclusions, less than 1 µm in diameter, which have the same ultrastructure as the smaller ones observed in granular cells. The collar is made up of thirty-eight or thirty-nine microvilli and is surrounded externally by a "glycocalyx" consisting of a reticulation of thin fibrils. The flagellum has no vane, but displays a sheet of fibrillar material similar to that observed outside the collar. No apopylar or cone cells were found, but their absence has to be checked on a larger number of chambers. The mesohyl has a low density around the choanocyte chambers, with a few extracellular symbiotic bacteria and highly dispersed collagen fibrils.

FIG. 5. — *M. araneosa* n.sp., **A**, TEM of the sponge surface; **pi**, exopinacocyte; **os**, ostium (?); **B**, TEM of the sponge surface showing the pinacocyte layer with a cell junction (arrow), the cuticle (c), the "glycocalyx" layer, and a granular cell; **C**, TEM of the mesohyl showing elongate granular cells and a few extracellular bacteria; **D**, TEM of a small canal lined by an endopinacocyte; **E**, TEM of a canal lined by endopinacocytes and granular cells, one of which (left) contains numerous intracellular bacteria. Scale bars: A, 3.2 µm; B, 0.6 µm; C, 1.8 µm; D, 1.6 µm; E, 2.0 µm.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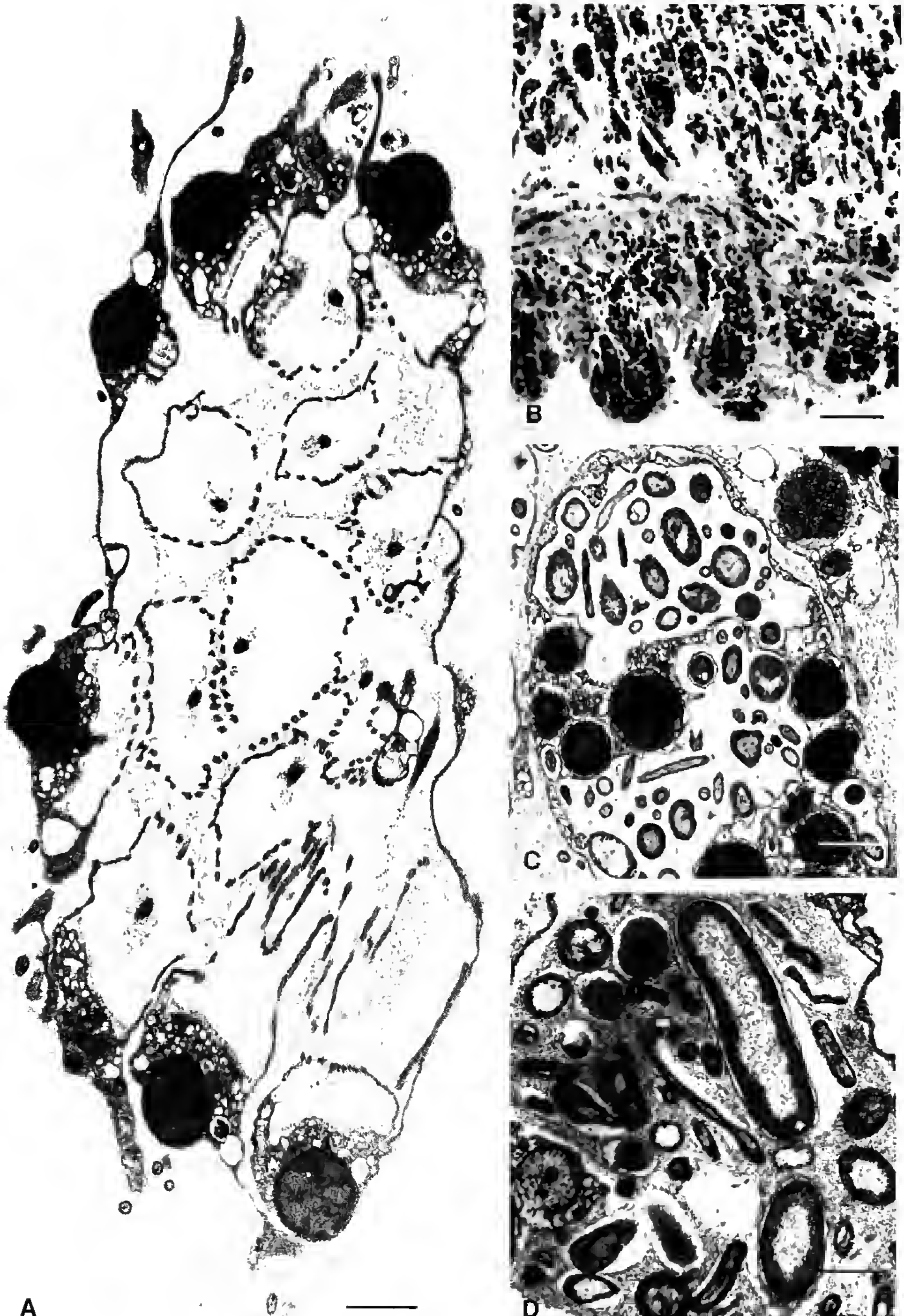
The intercellular matrix is made up of collagen fibrils with variable density. Fibrils are most often irregularly dispersed, except in zones with elongated granular cells and beneath the pinacoderm, where they form thin, poorly organized fascicles. Fibrils are of the rough type (Garrone 1978), 18-19 nm in diameter, with a poorly defined striation of approximately 22 nm periodicity. The matrix contains dispersed extracellular bacteria (Fig. 5C) which do not display the high morphological variety of the intracellular bacteria. Most are rod-shaped cells, 0.2-0.3/1-1.3 µm, with a dense area in the clear central nuclear zone.

Reproduction
No stages of reproduction has been observed.

REMARKS
This sponge without skeleton is very unusual with regard to anatomy and cytology, with a remarkable uniformity of cell types, a reduced aquiferous system, and an unusual morphology and mode of growth. These peculiarities, which are observed year round in all specimens examined, are not related to stages of reproduction, which may temporarily change the anatomy and cytology of some demosponges such as *Halisarca* drastically (Lévi 1956; Chen 1976; Bergquist 1996). They are also not related to a possible tissue regression, which has been described in overwintering specimens or in sponges undergoing degeneration by fragmentation under adverse conditions. Tissue regression causes a reduction or loss of the aquiferous system and a dedifferentiation of most cell types (Simpson 1984), which frequently become archaeocyte-like cells with numerous residual bodies, thus resulting in features which are reminiscent of those observed in *Myceliospongia*. However, the stability of characters in all the examined specimens and our observations on the growth of *Myceliospongia* during a six months period (Fig. 4B, C) both indicate clearly that we have observed normal, non-degenerating sponges. The relative resemblance of the cell features to those described during tissue regression only indicates that the mesohyl cells are here constantly poorly differentiated.
The above characteristics do not permit the allocation of *Myceliospongia* to any known family of Demospongiae in which non-skeletonized genera have been described. The simplicity of the cytology is shared with the Homoscleromorpha, in which two genera without skeleton are known (*Oscarella* and *Pseudocorticium*). However, *Myceliospongia* does not display any of the unique characteristics of this subclass, such as flagellated exo- and endopinacocytes, large choanocyte chambers, and a unique basement membrane underlying both pinacoderm and choanoderm (Boury-Esnault *et al.* 1984 ; Boute *et al.* 1996). The histology and anatomy differ extensively from those of Chondrillidae and Darwinellidae, families in which the genera *Chondrosia* and *Hexadella* respectively are devoid of skeleton. The sponge is clearly distinct from the new genus of Chondrillidae, *Thymosiopsis*, described earlier in this paper. It has neither the ectosomal organization of collagen fibrils nor the tubular, branched choanocyte chambers which are distinctive of the order Halisarcida (Bergquist 1996). The possibly distinctive features shared in varying measure by species of Halisarcidae and of Chondrillidae, such as a granulo-fibrillar matrix distinct from the collagen zones in which the choanocytes are anchored by long pseudopodia (Vacelet & Donadey 1987), are absent. There is no possible relationship to *Bajalus* Lendenfeld, 1885 which has recently been shown to be a synonym of *Halisarca* (Bergquist 1996).
Furthermore, the unique characters of *Myceliospongia* provide no clear evidence which would permit affiliation with any existing order of skeletonized Demospongiae. The fibrillar layer covering the exopinacocytes resembles the "glycocalyx" of the poecilosclerid *Hemimycale columella* (Willenz 1982). The absence of typical spherulous cells and the large number of inclusions similar to residual bodies in most cell types are shared with the keratose sponge *Dysidea avara* (Uriz *et al.* 1996). However, no relationship between *Myceliospongia* and the genera

FIG. 6. — *M. araneosa* n.sp. **A**, TEM of a choanocyte chamber; note the lateral expansions of the choanocytes. **B**, semi-thin section through the mesohyl near the undersurface (bottom). **C**, TEM of a granular cell with numerous intracellular bacteria. **D**, intracellular bacteria in a granular cell. Scale bars: A, 1.3 µm; B, 22.5 µm; C, 1.6 µm; D, 1.0 µm.


A
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C
D

Hemimycale and *Dysidea* should be suggested on the basis of these features alone. The only evidence is the rough nature of the collagen fibrils, which provides a weak indication of affiliation with the subclass Ceractinomorpha (Garrone 1978). The relationships of the genus within the Demo-spongiae thus cannot be resolved at present. The absence of morphological or cytological affinities with any order of Demospongiae could justify the distinction of a new order. However, we prefer to presently classify *Myceliospongia* as a genus *incertae sedis* within the Demospongiae, possibly within the Ceractinomorpha, pending further biochemical, reproductive or genetic information.

Unlike most other sponges without skeleton, the absence of fibres or spicules is not counterbalanced by a development of dense fascicles of collagen fibrils, as it is in Chondrillidae or Halisarcidae, or by a basement membrane as is the case in Homoscleromorpha. Consequently, the sponge is soft and fragile, and probably would not be able to withstand moderately exposed littoral environments.

The unique body organization, with a reduced aquiferous system, few choanocyte chambers, a remarkably developed system of expansions on the substratum which increases the external exchange surface, and a mucous sheet on the surface suggests that the sponge has a peculiar life strategy. Apparently, it is able to survive and even to grow expansions when the whole body is covered by massive sponges which smother most of the surface. It may be supposed that filaments have a role in the capture and ingestion of particles, with the mucous sheet possibly acting as in *Hemimycale columella* (Willenz 1981, 1982). Further studies are needed to elucidate how this sponge is functioning.

DISCUSSION

These two sponges are known only from the 3PP cave. This habitat is highly unusual in having stable temperature conditions, which approximate those of the deep Mediterranean which is homeothermic at 13 °C. It is quite unlikely that the sponges have been overlooked in other caves from the Marseille area, especially *Myceliospongia araneosa* n.sp. with its remarkable growth form. The cave has been submerged since the last Holocene sea level rise, 7000-8000 years ago, a relatively short time which would not permit local differentiation of such taxa. Consequently, the restricted known distribution to a cave which shelters a number of deep-sea invertebrates never recorded in other caves (Vacelet *et al.* 1994) implies that the two new sponges also live in the bathyal zone, from where they have colonized the cave. The 3PP cave is only 7 km distant from the Cassidaigne canyon, which is 100 to 3000 m deep with a poorly known invertebrate fauna. Although the sponge fauna of the canyon has been thoroughly explored (Vacelet 1969), the numerous precipitous walls and downward-facing surfaces certainly shelter many unrecorded sessile invertebrates which are very difficult or impossible to sample and observe. It is likely that propagules of the bathyal invertebrates present in the 3 PP cave have been advected by an intermittent, strong upwelling current frequent in this area (Bourcier 1978; Millot 1979). These invertebrates are absent from other littoral aphotic environments because of their stenothermic character.

The two new sponges significantly increase the already remarkably high number of sponges without any skeleton which live in dark caves. This remarkable abundance, which is probably shared by bathyal vertical and overhanging surfaces as discussed above, is not clearly related to any characteristic of this environment. It has been hypothesized that in karstic cave, a possible reduced amount of silica in the water prevents some demosponges from fully developing their spicule skeleton, thus explaining a relatively high frequency of spicule abnormalities (Bibiloni & Gili 1982; Bibiloni *et al.* 1989). However, it has been shown (Fichez 1989) that in a karstic cave, the amount of silica increases from the entrance to the terminal part, as a result of mineralization processes during the residence time of the water in the cave. It appears more likely that the extremely low hydrodynamic energy experienced by most dark caves and deep-sea environments allows the development of fragile invertebrates, such as sponges without skeleton or without a highly developed collagen cortex, which could not withstand exposed littoral environments.

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Deux nouveaux *Neoheligmonella* (Nematoda, Trichostrongylina, Nippostrongylinae) parasites de *Mastomys erythroleucus* (Muridae) au Sénégal

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RÉSUMÉ
Description de deux nouveaux Nippostrongylinae (Heligmosomoidea, Heligmonellidae) *Neoheligmonella skirringi* n.sp. et *N. mastomysi* n.sp. parasites de *Mastomys erythroleucus* dans la province de Casamance au Sénégal. Parmi les *Neoheligmonella*, ces deux espèces sont les seules avec *N. bainae* Durette-Desset, 1970, parasite de *Steatomys opimus* au Burkina Faso et *N. tranieri* Durette-Desset et Cassone, 1986 parasite d'*Uranomys ruddi* en Côte d'Ivoire à posséder les caractères suivants : (1) carène moyennement développée ; (2) gradient de taille des arêtes dorsales très léger ou absent ; (3) bourse caudale avec des côtes 2 et 3 de longueur équivalente aux côtes 5 et 6. *N. tranieri* se différencie immédiatement des deux espèces par l'absence de carène au milieu du corps. *N. bainae* se distingue de *N. skirringi* par la présence de six arêtes ventrales au lieu de huit et par un synlophe prévulvaire bien développé. Il se distingue de *N. mastomysi* par des côtes 8 qui naissent symétriquement sur la côte dorsale, par des côtes 9 recourbées et par un cône génital bien développé. *N. skirringi* et *N. mastomysi* se différencient l'une de l'autre par le nombre d'arêtes cuticulaires, la position du pore excréteur, la naissance des côtes 8 sur la côte dorsale, le synlophe prévulvaire et le nombre de rangées d'œufs dans l'utérus. Les deux espèces, bien que de régions géographiques proches, ne sont jamais trouvées ensemble chez le même individu hôte mais, dans chaque région, leur prévalence est similaire.

MOTS CLÉS
Neoheligmonella skirringi n.sp., *Neoheligmonella mastomysi* n.sp., Nematoda, Trichostrongylina, Nippostrongylinae, rongeurs Muridae, Sénégal.

ABSTRACT
Two new Neoheligmonella (Nematoda, Trichostrongylina, Nippostrongylinae) parasitic in Mastomys erythroleucus *from the Republic of Senegal.* Two new species belonging to the Nippostrongylinae (Heligmosomoidea, Heligmonellidae) are described. *Neoheligmonella skirringi* n.sp. and *N. mastomysi* n.sp. are both parasites of *Mastomys erythroleucus* from the Republic of Senegal (Province of Casamance). Among the species belonging to the genus *Neoheligmonella*, *N. bainae* Durette-Desset *et* Cassone, 1970 parasitic in *Steatomys opimus* from Burkina Faso, *N. tranieri* Durette-Desset *et* Cassone, 1986, parasitic in *Uranomys ruddi* from the Ivory Coast, and the two new species have the following characters: (1) carene of average development; (2) gradient in the size of the dorsal crests which is very slight or absent; (3) caudal bursa with rays 2 and 3 of equal length to that of rays 5 and 6. *N. tranieri* differs from *N. skirringi* and *N. mastomysi* in the absence of the carene at the mid-body level. *N. bainae* differs from *N. skirringi* in the presence of six ventral *vs* eight ridges and a well-developed prevulval synlophe. It differs from *N. mastomysi* in that there is a symetrical origin of rays 8 on the dorsal ray, rays 9 are hook-shaped and the genital cone is well-developed. *N. skirringi* and *N. mastomysi* are differentiated from each other by the number of cuticular ridges, the position of the excretory pore, the origin of rays 8 on the dorsal ray, the prevulval synlophe and the number of rows of eggs in the uterus.The two species, although found in neighbouring regions, do not occur together in the same individual hosr but in each area the prevalences species are similar.

KEY WORDS
Neoheligmonella skirringi n.sp.,
Neoheligmonella mastomysi n.sp.
Nematoda,
Trichostrongylina,
Nippostrongylinae,
Muridae,
rodents,
Senegal.

INTRODUCTION

Nous poursuivons dans ce travail l'identification des Nématodes Trichostrongles, récoltés depuis 1968 par les équipes de mammalogistes de l'Orstom lors de leurs études sur l'écologie, la systématique et la génétique des Rongeurs du Sénégal (Hubert 1977 ; Poulet 1982 ; Granjon 1987 ; Duplantier 1988). Dans une première note (Diouf *et al.* 1997), nous avons décrit deux Nippostrongylinae, l'un appartenant au genre *Neoheligmonella* Durette-Desset, 1970 chez *Arvicanthis niloticus* (Desmarest, 1822), dans la province de Dielmo, et l'autre au genre *Heligmonina* Baylis, 1928 chez *Mastomys erythroleucus* (Temminck, 1853) en Casamance.
Dans ce travail, nous décrivons deux nouvelles espèces de *Neoheligmonella* chez *Mastomys erythroleucus* en Casamance. À notre connaissance, c'est la première fois qu'une espèce de ce genre est décrite chez un *Mastomys* alors que le genre *Heligmonina* est représenté chez cet hôte par *H. affinis* (Baylis, 1928) au Niger, *H. bignonensis* Diouf *et al.*, 1997 en République du Sénégal et par *H. chabaudi* (Desset, 1964) en République centrafricaine et en République du Congo chez le *Mastomys* à trente-deux chromosomes.

MATÉRIEL ET MÉTHODES

Les Rongeurs ont été capturés vivants à l'aide de pièges rigides de type Manufrance au Cap Skirring, localité située dans le Sud du Sénégal.
Après autopsie des hôtes, les Vers ont été fixés à l'éthanol à 70° bouillant dans lequel ils sont conservés. Lors de l'étude morphologique, les spécimens sont montés entre lame et lamelle dans du lactophénol d'Amann.

La nomenclature utilisée au-dessus du groupe famille est celle de Durette-Desset & Chabaud (1995). Le synlophe est étudié selon la méthode de Durette-Desset (1985). La nomenclature utilisée pour l'étude de la bourse caudale est celle de Durette-Desset & Chabaud (1981).
Le genre *Neoheligmonella* ayant une bourse caudale subsymétrique, le rapport hauteur sur largeur a été calculé sur la bourse caudale étalée.

Pour les mensurations, le premier chiffre correspond à l'holotype ou à l'allotype, les chiffres entre parenthèses aux extrêmes des paratypes mesurés. Pour *Neoheligmonella skirringi*, tous les types disponibles ont été mesurés. Pour *Neoheligmonella mastomysi*, dix mâles et dix femelles du matériel-type ont été mesurés.

Les spécimens-types ont été déposés soit dans les collections de Biologie animale de l'Université CH. A. Diop du Sénégal (CS), soit dans les collections du Muséum National d'Histoire naturelle de Paris (MNHN).

SYSTÉMATIQUE

Neoheligmonella skirringi n.sp. (Fig. 1)

MATÉRIEL-TYPE. — ♂ holotype, ♀ allotype CS A20, 4 ♂♂, 5 ♀♀ paratypes, MNHN 558 HF, 3 ♂♂, 5 ♀♀ paratypes CS A22.

HÔTE. — *Mastomys erythroleucus* (Temminck, 1853), (Muridae).

LOCALISATION. — Tiers antérieur de l'intestin grêle.

ORIGINE GÉOGRAPHIQUE. — Cap Skirring (Casamance, Sénégal), date de récolte : 20.XI.1994.

AUTRE MATÉRIEL EXAMINÉ. — 2 ♂♂, 7 ♀♀ CS A18 ; 1 ♂, 1 ♀ CS A21 ; 2 ♂♂, 8 ♀♀ CS A26 ; 2 ♂♂, 8 ♀♀ CS A33 ; 1 ♂, 9 ♀♀ CS A35 ; 2 ♀♀ CS A39. Même hôte, même origine, date de capture entre le 18 et le 22 novembre 1994.

DESCRIPTION

Nématodes de petite taille enroulés en spirale de façon senestre le long de leur ligne ventrale, selon quatre tours de spire chez le mâle, six à sept chez la femelle. Pore excréteur et deirides situés au même niveau, juste en arrière de l'anneau nerveux. Œsophage musculaire légèrement plus long que l'œsophage glandulaire (Fig. 1A).

Tête

Vésicule céphalique présente. Ouverture buccale triangulaire. En vue apicale, on observe deux amphides, quatre papilles labiales externes et quatre papilles céphaliques (Fig. 1B).

Synlophe

(étudié en coupe transversale, chez trois mâles et trois femelles paratypes). Dans les deux sexes, corps parcouru longitudinalement par quinze arêtes cuticulaires continues naissant juste en arrière de la vésicule céphalique (Fig. 1C-I)). Les arêtes disparaissent en avant de la bourse caudale chez le mâle ; chez la femelle, les arêtes ventrales disparaissent en avant de la vulve, les dorsales légèrement en arrière de celle-ci (Fig. 1L, M). Distribution des arêtes au milieu du corps : cinq arêtes dorsales, huit ventrales et une carène bien développée, plus grande chez le mâle que chez la femelle. La carène est formée par les deux arêtes latérales gauches dont la ventrale est la plus forte. Gradient de taille décroissant de la gauche vers la droite pour la face ventrale. Arêtes dorsales de taille équivalente. Pointe des arêtes dirigée de la droite vers la gauche avec un axe d'orientation incliné à 85° sur l'axe sagittal (Fig. 1C, D). Chez la femelle, dans la région prévulvaire, les arêtes sont orientées perpendiculairement à la surface du corps (Fig. 1E).

Mâle

2200 (1800-2500) µm de long sur 90 (80-95) µm de large dans sa partie moyenne. Vésicule céphalique haute de 55 (45-60) µm sur 20 (20-20) µm de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 175 (165-180) µm, 320 (310-330) µm et 330 (320-345) µm de l'apex. Œsophage long de 450 (420-470) µm (Fig. 1A).

Bourse caudale subsymétrique de type 2-2-1 (Fig. 1J). Rapport hauteur sur largeur de la bourse caudale de 0,30 (0,29-0,32). Extrémités des côtes 4 coudées à angle droit vers l'avant. Côtes 6 petites et éloignées des côtes 8. Côtes 8 naissant symétriquement dans le tiers antérieur de la côte dorsale. Dorsale divisée dans son tiers distal en deux rameaux eux-mêmes bifurqués, les rameaux externes (côtes 9) sont recourbés vers l'avant et plus longs que les internes (côtes 10). Cône génital bien développé, portant la papille zéro en forme de languette sur sa lèvre ventrale et deux petites papilles 7 sur sa lèvre dorsale. Spicules filiformes, ailés, longs de 350 (320-380) µm, glissant dans un gubernaculum long de 40 (40-45) µm sur 25 (20-25) µm de large à sa base.

Chaque spicule se termine par une pointe aiguë (Fig. 1J).

Femelle
2800 (2300-3000) µm de long sur 110 (110-115) µm dans sa partie moyenne. Vésicule céphalique haute de 60 (55-65) µm sur 22 (20-25) µm de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 150 (145-155) µm, 185 (170-190) µm et 220 (210-225) µm. Œsophage long de 300 (290-350) µm. Monodelphie : vulve s'ouvrant à 120 (110-125) µm de l'extrémité caudale. *Vagina vera* long de 30 (30-35) µm. Vestibule, sphincter et trompe longs respectivement de 125 (120-135) µm, 30 (30-35) µm et 55 (50-60) µm (Fig. 1L). Utérus long de 525 (515-610) µm contenant 11 (9-18) œufs au stade morula, répartis sur une rangée et hauts de 65 (55-70) µm sur 55 (40-60) µm de large. Queue de 45 (35-50) µm de long, fortement recourbée ventralement entre la vulve et l'anus (Fig. 1L).

DISCUSSION
Voir discussion de *Neoheligmonella mastomysi.*

Neoheligmonella mastomysi n.sp. (Fig. 2)

MATÉRIEL-TYPE. — ♂ holotype, ♀ allotype CS B6, 5 ♂♂, 7 ♀♀ paratypes CS B7 et 3 ♂♂, 3 ♀♀ paratypes MNHN 559 HF.

HÔTE. — *Mastomys erythroleucus* (Temminck, 1853) (Muridae).

LOCALISATION. — Tiers antérieur de l'intestin grêle.

ORIGINE GÉOGRAPHIQUE. — Cap Skirring (Casamance, Sénégal), date de récolte : 19.XI.1994.

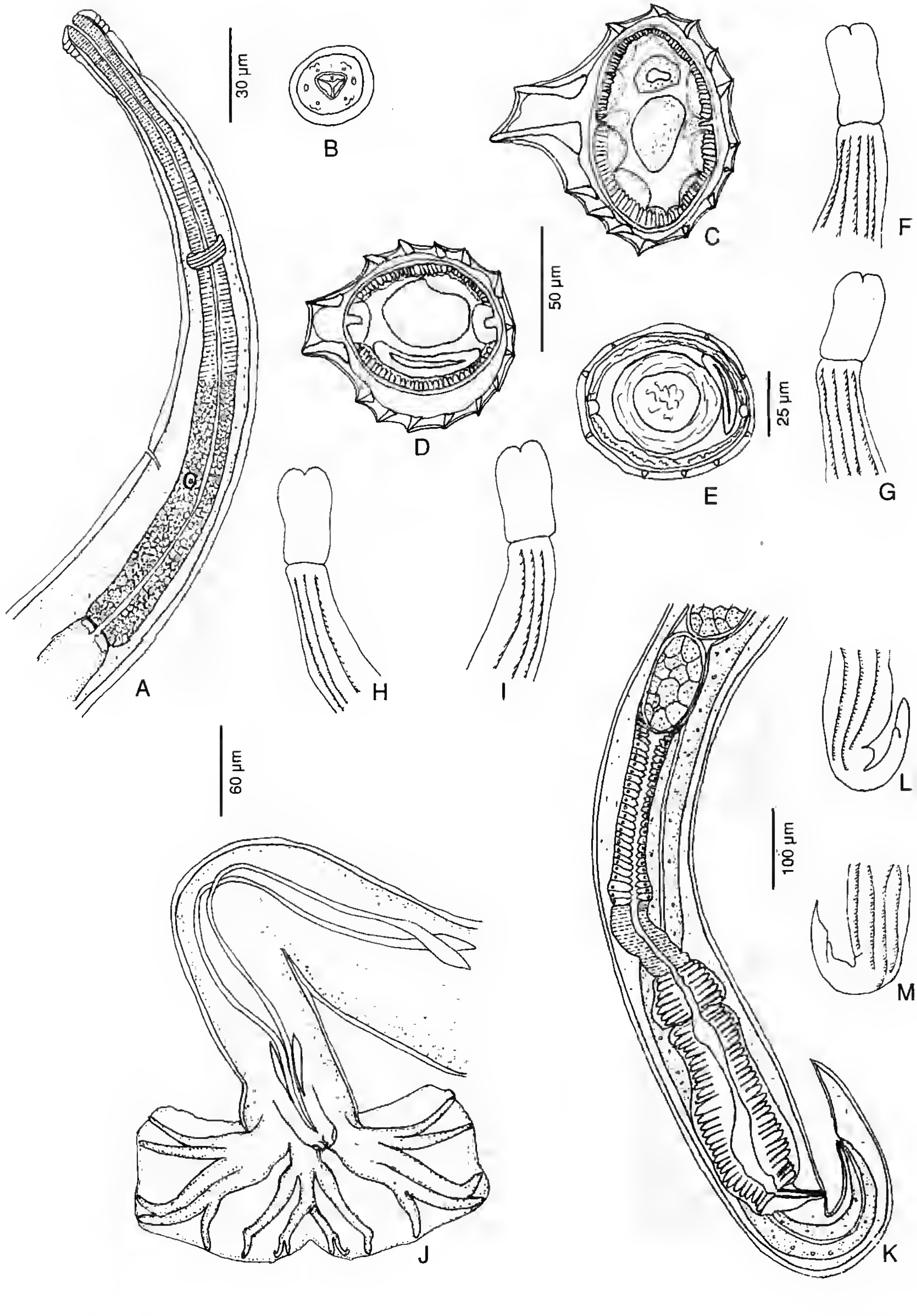
AUTRE MATÉRIEL EXAMINÉ. — 1 ♂, 1 ♀ CS B1 ; 1 ♀ CS B11 ; 1 ♂ CS B21 ; 3 ♂♂, 17 ♀♀ CS B23 ; 1 ♂, 1 ♀ CS B24 ; 3 ♂♂, 2 ♀♀ CS B32 ; 1 ♂, 1 ♀ CS B38. Même hôte, même origine, date de capture entre le 18 et le 22 novembre 1994.

DESCRIPTION
Nématodes de petite taille enroulés en spirale de façon senestre le long de leur ligne ventrale, selon un à deux tours de spire chez le mâle, trois à quatre chez la femelle. Pore excréteur situé juste en arrière de l'anneau nerveux ; deirides légèrement postérieures. Œsophage musculaire légèrement plus court que l'œsophage glandulaire (Fig. 2A).

Tête
Vésicule céphalique présente. Ouverture buccale triangulaire. En vue apicale, on observe deux amphides, quatre papilles labiales externes et quatre papilles céphaliques (Fig. 2B).

Synlophe
(étudié en coupe transversale chez deux mâles et trois femelles). Dans les deux sexes, corps parcouru longitudinalement par treize arêtes cuticulaires continues naissant en arrière de la vésicule céphalique sauf l'arête dorsale gauche et l'arête latérale droite qui naissent à environ 60 (50-70) µm en arrière de la vésicule céphalique (Fig. 2F-I). Elles disparaissent en avant de la bourse caudale chez le mâle et à différents niveaux entre la vulve et l'anus chez la femelle (Fig. 2J, K). Distribution des arêtes au milieu du corps : cinq arêtes dorsales, cinq ventrales, une petite arête proche du champ latéral droit et une carène bien développée formée par les deux arêtes latérales gauches dont la ventrale est la plus forte. À l'exception de la petite arête droite, gradient de taille des arêtes décroissant de la gauche vers la droite sur la face ventrale. Sur la face dorsale, gradient de taille décroissant de la droite vers la gauche chez le mâle et absence de gradient chez la femelle. Pointe des arêtes dirigée de la droite vers la gauche avec un axe d'orientation sub-frontal (Fig. 2C, D). Chez la femelle, dans la région pré-vulvaire, il n'existe pas de modifications importantes à l'exception d'une diminution de la taille de la carène (Fig. 2E).

FIG. 1. — *Neoheligmonella skirringi* n.sp., **A**, ♂, extrémité antérieure, vue latérale gauche ; **B**, ♀, tête, vue apicale ; **C**, ♂, synlophe au milieu du corps ; **D**, ♀, synlophe au milieu du corps ; **E**, ♀, synlophe pré-vulvaire ; **F-I**, ♀, extrémité antérieure, naissance des arêtes cuticulaires ; **F**, vue ventrale ; **G**, vue dorsale ; **H**, vue latérale droite ; **I**, vue latérale gauche ; **J**, ♂, bourse caudale, vue ventrale ; **K**, ♀, extrémité postérieure, vue latérale droite ; **L**, **M**, ♀, extrémité postérieure, disparition des arêtes cuticulaires ; L, vue latérale droite ; **M**, vue latérale gauche. Échelles : A, F-K, 60 µm ; B, 30 µm ; C, D, 50 µm ; E, 25 µm ; L, M, 100 µm.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Mâle

5700 (5400-6000) µm de long sur 100 (90-110) µm de large dans sa partie moyenne. Vésicule céphalique haute de 60 (60-65) µm sur 26 (25-27) µm de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 175 (165-180) µm, 195 (185-200) µm et 230 (220-235) µm de l'apex. Œsophage long de 390 (380-410) µm (Fig. 2A).

Bourse caudale subsymétrique de type 2-2-1 (Fig. 2L). Rapport hauteur sur largeur de la bourse caudale de 0,040 (0,039-0,043). Extrémités des côtes 4 coudées à angle droit vers l'avant. Côtes 6 petites et éloignées des côtes 8. Côtes 8 naissant asymétriquement sur la côte dorsale, la côte droite naissant juste en arrière de la racine de la dorsale, et la côte gauche, dans le tiers médian de celle-ci. Dorsale divisée à la moitié de sa hauteur en deux rameaux eux-mêmes bifurqués, les rameaux externes (côtes 9) étant plus longs que les internes (côtes 10). Cône génital portant les deux petites papilles 7 sur sa lèvre dorsale et la papille zéro sur la lèvre ventrale. Spicules filiformes, ailés, longs de 300 (295-310) µm, glissant dans un gubernaculum long de 30 (30-35) µm sur 20 (20-25) µm de large à sa base. Chaque spicule se termine par une pointe aiguë (Fig. 2L).

Femelle

6400 (6200-7000) µm de long sur 150 (145-155) µm de large dans sa partie moyenne. Vésicule céphalique haute de 60 (55-65) µm sur 32 (30-35) µm de large. Anneau nerveux, pore excréteur et deirides situées respectivement à 230 (225-260) µm, 250 (240-260) µm et 380 (370-385) µm de l'apex. Œsophage long de 450 (435-470) µm.

Monodelphie : vulve s'ouvrant à 120 (115-125) µm de l'extrémité caudale. *Vagina vera* long de 60 (55-75) µm. Vestibule, sphincter et trompe longs respectivement de 160 (155-170) µm, 40 (35-45) µm et 150 (145-150) µm (Fig. 2M). Utérus long de 1300 (1200-1500) µm contenant 35 (28-40) œufs au stade morula répartis sur trois rangées dans la partie distale de l'utérus et deux dans la partie proximale, hauts de 60 (50-65) µm sur 40 (35-45) µm de large. Queue arrondie à son extrémité, longue de 50 (45-55) µm (Fig. 2M).

Discussion

Les deux espèces parasites de *Mastomys erythroleucus* décrites ci-dessus présentent les principaux caractères du genre *Neoheligmonella* Durette-Desset, 1971 (Heligmonellidae, Nippostrongylinae) : synlophe avec axe d'orientation des arêtes incliné au moins à 70° sur l'axe sagittal, arête latéro-ventrale gauche bien développée, nombre d'arêtes cuticulaires compris entre dix et quinze ; bourse caudale subsymétrique de type 2-2-1, avec un court tronc commun à la côte dorsale et aux côtes 8.

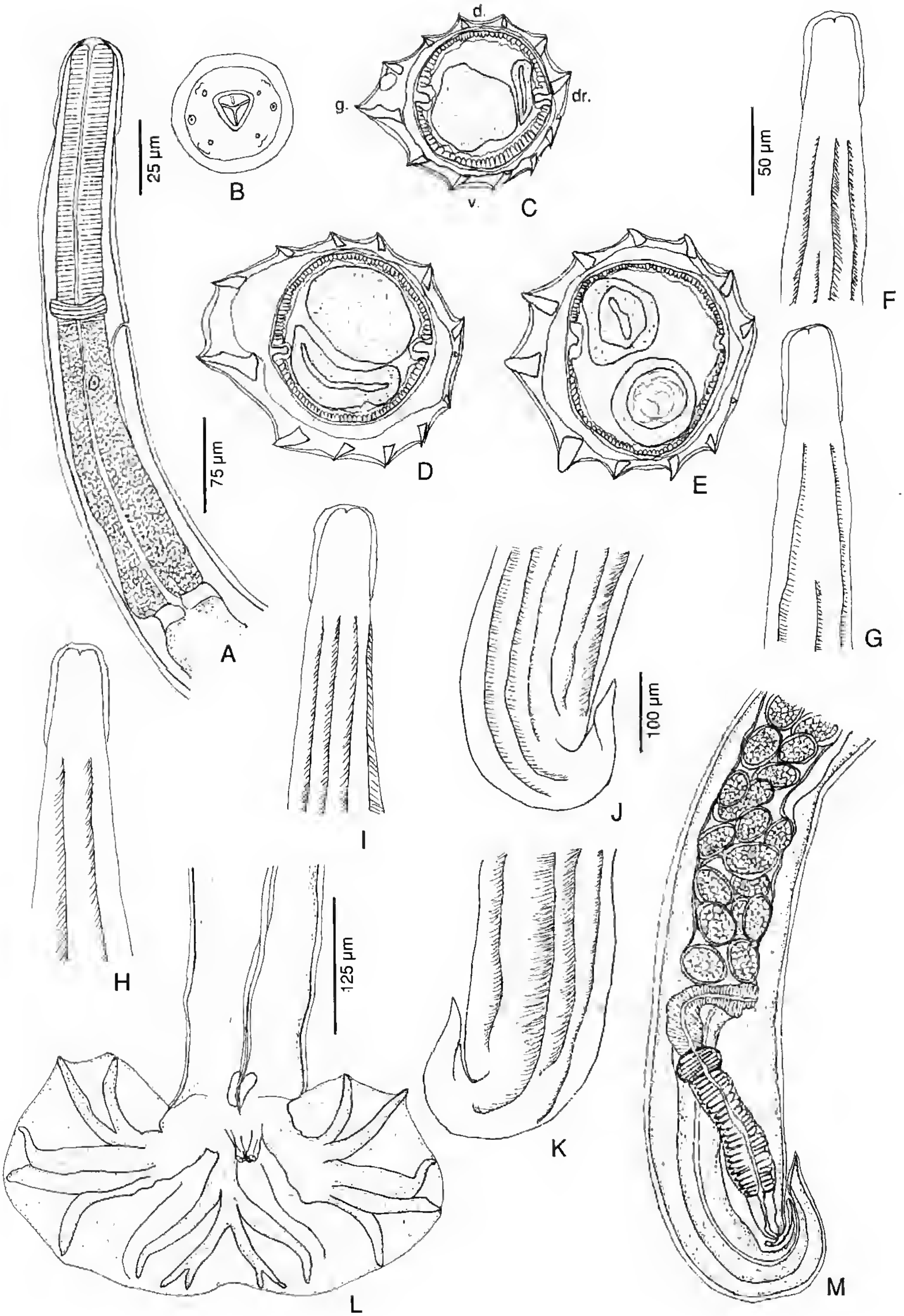
Ce genre compte quinze espèces parasites, pour la plupart de Muridae éthiopiens.

Seules *N. bainae* Durette-Desset, 1970, parasite de *Steatomys opimus* Pousargues, 1894 au Burkina Faso et *N. tranieri* Durette-Desset *et* Cassone, 1986, parasite d'*Uranomys ruddi* Dollman, 1909 en Côte d'Ivoire possèdent comme les spécimens du *Mastomys* : (1) un synlophe caractérisé par la présence d'une carène moyennement développée ; (2) une bourse caudale avec des côtes 2 et 3 de taille équivalente à celles des côtes 5 et 6 ; (3) une queue femelle fortement recourbée ventralement.

La première espèce parasite du *Mastomys* s'éloigne de *N. tranieri* par la position médiane du pore excréteur, par la naissance symétrique des côtes 8 sur la côte dorsale, par des côtes 9 plus longues que les côtes 10 et surtout par la présence de la carène tout le long du corps. Comme *N. bainae*, elle possède des côtes 8 naissant symétriquement sur la côte dorsale mais elle s'en distingue par la présence de six arêtes ventrales au lieu de huit, par un synlophe prévulvaire bien développé et par la présence de deux rangées d'œufs dans l'utérus.

La seconde espèce parasite du *Mastomys* possède comme *N. tranieri* des côtes 8 naissant asymétriquement sur la côte dorsale mais elle s'en éloigne

Fig. 2. — *Neoheligmonella mastomysi* n.sp., **A**, ♂, extrémité antérieure, vue latérale droite ; **B**, ♀, tête, vue apicale ; **C**, ♂, synlophe au milieu du corps ; **D**, ♀, synlophe au milieu du corps ; **E**, ♀, synlophe prévulvaire ; **F-I**, ♂, extrémité antérieure, naissance des arêtes cuticulaires ; **F**, vue dorsale ; **G**, vue latérale droite ; **H**, vue latérale gauche ; **I**, vue ventrale ; **J**, **K**, ♀, extrémité postérieure, disparition des arêtes cuticulaires ; **J**, vue latérale droite ; **K**, vue latérale gauche ; **L**, ♂, bourse caudale, vue ventrale ; **M**, ♀, partie postérieure, vue latérale droite. Échelles : A, C-E, H, I, 75 µm ; B, 25 µm ; F, G, 50 µm ; J, K, M, 100 µm ; L, 125 µm.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par la position antérieure du pore excréteur, par un cône génital peu développé, par des côtes 9 rectilignes et plus longues que les côtes 10 et surtout par la présence de la carène tout le long du corps. Elle se distingue de *N. bainae* par la position plus antérieure du pore excréteur, par des côtes 8 naissant symétriquement sur la côte dorsale, par des côtes 9 rectilignes et plus longues que les côtes 10 et par la présence de deux rangées d'œufs dans l'utérus.

Les deux espèces parasites du *Mastomys* peuvent être séparées l'une de l'autre par le nombre d'arêtes cuticulaires, par la présence d'un léger gradient de taille des arêtes sur la face dorsale du mâle de la deuxième espèce, par le synlophe prévulvaire, par la position du pore excréteur, par la naissance des côtes 8 sur la côte dorsale, par la forme et la longueur des côtes 9, et par le nombre de rangées d'œufs dans l'utérus. Nous proposons de nommer la première espèce *Neoheligmonella skirringi* n.sp., et la seconde *N. mastomysi* n.sp. en référence aux hôtes chez lesquels elles ont été trouvées. Il est intéressant de constater que ces deux espèces très proches morphologiquement n'ont jamais été trouvées ensemble chez le même individu-hôte. Elles pourraient être interprétées comme des espèces vicariantes, *N. skirringi* parasitant les *Mastomys* capturés dans des rizières alors que *N. mastomysi* a été trouvée chez les *Mastomys* vivant dans les zones cultivées aux abords de la mangrove.

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Cirripedia (Crustacea) from the "Campagne Biaçores" in the Azores region, including a generic revision of Verrucidae

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ABSTRACT

The cirripeds sampled by the N. O. *Jean Charcot* from the Azores region include thirty-four species: twenty lepadomorphs, eight verrucomorphs and six balanomorphs. Among these are two new species: *Arcoscalpellum eponkos* n.sp. and *Tesseropora arnoldi* n.sp. and several little known species. The family Verrucidae is revised, and a key to the genera is included. *Verruca* and *Metaverruca* are rediagnosed, two new genera are proposed: *Newmaniverruca* n.g. and *Costatoverruca* n.g. A list of recent species of Verrucidae is provided, reported with keys to all of the species. Forty-five species of cirripeds are reported from the Azores region, of which one third are endemic.

KEY WORDS
Cirripedia,
Verrucidae,
new genus and species,
Azores region.

RÉSUMÉ

Cirripèdes (Crustacea) de la « Campagne Biaçores » dans la région des Açores, avec une révision des genres de Verrucidae. Les cirripèdes recueillis par le N. O. *Jean Charcot* dans la région des Açores comprennent trente-quatre espèces : vingt Lépadomorphes, huit Verrucomorphes et six Balanomorphes. Parmi eux, deux espèces sont nouvelles : *Arcoscalpellum eponkos* n.sp. et *Tesseropora arnoldi* n.sp., et plusieurs peu connues. Les Verrucidae sont révisés et une clé des genres est incluse. *Verruca* et *Metaverruca* font l'objet d'une diagnose émendée et deux nouveaux genres sont proposés : *Newmaniverruca* n.g. et *Costatoverruca* n.g. Une liste des espèces actuelles de Verrucidae est fournie, ainsi que des clés pour toutes les espèces. Quarante-cinq espèces de cirripèdes sont signalées de la région des Açores, dont le tiers est endémique.

MOTS CLÉS
Cirripedia,
Verrucidae,
nouveaux genres et espèces,
région des Açores.

INTRODUCTION

The "Campagne Biaçores" undertaken by the N. O. *Jean Charcot* and directed by Dr Jacques Forest, sampled the Azores Region from the intertidal to the abyssal zone (4700 m), especially along the Mid-Atlantic Ridge. During the cruise at the West European Basin deep-sea samples were collected.

The deep water fauna of the Azores region is better known than that of shallow waters. This is the result of dredging by the *Challenger*, *Hirondelle*, *Princesse Alice*, *Travailleur*, *Talisman*, and more recently by the *Meteor* (Hoek 1883; Aurivillus 1898; Gruvel 1900a, b, 1902a, 1920; Young in press). The species found in shallow waters were described by Pilsbry (1916), Newman & Ross (1977) and Baker (1967). The latter paper by Baker is based on collections from the Chelsea Expedition at São Jorge Island.

The present study describes the cirriped species collected during the "Campagne Biaçores" from intertidal to abyssal depths. The verrucids collected during this cruise form the basis for a review and revision of the Verrucidae.

All the specimens are deposited in the Muséum national d'Histoire naturelle, Paris (MNHN), the Museu Nacional do Rio de Janeiro (MNRJ) and the United States National Museum (USNM).

Abbreviations used are as follows:

tl	total length;
rc	rostro-carinal diameter.

EARLY STUDIES ON THE BARNACLES OF THE AZORES

The barnacles from the Azores region were collected first by H. M. S. *Challenger*, which dredged around the archipelago. Hoek (1883) described two new species, *Scalpellum acutum* and *Dichelaspis sessilis*. Aurivillius (1898) described nineteen species from this region based on collections from the campagnes of *Hirondelle* and *Princesse Alice*: *Scalpellum debile*, *S. rigidum*, *S. mamillatum*, *S. anceps*, *S. molle*, *S. erectum*, *S. grimaldii*, *S. calyculus*, *S. falcatum*, *S. incisum*, *S. pusilum*, *Poecilasma unguiculus*, *Verruca recta*, *V. costata*, *V. aequalis*, *V. inermis*, *V. crenata*, *V. cornuta* and *V. sculpta*.

Gruvel (1900a, b) described the species collected by the *Travailleur* and *Talisman* later described in detail (Gruvel 1902a). In the present study eight species new to the Azores are redescribed: *S. edwardsii*, *S. recurvitergum*, *S. atlanticum*, *S. striatum*, *S. luteum*, *V. erecta*, *V. trisulcata* and *V. linearis*. In addition *S. regium* Thomson, 1873, and *V. strömia* (Müller, 1776) were reported from this region. Gruvel also reported *S. gigas* Hoek from the Azores region, but the coordinates presented appear to represent specimens collected off the coast of France.

Pilsbry (1916) described *Megabalanus tintinnabulum azoricus* and recorded *Balanus trigonus* Darwin, 1854, and *Chthamalus stellatus stellatus* (Poli, 1791), all of which are shallow water species.

Gruvel (1920) provided the most complete study of the barnacles from the Azores, based on a series of collections made by the yachts of S. A. S. le Prince de Monaco. He reported thirty-seven shallow and deep water species, and added new information regarding the following species: *S. vulgare* Leach, 1824, *S. velutinum* Hoek, 1883, *S. alboranense* Gruvel, 1920; *S. gracile* Hoek, 1907a, *S. pilsbryi* Gruvel, 1911, *V. spengleri* Darwin, 1854, *B. amphitrite* Darwin, 1854, and *B. spongicola* Brown, 1844.

A collection made in the shallow waters of São Jorge Island (Baker 1967) confirmed the occurrence of *C. stellatus*, *B. trigonus*, *B. tintinnabulum azoricus*, and *V. spengleri*. Baker (1967) reported the presence of *Tetraclita squamosa elegans* Darwin, 1854. However, Newman & Ross (1977) indicated that *T. squamosa elegans* likely represents a new species, *Tesseropora atlantica*.

Zevina (1976) recorded *S. vitreum* Hoek, 1883, and *S. michelottianum* Seguenza, 1876, from the Azores and described *S. limpidus* from off northeast of this archipelago.

Young (in press) studied the fauna of the Great Meteor Bank and recorded *Heteralepas microstoma* (Gruvel, 1901) from this region.

THE SPECIES FROM THE "CAMPAGNES BIAÇORES"

Order PEDUNCULATA Lamarck, 1818
Suborder HETERALEPADOMORPHA Newman, 1987
Family HETERALEPADIDAE Nilsson-Cantell, 1921
Genus *Heteralepas* Pilsbry, 1907a

Heteralepas microstoma (Gruvel, 1901)

Alepas microstoma Gruvel, 1901: 259; 1902b: 282, pl. 24, figs 1B, B', 7, 8; 1905: 162, fig. 180.

MATERIAL EXAMINED. — Stn 73, 1 specimen, tl: 2.4 cm, on a gorgonian, MNHN Ci 2562.

REMARKS

Heteralepas microstoma is a common species from the Azores and Madeira Archipelagos, and the Great Meteor Seamounts (Young in press). It ranges from depths of 269 to 623 m, but more commonly around 300 m, forming large aggregations usually fixed on the stem of octocorals.

Suborder LEPADOMORPHA Pilsbry, 1916
Family OXYNASPIDIDAE Gruvel, 1905
Genus *Oxynaspis* Darwin, 1852

Oxynaspis patens Aurivilius, 1894

Oxynaspis patens Aurivillius, 1894: 38, pl. 3, figs 1-2, pl. 6, figs 13-15; pl. 8, fig. 9. – Totton 1940: 476, fig. 16. – Pilsbry 1907a: 79. – Weisbord 1979: 39, pl. 3, fig. 6-9. – Zevina 1982: 36, fig. 26.

MATERIAL EXAMINED. — Stn 89, 2 specimens, tl: 0.9-1.0 cm, MNHN Ci 2563.

REMARKS

Oxynaspis patens was described by Aurivillius (1894) based on specimens from Anguilla Island, Antilles, between depths of 125-355 m, and later recorded from the Bahamas (Pilsbry 1916), and Josephine and Great Meteor Seamounts, between 170-300 m (Young in press). The record of this species from the Azores confirms its occurrence in the Eastern Atlantic (Fig. 1).

Oxynaspis celata Darwin, 1852

Oxynaspis celata Darwin, 1852: 134, pl. 3, fig. 1. – Gruvel 1905: 103, fig. 114. – Nilsson-Cantell 1921: 226, fig. 37.

MATERIAL EXAMINED. — Stn P44, 1 specimen without carina, MNHN Ci 2536.

REMARKS

This specimen may be identified with certainty as *O. celata*, but lacking in the carina, the subspecies cannot be identified. Based on the geographical distribution (Fig. 2), it is probably *O. celata* s.str.

Bacon (1976) and Leta & Young (1996) accorded species status for *O. celata hirtae* Totton, including all of the references to *O. celata* from the Western Atlantic. Figure 2 presents the general distribution of the *O. celata* group, including the distribution of *O. hirtae*.

Family POECILASMATIDAE Annandale, 1909
Genus *Poecilasma* Darwin, 1852

Poecilasma aurantia Darwin, 1852

Poecilasma aurantia Darwin, 1852: 105, pl. 2, fig. 2.

Poecilasma Kempferi var. *aurantium* – Gruvel 1902a: 31, pl. 4, figs 1-2; 1905: 115, fig. 129. – Weltner 1922: 79.

Poecilasma kaempferi aurantia – Zevina 1982: 98, fig. 86m.

MATERIAL EXAMINED. — Stn 62, 9 specimens, tl: 0.5-1.8 cm, MNHN Ci 2559, MNRJ 8869. — Stn 148, 14 specimens, tl: 0.5-1.2 cm, MNHN Ci 2575, MNRJ 8870. — Stn 157, 10 specimens, tl: 0.4-1.2 cm, MNHN Ci 2581, MNRJ 8871. — Stn 159, 1 specimen, tl: 1.5 cm, MNHN Ci 2583. — Stn 180, 2 specimens, tl: 1.1-1.3 cm, MNHN Ci 2665. — Stn 199, 2 specimens, tl: 0.8-1.1 cm, MNHN Ci 2609. — Stn 237, 8 specimens, tl: 0.4-1.0 cm, MNHN Ci 2628.

REMARKS

Some of the species assigned to *Poecilasma kaempferi* group are questionable, because most of them do not have readily diagnostic characters (Young in press). The specimens herein studied are assigned to *P. aurantia.* All of the specimens examined agree to Darwin's (1852) description of *P. aurantia*, and the type locality of this species is the Madeira Archipelago. A revision of this group is needed.

Genus *Glyptelasma* Pilsbry, 1907a

Glyptelasma hamatum (Calman, 1919)

Megalasma (*Glyptelasma*) *hamatum* Calman, 1919: 370, figs 5-7. – Nilsson-Cantell 1927: 770, fig. 12; 1928: 23, fig. 11; 1931: 10; 1934: 49; 1955: 219. – Weisbord 1979: 48, pl.5, figs 1-2, pl. 14, fig. 3. – Zevina 1982: 93, fig. 83.

Megalasma hamatum – Zevina 1969: 67; 1976: 1155.

MATERIAL EXAMINED. — Stn 180, 1 specimen, tl: 0.8 cm, MNHN Ci 2666. — Stn 202, 16 specimens, tl: 0.9-2.5 cm, MNHN Ci 2613, MNRJ 8872. — Stn 227, 1 specimen, tl: 1.8 cm, MNHN Ci 2624.

REMARKS

Glyptelasma hamatum is defined by the pair of short, hook-like processes on the prosoma and by the filamentary appendage at the base of cirrus I.

This species has a circumtropical distribution, occurring between depths of 457 and 3778 m (Weisbord 1979) and was recorded previously in the Eastern Atlantic from the Cape Verde Islands (Calman 1919) and off Sierra Leone (Nilsson-Cantell 1927; Fig. 1).

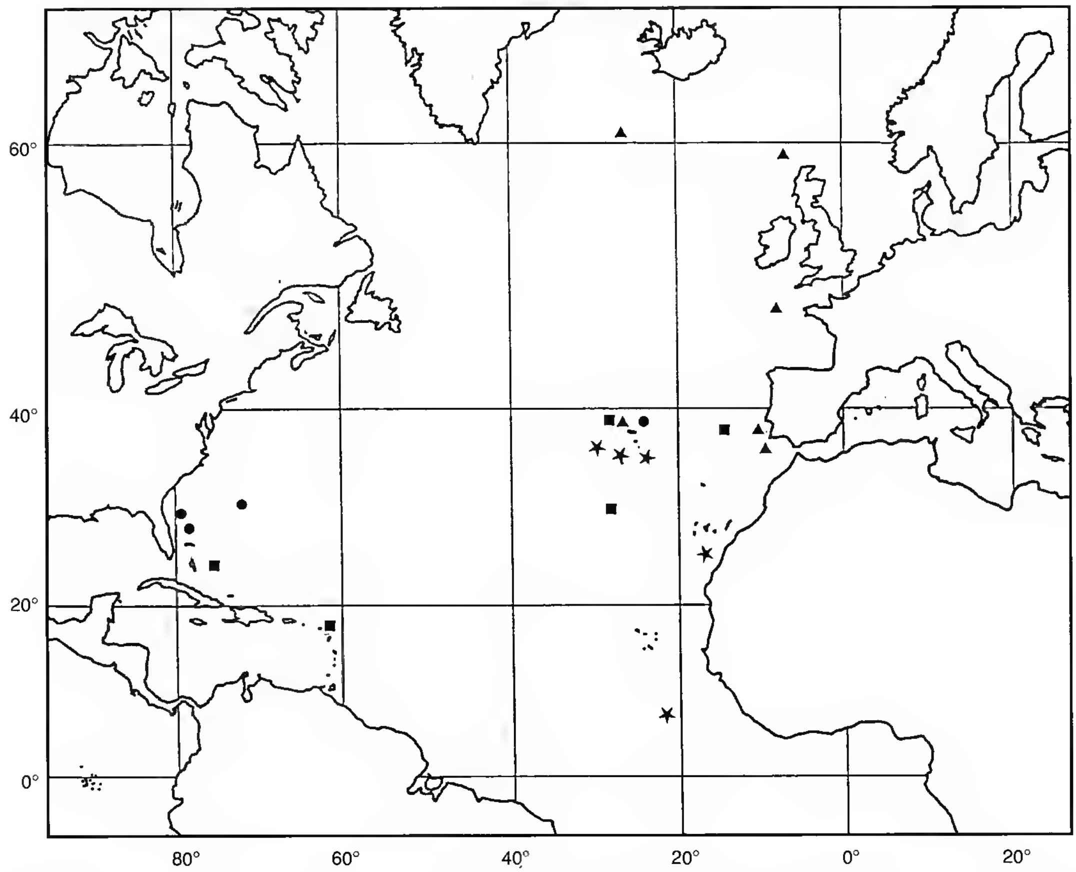

FIG. 1. — Geographic distribution of *Oxynaspis patens* Aurivillius (■), *Glyptelasma hamatum* Calman (★), *Arcoscalpellum tritonis* (Hoek) (▲) and *Hexelasma americanum* (Pilsbry) (●).

Family LEPADIDAE Darwin, 1852
Genus *Lepas* Linnaeus, 1758

Lepas anatifera Linnaeus, 1758

Lepas anatifera Linnaeus, 1758: 668. – Darwin 1852: 73, pl. 1, fig. 1, 1a-c. – Pilsbry 1907a: 79, pl. 9, figs 3-5.

Lepas (*Anatifa*) *anatifera* – Zevina 1981: 17, fig. 8.

MATERIAL EXAMINED. — Stn L7, 10 specimens, tl: 0.9-2.5 cm, MNHN Ci 2539.

REMARKS
Lepas anatifera is a species commonly found attached to floating objects (Pilsbry 1907a; Weisbord 1979).

Lepas pectinata Spengler, 1792

Lepas pectinata Spengler, 1792: 106, pl. 10, fig. B, 2a-c. – Darwin 1852: 85, pl. 1, figs 3, 3a. – Pilsbry 1907a: 81, pl. 8, figs 4-6, 8.

Lepas (*Anatifa*) *pectinata* – Zevina 1981: 15, fig. 6.

MATERIAL EXAMINED. — Stn L7, 7 specimens, tl: up to 1.0 cm, MNHN Ci 2540. — Stn 120, 16 specimens, tl: up to 0.6 cm, MNHN Ci 2565. — Stn 131, more than 100 specimens, up to 0.7 cm, MNHN Ci 2569, MNRJ 8873.

REMARKS
Lepas pectinata is a species commonly found attached to floating objects, including floating detached algae (Pilsbry 1907a; Weisbord 1979). The specimens, from depths of 2100 and 2120 m, clearly represent situations where detached algae (*Sargassum*) sank to this depth or were erroneously picked up during dredging work, since *L. pectinata* and *Sargassum* do not live at these depths.

Genus *Conchoderma* Olfers, 1814

Conchoderma auritum (Linnaeus, 1767)

Lepas aurita Linnaeus, 1767: 1110.

Conchoderma auritum – Darwin 1852: 141, pl. 3, figs 4, 4a-c. – Pilsbry 1907a: 99, pl. 9, fig. 2. – Zevina 1981: 26, fig. 15.

MATERIAL EXAMINED. — Ponta Delgada, 3 specimens, tl: 1.3-2.0 cm, MNHN Ci 2656.

REMARKS
Conchoderma auritum is commonly found on whales and ships, and also on turtles (Pilsbry 1907a; Weisbord 1979). The specimens from "Ponta Delgada" were collected attached to the hull of N. O. *Jean Charcot.*

Suborder SCALPELLOMORPHA
Newman, 1987
Family CALANTICIDAE Zevina, 1978
Genus *Smilium* Gray, 1825

Smilium acutum (Hoek, 1883)

Scalpellum acutum Hoek, 1883: 80, pl. 3, fig. 19; pl. 8, fig. 12; 1907a: 64, pl. 7, fig. 1. – Gruvel 1920: 12, pl. 2, fig. 7.

Smilium acutum – Newman & Ross 1971: 38, textfig. 12, pl. 5F (synonymy). – Foster & Buckeridge 1995a: 166, fig. 1c.

MATERIAL EXAMINED. — Stn 179, 4 specimens, tl: 0.4-1.3 cm, MNHN Ci 2593, MNRJ 8874.

REMARKS
Smilium acutum is a world-wide species (Newman & Ross 1971). In the Eastern Atlantic it has been recorded from the West European Basin, off Morocco, Cape Verde, Madeira, and also the Azores (Hoek 1883; Calman 1918; Gruvel 1920; Foster & Buckeridge 1995a; Fig. 2).

Family SCALPELLIDAE Pilsbry, 1907a
Subfamily SCALPELLINAE Pilsbry, 1907a
Genus *Scalpellum* Leach, 1817

Scalpellum scalpellum Linnaeus, 1767

Lepas scalpellum Linnaeus, 1767: 1109.

Scalpellum scalpellum – Darwin 1852: 222, pl. 5, fig. 15. – Pilsbry 1907a: 16. – Nilsson-Cantell 1978: 16, figs 6-7. – Zevina 1981: 94, fig. 65.

MATERIAL EXAMINED. — Stn 260, 27 specimens, tl: up to 1.7 cm, MNHN Ci 2654, MNRJ 8875.

Remarks

Scalpellum scalpellum is a common species along the European and North African coasts. It ranges from depths of 10 to 540 m, but occurs more commonly between 30 and 200 m (Nilsson-Cantell 1978).

Subfamily Meroscalpellinae Zevina, 1978
Genus *Neoscalpellum* Newman *et* Ross, 1971

Neoscalpellum debile (Aurivillius, 1898)

Scalpellum debile Aurivillius, 1898: 189. – Gruvel 1905: 27; 1920: 31, pl. 5, figs 13-15, pl. 7, fig. 1.

Scalpellum edwardsii Gruvel, 1900a: 189; 1902a: 63, pl. 2, figs 3B, 16; 1905: 28, fig. 27.

Scalpellum dicheloplax Pilsbry, 1907a: 70, fig. 28a-c. – Hoek 1914: 4.

Scalpellum dicheloplax benthophila Pilsbry, 1907a: 73, fig. 28d.

Scalpellum alboranense Gruvel, 1920: 33, pl. 5, figs 4-6.

Neoscalpellum debile – Newman & Ross 1971: 96, figs 49-50.

Material examined. — Stn 131, 3 specimens, tl: 1.0-1.1 cm, MNHN Ci 2568. — Stn 202, 1 specimen, tl: 0.8 cm, MNHN Ci 2614. — Stn 245, 2 specimens, tl: 0.6-1.2 cm, MNHN Ci 2708. — Stn 249, 2 specimens, tl: 0.8-2.3 cm, MNHN Ci 2642. — Stn 250, 1 specimen, tl: 3.3 cm, MNHN Ci 2646.

Remarks

Neoscalpellum debile was discussed by Newman & Ross (1971: 96) and Young (in press). It has a North Atlantic distribution, with several records from the Azores Region (disrribution map in Young, in press).

Subfamily Arcoscalpellinae Zevina, 1978
Genus *Arcoscalpellum* Hoek, 1907a

Arcoscalpellum michelottianum (Seguenza, 1876)

Scalpellum michelottianum Seguenza, 1876: 381, pl. 6, figs 15-25, pl. 10, fig. 26.

Scalpellum velutinum Hoek, 1883: 96, pl. 4, figs 10-11, pl. 9, figs 7-9.

Arcoscalpellum michelottianum – Newman & Ross 1971: 71, textfig. 34, pl. 9b (synonymy).

Material examined. — Stn 105, 1550 m, 1 specimen, tl: 1.3 cm, MNHN Ci 2564. — Stn 180, 10 specimens, tl: 1.2-4.0 cm, MNHN Ci 2594, MNRJ 8876. — Stn 196, 6 specimens, tl: 1.9-3.1 cm, MNHN Ci 2606, MNRJ 8877.

Remarks

This is one of the most common deep sea species. It occurs world-wide, and there are several records from the Eastern Atlantic (distribution map in Young, in press) (Hoek 1883; Gruvel 1902a, 1905, 1920; Nilsson-Cantell 1928).

Arcoscalpellum tritonis (Hoek, 1883)
(Fig. 1)

Scalpellum tritonis Hoek, 1883: 122, pl. 5, figs 9-10, pl. 10, fig. 10; 1884: 4. – Pilsbry 1907a: 34. – Broch 1953: 4.

Arcoscalpellum tritonis – Newman & Ross 1971: 60. – Zevina 1978: 1350; 1981: 342, fig. 342.

Material examined. — Stn 66, 2 specimens, tl: 1.6-1.7 cm, MNHN Ci 2663. — Stn 251, 1 specimen, tl: 1.4 cm, MNHN Ci 2649.

Remarks

The are no noteworthy differences between these specimens and those from *Siboga* and from *Meteor* (Hoek 1883; Young in press), except the relative length and development of the inframedian latus, which is more variable. The specimens from the *Meteor* have the inframedian latus a little higher than wide with the height almost twice width in some specimens.

Arcoscalpellum eponkos n.sp.
(Figs 3-4)

Material examined. — Holotype: stn 249, tl: 0.9 cm, MNHN Ci 2643. Paratypes: 2 specimens from the same locality, tl: 0.4 and 0.6 cm, MNHN Ci 2669.

Etymology. — From the Greek, *eponkos* (pregnant) in reference to the inflated scutum.

Diagnosis

Plates of capitulum approximate, thin, smooth,

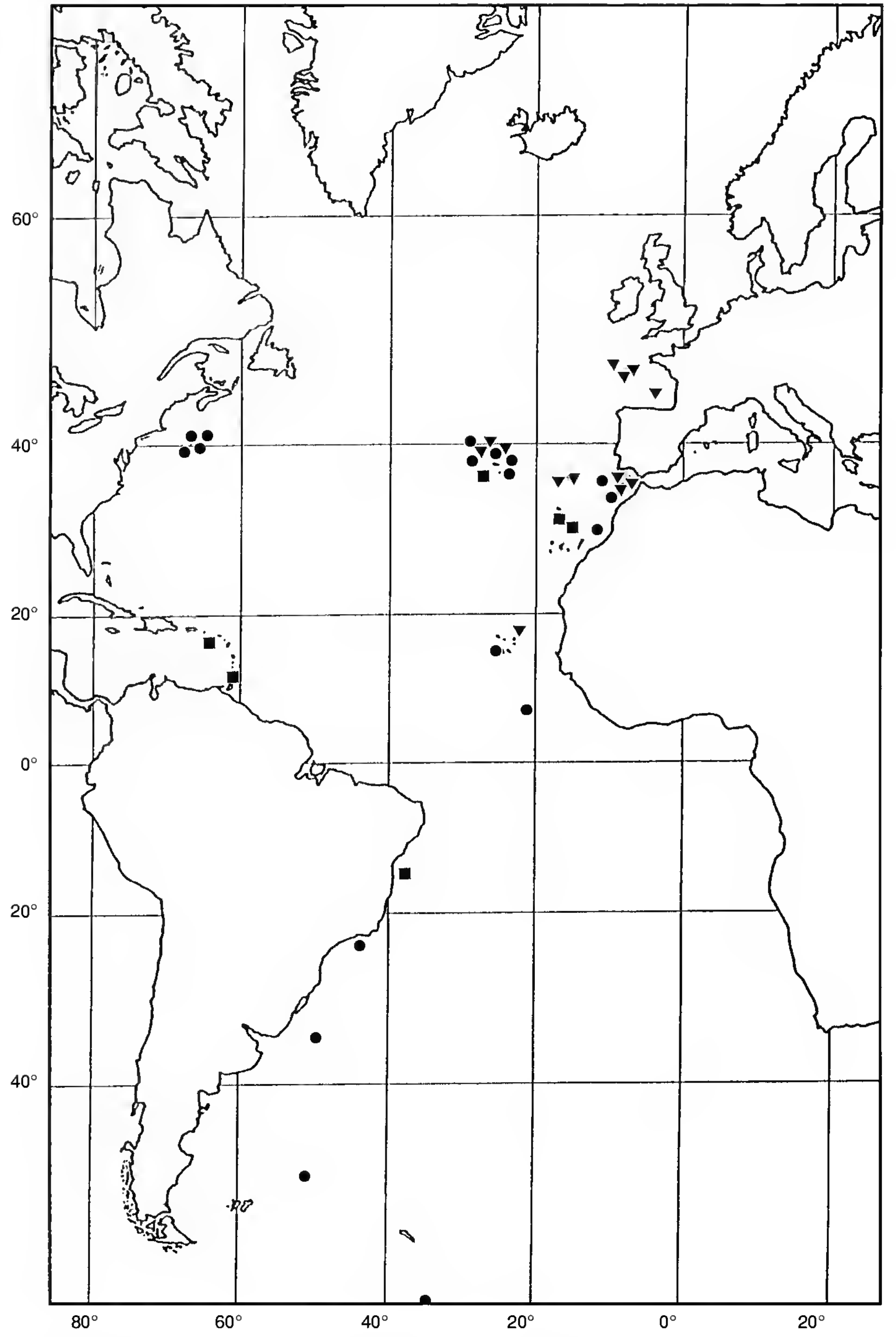

FIG. 2. — Geographic distribution of *Oxynaspis celata* group (■) (in the Western Atlantic, *O. hirtae* Totton and in the Eastern Atlantic, *O. celata* Darwin *s.s.*), *Smilium acutum* (Hoek) (▼) and *Altiverruca gibbosa* (Hoek) (●).

except for strong longitudinal ridges at basi-lateral surface of carino-latus. Scutum conspicuously inflated at basi-occludent area, with strong tergal arm. Caudal appendage uniarticulated.

Description

Female

Capitulum (Fig. 3A-D) covered by thin hairless cuticle; length about twice width, capitulum laterally compressed except for convex enlargement in scuta; carinal margin more convex than occludent margin. Plates thin, smooth, except for strong longitudinal ridges at basi-lateral area of carino-latus and thin sparse growth lines. Plates approximate.

Scutum (Fig. 3A-B) conspicuously inflated in basi-occludent area, pronounced tergal arm approximately one quarter length of tergal margin, shallow groove near the apex of upper-latus; length twice width; all margins convex, except for concavity at upper portion of lateral margin; apex recurved, extending over tergum.

Tergum (Fig. 3A) triangular, apex conspicuously recurved towards carina; basal margin almost straight, occludent margin convex; surface area larger than that of scutum.

Carina (Fig. 3A, C) regularly arched, uniformly broad, tectum flat, basal portion triangular.

Upper-latus (Fig. 3A) quadrangular; scutal margin longer than tergal; scutal margin concave, others almost straight; carino-lateral more than twice width of carinal margin.

Carino-latus (Fig. 3A, C) pentagonal, height more than twice width, umbo near base of carina, projecting slightly beyond carinal outline; basi-lateral area with strong radial ridges. Plates contiguous under carina, interdigitating.

Inframedian latus (Fig. 3A) triangular, not projecting, apex at same height as upper-latus height; height three times greater than width, bordered by low elevated ridge.

Rostro-latus (Fig. 3A, D) higher than wide; basal and scutal margins diverging, latter larger, with slight apico-basal ridge separating plate into two triangular areas.

Rostrum (Fig. 3D) elongated, almost two third length of rostro-latus margin, thin, rounded at top.

Peduncle (Fig. 3A) short, length approximately one fifth that of capitulum, covered by conspicuous laterally elongated scales.

Labrum (Fig. 3E) with single row of thirty-six small teeth. Palp (Fig. 3E) small, distally acuminate, with sparse setae on all surfaces. Mandible (Fig. 3F) with three teeth, lower angle denticulated; distance between first and second tooth two third that between second and third. Maxilla I (Fig. 3G) with two steps, lower one projecting; upper angle with two large and two smaller spines, eight intermediate small spines directed basally along cutting border below. Maxilla II (Fig. 3H) bilobed, with simple setae along margins; maxillary gland not projecting.

Cirrus I (Fig. 3I) with anterior ramus 0.70 length of posterior one; lesser ramus with articles slightly protuberant, clothed with numerous, simple setae. Cirri II-VI with subequal to equal rami; intermediate articles of cirrus VI (Fig. 3J) 2.5 times as long as wide, armed with three pairs of simple setae and scattered small setae on anterior margin, one to two setae on postetior angle. Caudal appendage (Fig. 3K) uniarticulated, short, about one fifth height of coxopodite, with few simple setae at apex. Number of articles of cirri I-VI and caudal appendage is presented in table 1.

Table 1. — Number of articles of cirri I-VI, and caudal appendage of *Arcoscalpellum eponkos* n.sp. Holotype, stn 249. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri; +, broken ramus.

	I	II	III	IV	V	VI	CA
RC	7/9	15/16	18/18	19+/20	23/21	21/20	1
LC	6/10	15/17	18/19	21/21	20/21	22/22	1

Remarks

Arcoscalpellum eponkos n.sp. is a small species, the largest specimen reaching 9 mm in overall height. The characteristic inflated scutum with a tergal arm, longitudinal ridges restricted to the basi-lateral surface of the carino-lateral, and the uniarticulated caudal appendage distinguish this species from all other species of *Arcoscalpellum* s.str. Small specimens do not have the inflated scutum, but the other characteristics are already well developed.

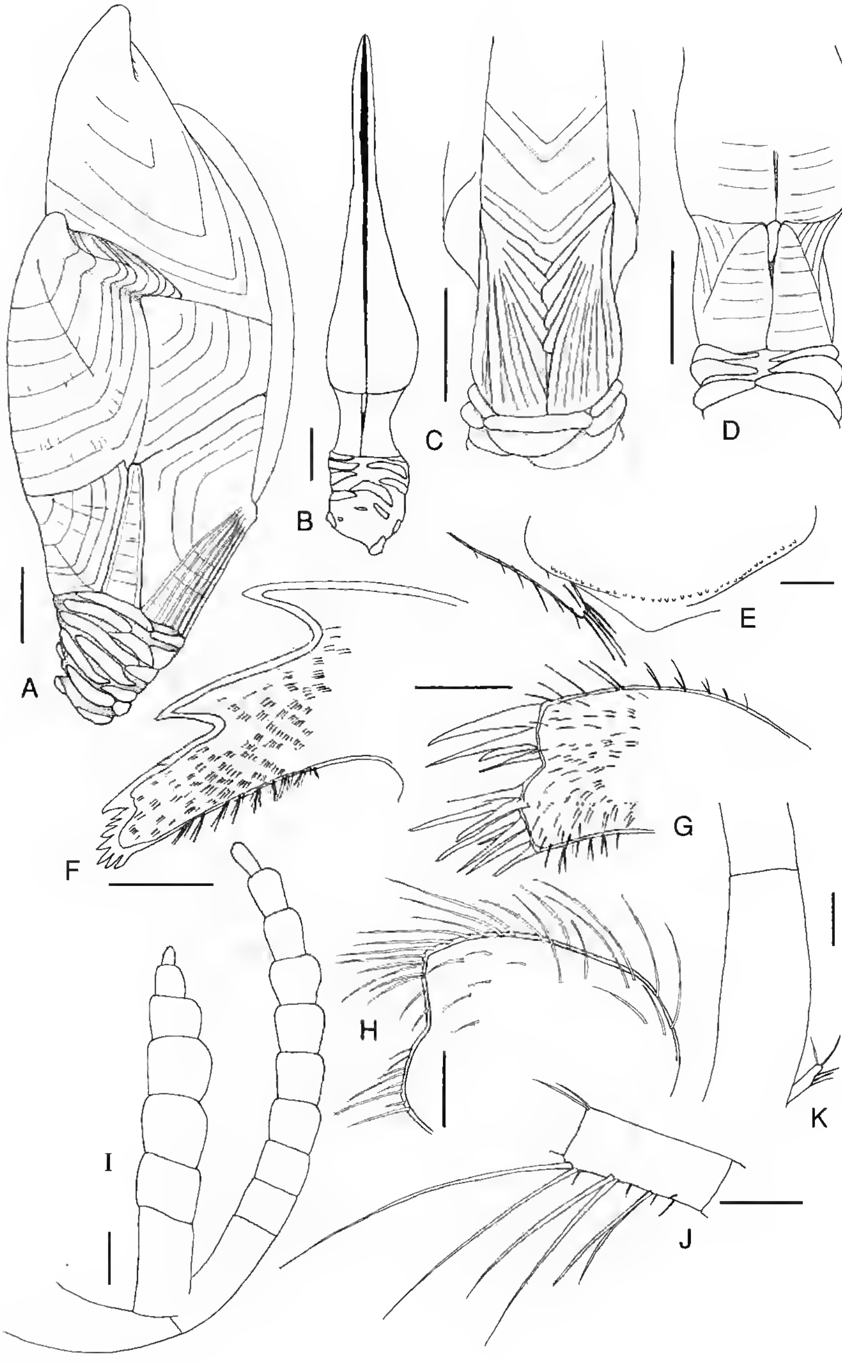

FIG. 3. — *Arcoscalpellum eponkos* n.sp. Holotype: **A**, **B**, lateral and rostral views; **C**, carinal view of the carino-lateral and base of carina; **D**, rostral view of rostro-lateral and rostrum; **E**, labrum and palp; **F**, mandible; **G**, maxilla I; **H**, maxilla II; **I**, outline of cirrus I; **J**, intermediate article of cirrus VI; **K**, caudal appendage. Scale bars: A-D, 1 mm; E-H, 0.1 mm; I-K, 0.2 mm.

The lengthened inframedian latus and the high carino-latus suggests that this species is closely related to *A. radiatum* Rao *et* Newman, *A. gryllum* Zevina, *A. compositum* (Zevina), *A. galapaganum* (Pilsbry) and *A. sculptum* (Hoek). However, none of these species have a tergal arm on the scutum, except for the *A. sculptum*, which has a poorly developed arm. *A. sculptum* also has strongly ridged plates.

Arcoscalpellum eponkos n.sp. is known only from the type-locality, West European Basin, between depths of 4620-4690m (Fig. 4).

Genus *Planoscalpellum* Zevina, 1978

Planoscalpellum limpidus (Zevina, 1976)

Scalpellum limpidus Zevina, 1976: 1152, fig. 2.

Planoscalpellum limpidus – Zevina 1978: 1347; 1981: 187, fig. 131; 1993a: 125.

MATERIAL EXAMINED. — Stn 245, 1 specimen, tl: 1.0 cm, MNHN Ci 2640. — Stn 249, 1 specimen, tl: 1.0 cm, MNHN Ci 2645.

REMARKS

Planoscalpellum limpidus occurs at depths between 5001-5580 m. It was recorded originally from the Azores (Zevina 1976) and later in the Antarctic (Zevina 1993a) and Iberian Basin (Young in press). The present new records extend the northern distribution to 45°50'N and indicate a shallower depth of 4270 m. *P. limpidus* is redescribed and discussed in detail by Young (in press).

Genus *Catherinum* Zevina, 1978

Catherinum recurvitergum (Gruvel, 1900a) (Figs 4-5)

Scalpellum recurvitergum Gruvel, 1900a: 190; 1902a: 67, pl. 2, figs 3h, 21-22; 1902c: 523; 1905: 49, fig. 54. – Weltner 1922: 72. – Nilsson-Cantell 1938: 8; 1955: 218. – Zevina 1976: 1155.

Catherinum recurvitergum – Zevina 1978: 1348; 1981: 245, fig. 181.

MATERIAL EXAMINED. — Stn 202, 1 specimen and 1 scutum, tl: 1.6 cm, MNHN Ci 2616. — Stn 245, 3 specimens, tl: 1.1-1.3 cm, MNHN Ci 2641, MNRJ 8878.

DESCRIPTION

Female

Capitulum (Fig. 5A-C) covered by thin hairless cuticle; length twice its width, width uniform; carinal and occludent margins convex, with same curvature. Plates with thin, sparse growth lines, with longitudinal ridges variously developed, ridges absent in specimens up to 10 mm in length, slightly elevated in specimens of about 13 mm, conspicuous and strong in specimens of 15 mm. Plates approximate, cuticle separating carina from other plates.

Scutum (Fig. 5A) with occludent margin convex, with shallow groove near apex of upper-latus; scutal length twice width; tergal arm small, about one fifth length of tergal margin; tergal margin equal to length of basal margin, with small upper rim; carinal and occludent margins convex, except for concavity at upper portion of former; apex curved, extending slightly over tergum.

Tergum (Fig. 5A) triangular, with longitudinal ridges more developed at occludent area; basal margin almost straight, occludent margin convex, carinal irregular; apex recurved in small specimens, acute or eroded and obtuse in large specimens, slightly recurved toward carina; surface area of tergum equal to that of scutum.

Carina (Fig. 5A, B) regularly arched, broader apicaly, tectum slightly concave, bordered by two low longitudinal ribs, basal portion rounded.

Upper-latus (Fig. 5A) pentagonal. Length of scutal margin greater than tergal one, former concave. All other margins essentially straight, carino-lateral longest, followed in size by tergal and inframedian margins. Apex with small upper rim.

Rostro-latus (Fig. 5A, C) wider than high; basal and scutal margins diverging, scutal margin greater in length than basal margin, apico-basal ridge separating plate into two triangular surfaces.

Carino-latus (Fig. 5A, B) pentagonal, higher than wide, umbo near base of carina, umbo projecting slightly beyond carinal margin. Plates contiguous under carina.

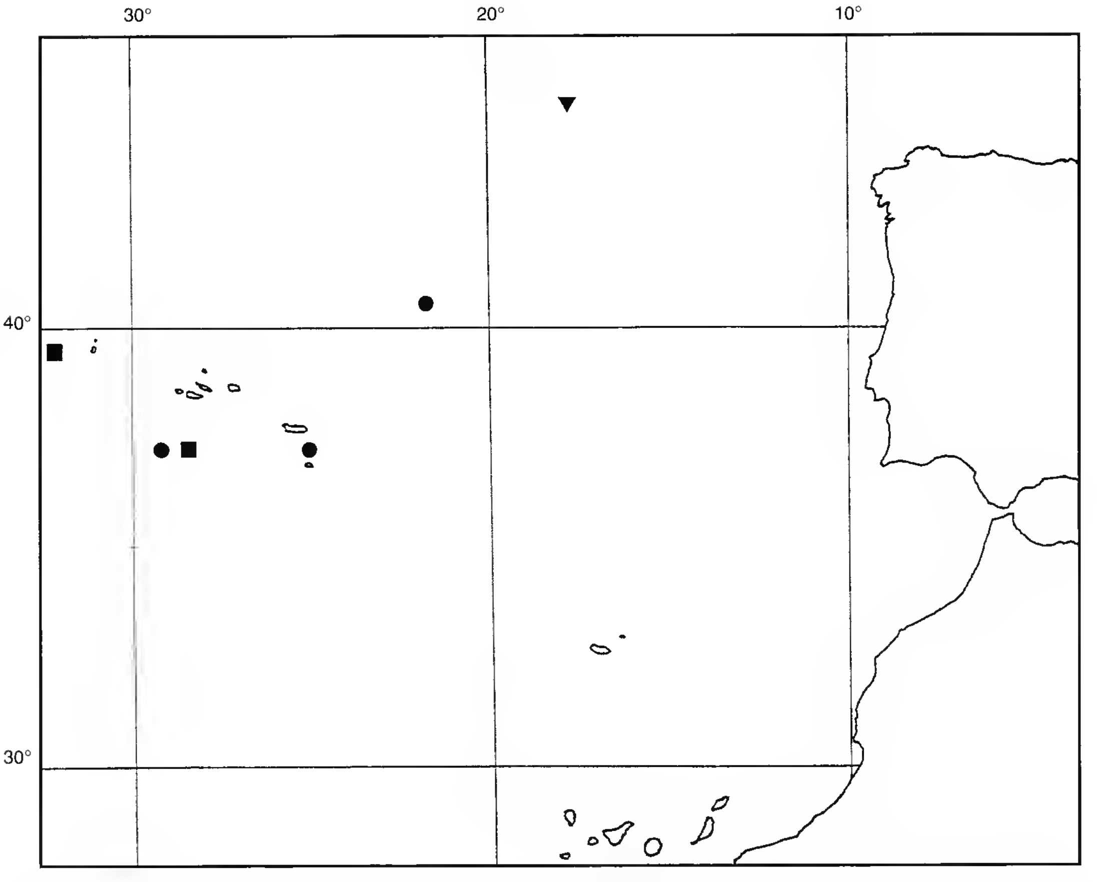

FIG. 4. — Geographic distribution of *Arcoscalpellum eponkos* n.sp. (▼), *Catherinum recurvitergum* (Gruvel) (●) and *Teloscalpellum luteum* (Gruvel) (■).

Inframedian latus (Fig. 5A) vase-shaped, umbo subcentral, apical portion higher and wider than basal portion.

Rostrum (Fig. 5C) elongate; length almost two third that of rostro-latus margin; thin, apically rounded.

Peduncle (Fig. 5A) about one quarter length of capitulum, covered by conspicuous lengthened scales.

Labrum (Fig. 5D) with row of forty-four small teeth. Palp (Fig. 5D) small, paddle-like, with setae on all surfaces.

Mandible (Fig. 5E) with three teeth, lower angle denticulated; distance between first and second teeth less than twice that between second and third one.

Maxilla I (Fig. 5F) with straight border, two large and thick spines at upper angle, nine moderate to small spines directed downwards below.

Maxilla II (Fig. 5G) triangular with finely pinnate setae along margins; maxillary gland projecting prominently.

Cirrus I (Fig. 5H) with shorter ramus 0.75 length of longer; articles little protuberant, clothed with numerous simple setae.

Cirri II-VI with subequal to equal rami, interme-

diare articles of cirrus VI (Fig. 5I, J) twice as long as wide, wirh three or four pairs of simple setae and scartered small serae on anterior margin, pairs of serae more developed along rhe posterior ramus; one to rwo setae on posterior angle. Caudal appendage (Fig. 5K) multiarticulated (7-8), almost twice length of protopod, simple setae at distal point, a few setae on distal margins of articles.
Number of articles of cirri I-VI and caudal appendage is presented in table 2.

TABLE 2. — Number of articles of cirri I-VI, and caudal appendage of *Catherinum recurvitergum* (Gruvel), stn 202. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri; +, broken ramus.

	I	II	III	IV	V	VI	CA
RC	8/10	17/19	14+/15+	22/14+	22/23	23/16+	8
LC	8/10	16/16+	20/22	12+/23	15+/22	23/23	7

REMARKS
The specimen described by Gruvel (1902a) is 11 mm in capitulum lengrh and was illustrated wirhout longitudinal ridges. However, in his description Gruvel stated that the plates had conspicuous radial lines.
The present specimens examined range from 10 to 16 mm in capitulum lengrh, and it is apparent that the development of the longitudinal ridges increases during ontogeny.
The smallest specimen (10 mm) has only a few longitudinal ridges on the plates and the largest (16 mm) has such ridges on all plates except for the carina (Fig. 5A). Otherwise, the apex of the recurved tergum noted by Gruvel (1902a) is not as recurved in the specimens examined.
Catherinum recurvitergum was originally described from rhe Azores from 3175 m (Gruvel 1900a; 1902a) and subsequenrly only recorded from eastern Africa from 1289 m (Weltner 1922). Welrner did not describe or figure his specimens. The specimens sampled are from the type locality, Azores region (Fig. 4), between 2900 and 4270 m, which extends the depth range of this species.

Genus *Amigdoscalpellum* Zevina, 1978

Amigdoscalpellum rigidum (Aurivillius, 1898)

Scalpellum rigidum Aurivillius, 1898: 189. – Gruvel 1905: 86. – Zevina 1976: 1155.

Scalpellum striatum Gruvel, 1900a: 191; 1902a: 77, pl. 2, fig. 3I; 1905: 72, fig. 81; 1920: 23, pl. 2, figs 4-6, 9-11; pl. 7, fig. 11. – Nilsson-Cantell 1955: 219. – Belloc 1959: 3.

Amigdoscalpellum rigidum – Zevina 1978: 1349; 1981: 277, fig. 209.

MATERIAL EXAMINED. — Stn 174, 2 specimens, tl: 2.0 and 2.1 cm, MNHN Ci 2590. — Stn 176, 1 specimen, tl: 2.7 cm, MNHN Ci 2592. — Stn 202, 17 specimens, tl: 1.5-3.7 cm, MNHN Ci 2615, MNRJ 8879. — Stn 206, 1 specimen, tl: 2.5 cm, MNHN Ci 2618. — Stn 227, 1 specimen, tl: 4.0 cm, MNHN Ci 2625. — Stn 245, 1 specimen, tl: 2.6 cm, MNHN Ci 2637. — Stn 251, 2 specimens, tl: 2.1-2.4 cm, MNHN Ci 2647.

REMARKS
Amigdoscalpellum rigidum appears to be a common deep-sea species from the Azores, Cape Verde, and the Iberian Basin, occurring between depths of 1267-4400 m (Aurivillius 1898; Gruvel 1905; Young in press). It was also recorded once from the Newfoundland Basin, from 1267 m (Aurivillius 1898). The new samples extend its distribution to the West European Basin. *A. rigidum* is redescribed and discussed by Young (in press).

Genus *Trianguloscalpellum* Zevina, 1978

Trianguloscalpellum ovale (Hoek, 1883)

Scalpellum regium var. *ovale* Hoek, 1883: 109, pl. 5, figs 5-6.

Trianguloscalpellum regium ovale – Zevina 1981: 311, fig. 235.

MATERIAL EXAMINED. — Stn 249, 2 specimens, tl: 3.3 and 4.9 cm, MNHN Ci 2644.

REMARKS
T. ovale is redescribed and discussed in detail by Young (in press) who presents a key for the related species. This new sample does not add any

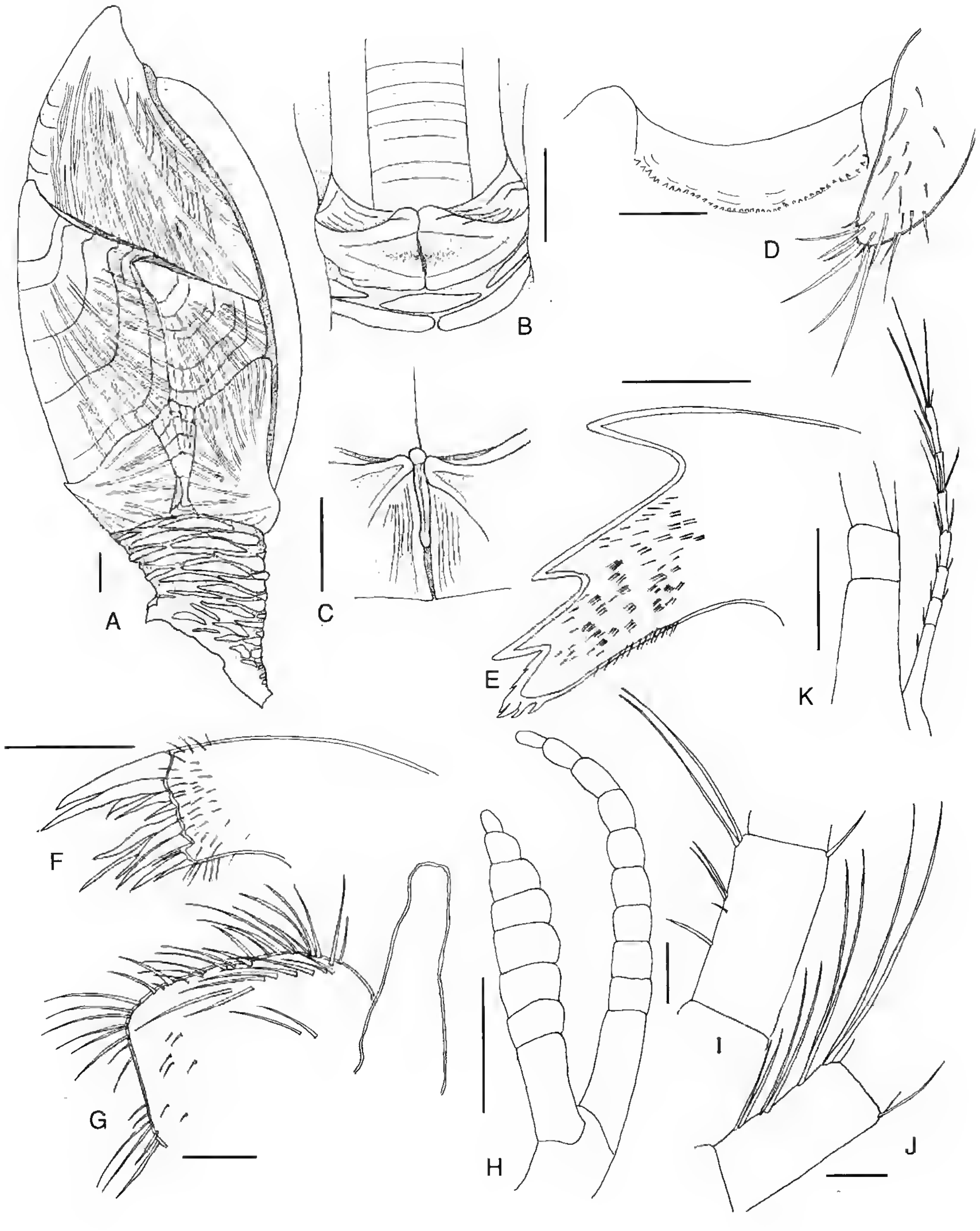

FIG. 5. — *Catherinum recurvitergum* (Gruvel). **A**, lateral view; **B**, carinal view; **C**, rostral view; **D**, labrum and palp; **E**, mandible; **F**, maxilla I; **G**, maxilla II; **H**, outline of cirrus I; **I**, **J**, intermediate article of anterior and posterior rami of cirrus VI; **K**, caudal appendage. Scale bars: A-C, H, K, 1 mm; D-G, I-J, 0.2 mm.

information about the North Atlantic deep sea distribution of this species.

Trianguloscalpellum regium (Thomson, 1873)

Scalpellum regium Thomson, 1873: 347 (part); 1877: 4 (part). – Hoek 1883: 106, pl. 4, figs 3-5, pl. 9, fig. 12, pl. 10, figs 1-2; 1884: 10. – Pilsbry 1907a: 28, pl. 3, fig. 5 (part). – Gruvel 1912a: 2; 1920: 30, pl. 1, fig. 7.

Scalpellum molle Aurivillius, 1898: 191. – Gruvel 1905: 76; 1920:29, pl. 5, figs 10-12. – Nilsson-Cantell 1955: 218. – Zevina 1976: 1155; 1981: 309.

Trianguloscalpellum regium – Zevina 1978: 1350. – Foster & Buckeridge 1995a: 167, figs 2A-D, 3.

Trianguloscalpellum regium regium – Zevina 1981: 309, fig. 234.

MATERIAL EXAMINED. — Stn 129, 3 specimens, tl: 1.3-4.3 cm, MNHN Ci 2566. — Stn 202, 27 specimens, tl: up to 6.4 cm, MNHN Ci 2617, MNRJ 8880. — Stn 245, 9 specimens, tl: 0.4-7.0 cm, MNHN Ci 2638. — Stn 251, 3 specimens, tl: 1.7-5.4 cm, MNHN Ci 2648.

REMARKS

In the smaller specimens the upper flange of the carino-latus does not appear to be as well developed as in the larger specimens described by Young (in press). The roof of the carina changes in shape from flat with a central elevation in smaller specimens to flat with lateral ridges in larger ones.

T. regium is redescribed in detail and discussed by Young (in press). The present samples do not add new information regarding its North Atlantic deep-sea distribution.

Genus *Teloscalpellum* Zevina, 1978

Teloscalpellum luteum (Gruvel, 1900a)
(Figs 4, 6)

Scalpellum luteum Gruvel, 1900a: 192; 1902a: 80, pl. 2, fig. 11; 1905: 84, fig. 93. – Nilsson-Cantell 1955: 218. – Zevina 1976: 1155.

Teloscalpellum luteum – Zevina 1978: 1350; 1981: 363, fig. 280.

MATERIAL EXAMINED. — Stn 129, 1 specimen, tl: 3.0 cm, MNHN Ci 2567.

DESCRIPTION

Female

Capitulum (Fig. 6A, B) covered by thin hairless cuticle; length less than twice its width, breadth uniform; carinal margin more convex than occludent. Plates with strong longitudinal ridges and thin, sparse growth lines. Narrow cuticle separating most of plates.

Scutum (Fig. 6A) convex only at occludent area; height less than twice width; lateral margin longer than basal, sinuous; basal and occludent margins convex, tergal slightly concave; apex curved, extending over tergum.

Tergum (Fig. 6A) triangular, with longitudinal ridges developed only at occludent side; basal margin almost straight, occludent margin convex, carinal with depressed area near the carinal apex; apex obtuse, slightly turned toward carina; surface area greater than scutum.

Carina (Fig. 6A) regularly arched, tectum concave, bordered by high longitudinal rib, basal portion absent in specimen, therefore I could not observe its shape.

Upper-latus (Fig. 6A) pentagonal. Scutal and tergal margins equal in length, former concave. All other margins almost straight, carino-lateral longest, followed in size by tergal and inframedian margins. Umbo subapical. Apex thickened, forming upper ridged rim.

Rostro-latus (Fig. 6A, B) wider than high; basal and scutal margins parallel, latter longer; apices of plates overlapping.

Carino-latus (Fig. 6A) pentagonal, higher than wide, umbo near base of carina, not projecting from carinal outline. Plates contiguous under carina.

Inframedian latus (Fig. 6A) triangular, length twice its width, apex slightly turned anteriorly, with rim along carinal side.

Rostrum (Fig. 6B) absent.

Peduncle (Fig. 6A) about one half length of capitulum, covered by conspicuous lengthened scales and thick cuticle.

Labrum (Fig. 6C, D) with row of small teeth. Palp (Fig. 6C) small, acuminate, with few setae on upper margin and terminally. Mandible (Fig. 6E, F) with three teeth, with or without large tooth between first and second teeth, denticulated lower angle with few teeth; distance bet-

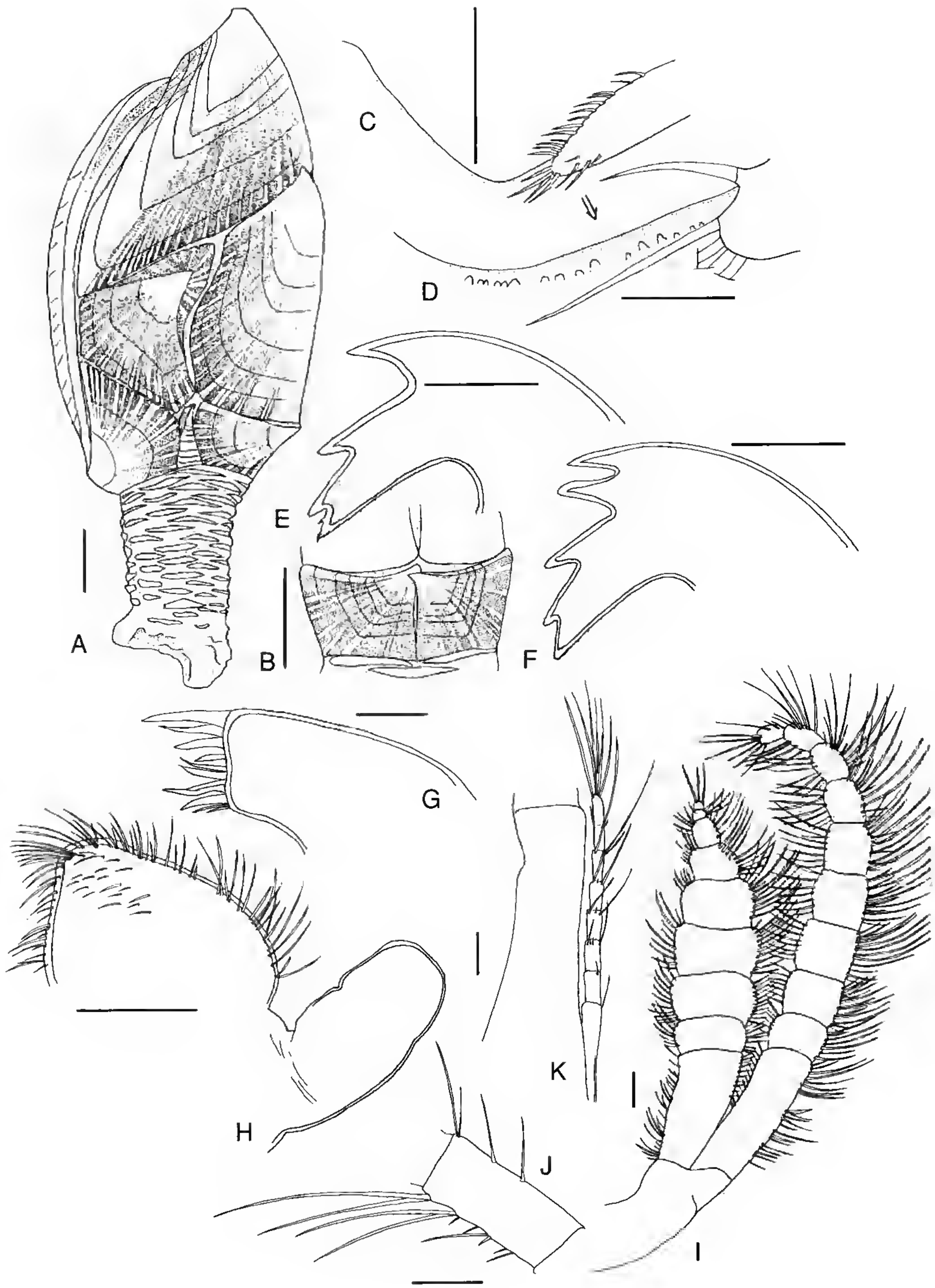

FIG. 6. — *Teloscalpellum luteum* (Gruvel). **A**, lateral view; **B**, carinal view; **C**, **D**, labrum and palp; **E**, **F**, mandibles; **G**, maxilla I; **H**, maxilla II; **I**, cirrus I; **J**, intermediate article of cirrus VI; **K**, caudal appendage. Scale bars: A-C, H, K, 1 mm; D-G, I, J, 0.2 mm.

ween first and second teeth twice distance between second and third one; setulation absent, only small scales on lower margin. Maxilla I (Fig. 6G) with straight anterior border or upper portion projecting slightly, with two large and thick spines at upper angle, nine to twelve moderate to small spines directed basally below. Maxilla II (Fig. 6H) nearly quadrangular with finely pinnate setae along margins; maxillary gland projecting prominently.

Cirrus I (Fig. 6I) with anterior ramus 0.65 of length of posterior one; articles of shorter ramus protuberant, both rami clothed with numerous simple setae. Cirri II-VI with equal rami, intermediate articles (Fig. 6J) about twice as long as wide, with three or four pairs of simple setae and scattered small setae on anterior margin, one to two setae on posterior angle, one or two simple setae on posterior margin. Caudal appendage (Fig. 6K) multiarticulated (8), slightly longer than protopod, with simple setae at distal point, few setae on distal margins of articles. Number of articles of cirri I-VI and caudal appendage is presented in table 3.

TABLE 3. — Number of articles of cirri I-VI, and caudal appendage of *Teloscalpellum luteum* (Gruvel), stn 129. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri; +, broken ramus.

	I	II	III	IV	V	VI	CA
RC	9/10	12+/20	22/22	28/30	30/31	33/28	8
LC	9/10	17/19	24/25	28/31	28/33	34/29	8

REMARKS

Teloscalpellum luteum (Gruvel) is known only by one specimen, capitular length 20 mm, from the type locality – Azores – at 3175 m (Gruvel 1900a, 1902a). Gruvel did not illustrate the longitudinal ridges of the plates, but did describe this character. These longitudinal ridges are conspicuous in the specimen studied.

The general shape of the capitular plates, especially the coronate upper-latus, agree with the description of Gruvel (1902a). The basal portion of the carina, where it meets the carinal latera, is absent in the specimen and, therefore, I could not observe the relationship of the carinal-latera.

T. luteum was collected in the same area as the type specimens (Azores), and from a similar depth (3056-3000 m; Fig. 4).

Order SESSILIA Lamarck, 1818
Suborder VERRUCOMORPHA Pilsbry, 1916
Family VERRUCIDAE Darwin, 1854
Genus *Altiverruca* Pilsbry, 1916

Altiverruca obliqua (Hoek, 1883)
(Figs 7-9)

Verruca obliqua Hoek, 1883: 143, pl. 12, figs 15-17. – Weltner 1897: 274. – Gruvel 1905: 173, fig. 191. – Hoek 1907b: 9.

Verruca obliqua, section D - *Altiverruca* – Pilsbry 1916: 40.

Altiverruca obliqua – Buckeridge 1994: 93.

Altiverruca vertica – Foster & Buckeridge 1995a: 180, fig. 14.

MATERIAL EXAMINED. — Stn 180, 1 specimen without eggs or larvae, rc: 0.6 cm, MNHN Ci 2595.

DESCRIPTION

Shell (Fig. 7A-C) white, smooth, growth lines widely spaced, not projecting. Opercular valves angularly placed, approximately 45° to basis (Fig. 7D). Base calcareous. Rostrum and carina (Fig. 7C) convex with apices projecting, latter higher; suture sinuose. Fixed-tergum (Fig. 7B) triangular, wider in middle, higher than fixed-scutum, with two well developed alate projections, little covered by radii-like projections of adjoining plates. Fixed-scutum (Fig. 7B) triangular, with well developed alate projection on to rostrum, covered by small radius-like projection of this plate; internally smooth.

Scutum smaller than tergum, basal margin one half length of tergum margin. Scutum (Fig. 7E) with two articular ridges, and flat upper triangular projection at occludent margin; axial ridge barely developed and curved; rostral area smooth. Internally, with deep depression for adductor muscle; occludent margin with small tooth at lower portion formed by second articular ridge. Tergum (Fig. 7F) quadrangular, with three articular ridges; axial ridge narrowest, intermediate ridge broad, separated from upper ridge by conspicuous groove. Internally, surface slightly concave; occludent margin nearly straight, except for upper convex portion.

Labrum (Fig. 8A) with one series of forty teeth. Palp (Fig. 8A) long, few simple setae at upper margin and distal area. Mandible (Fig. 8B) with three teeth, distance between the first and second one twice that between the second and third one; lower angle denticulated. Maxilla I (Fig. 8C, D) straight or with the lower part projecting, with 10 to 13 unpaired spines. Maxilla II triangular, anterior margin concave medially, posterior margin convex; covered by long simple setae.

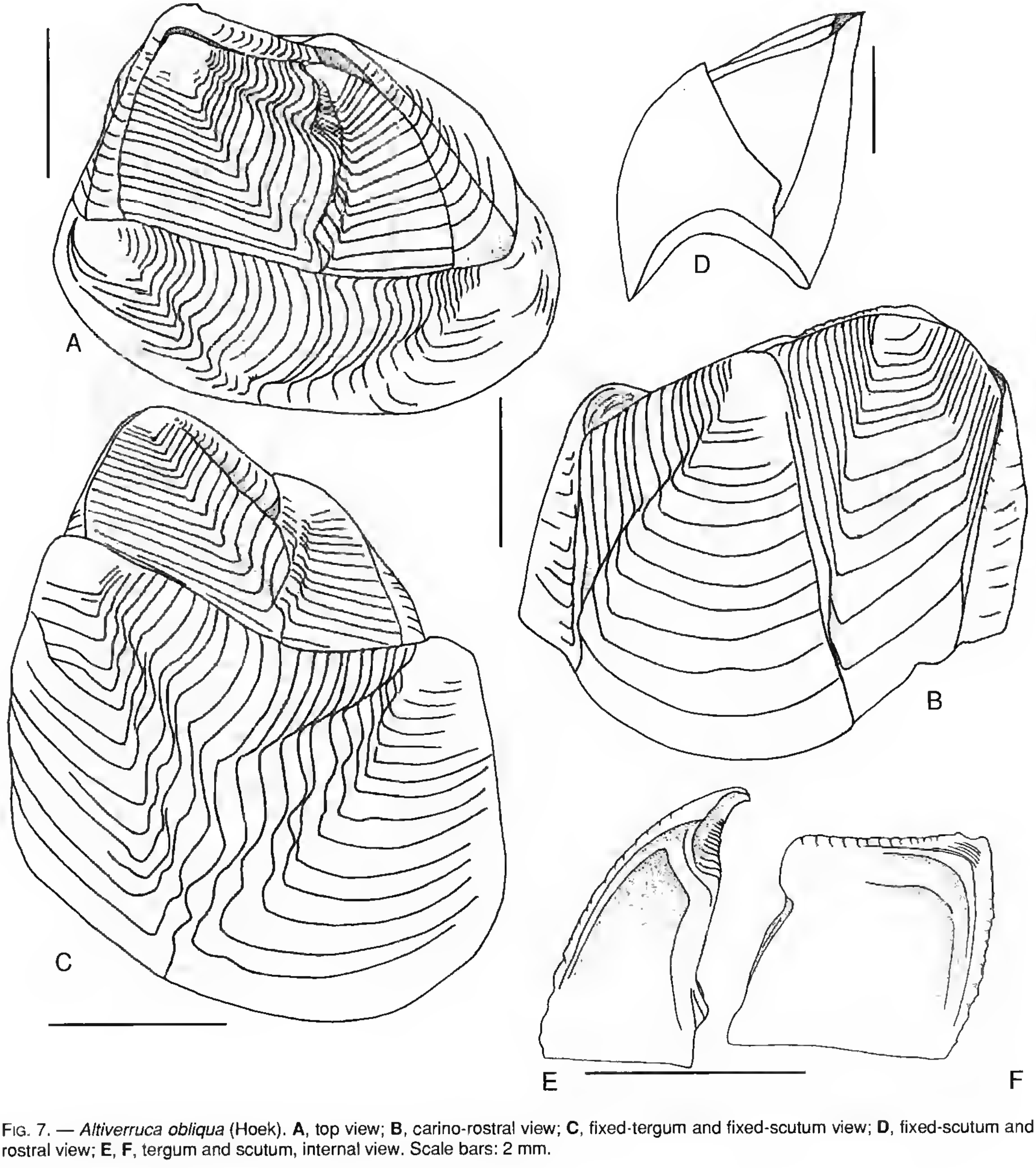

FIG. 7. — *Altiverruca obliqua* (Hoek). **A**, top view; **B**, carino-rostral view; **C**, fixed-tergum and fixed-scutum view; **D**, fixed-scutum and rostral view; **E**, **F**, tergum and scutum, internal view. Scale bars: 2 mm.

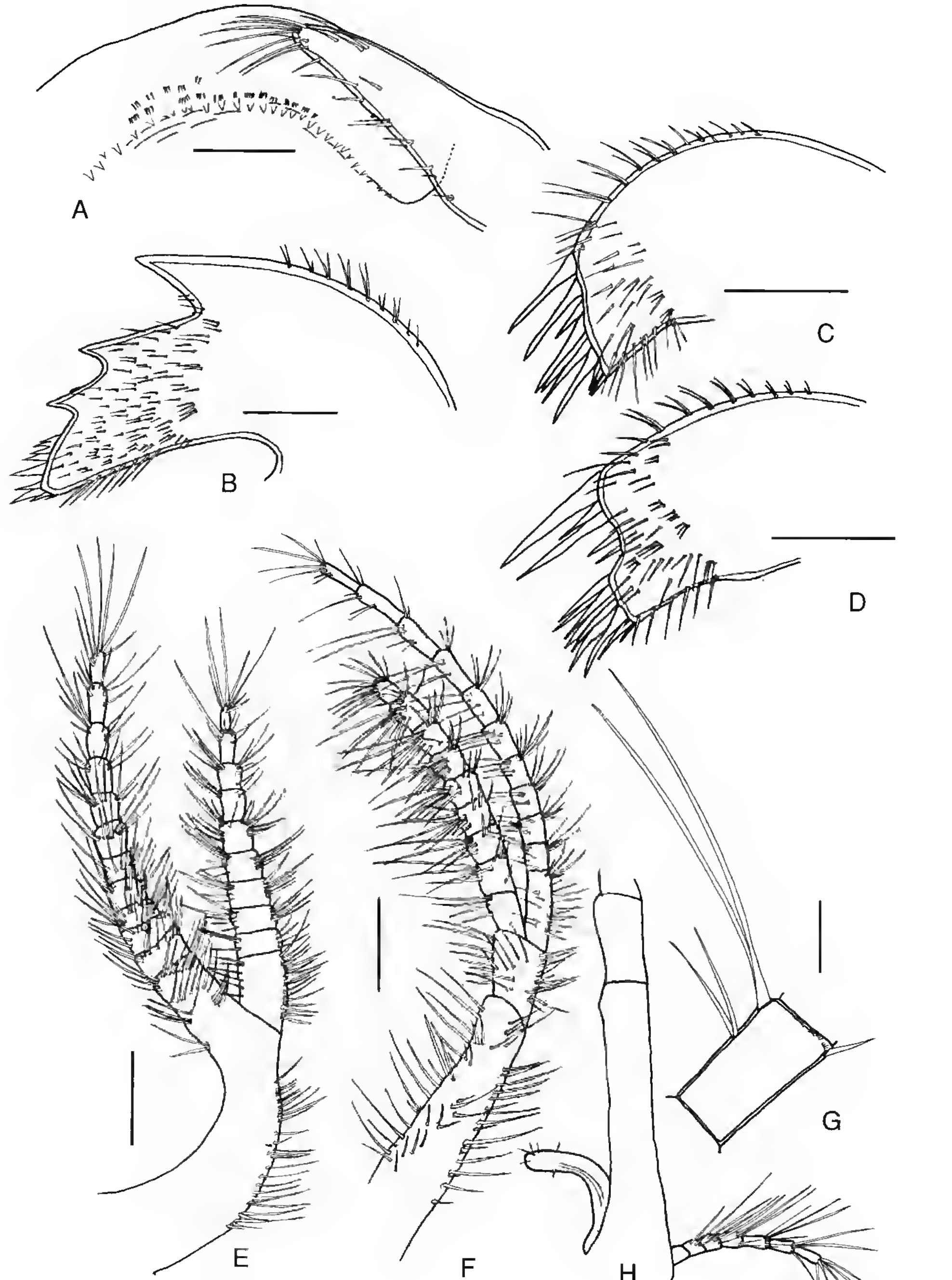

FIG. 8. — *Altiverruca obliqua* (Hoek). **A**, labrum and palp; **B**, mandible; **C**, **D**, maxillae I; **E**, cirrus I; **F**, cirrus II; **G**, intermediate article of cirrus VI; **H**, caudal appendage and penis. Scale bars: A-D, G, 0.1 mm; E, F, H, 0.3 mm.

Cirrus I (Fig. 8E) with anterior ramus a little longer than posterior, articles of both rami covered by numerous long, simple setae. Cirrus II (Fig. 8F) with unequal rami, anterior two third length of posterior, with protuberant articles; anterior ramus covered by numerous long, simple setae, posrerior with setation similar to articles of cirri III-VI. Cirrus III with subequal rami, cirri IV-VI with equal rami. Length of intermediate article of cirrus VI (Fig. 8G) twice width, with two pairs of simple setae on anterior margin, one or two short, stout setae on posterior angle, multifid scales at distal margins. Caudal appendage (Fig. 8H) multiarticulated, with six to seven articles, one half length of coxopodite. Penis (Fig. 8H) short with few setulae. Number of articles of cirri I-VI and caudal appendage is presented in table 4.

TABLE 4. — Number of articles of cirri I-VI, and caudal appendage of *Altiverruca obliqua* (Hoek), stn 180. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirril.

	I	II	III	IV	V	VI	CA
RC	12/10	9/11	15/16	16/16	17/18	20/20	7
LC	10/10	8/9	13/13	17/17	17/19	19/20	6

REMARKS

Hoek (1883) described *A. obliqua* based on four small specimens collected off southwestern Spain at a depth of 2782 meters. This species has not been collected since.

This species was recently considered a synonym of *A. quadrangularis* (Hoek, 1883) by Foster & Buckeridge (1995b), but this conclusion seems to be premature. *Altiverruca quadrangularis*, first reported from the Southern Atlantic, is now

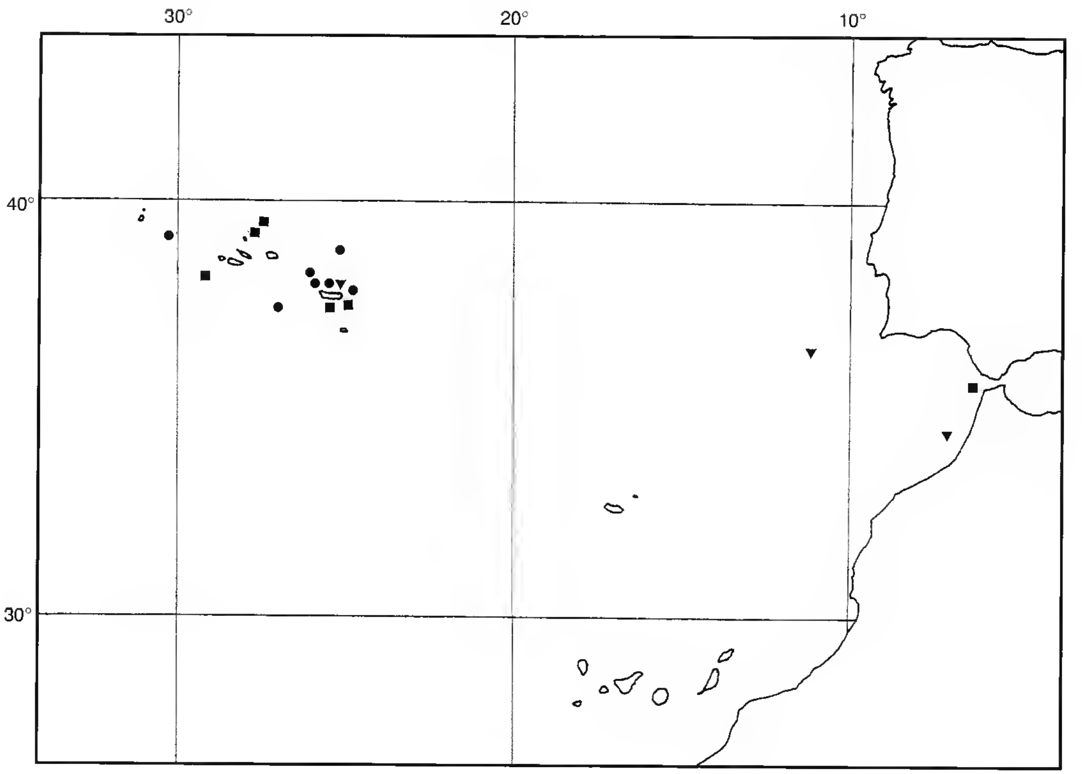

FIG. 9. — Geographic distribution of *Altiverruca obliqua* (Hoek) (▼), *Metaverruca aequalis* (Aurivillius) (●) and *Metaverruca trisulcata* (Gruvel) (■).

known from all the oceans (Lahille 1910; Gruvel 1920; Zevina 1988; Rosell 1989; Foster & Buckeridge 1995b).

Considering the original descriptions of both species, several characters distinguish them. Both have a tergum with three articular ridges, but *A. obliqua* has the intermediate ridge (second of Hoek) broad, leaving a thin groove between this ridge and the first one. Alternatively, *A. quadrangularis* has the second ridge narrow, with a very broad space separating it from the first ridge. The scutum of *A. obliqua* is proportionately narrower, its base one half the width of the base of tergum. In *A. quadrangularis* the movable scutum is significantly larger, with its width more than two third of the width of the base of the tergum. The axial ridge (third ridge of Hoek) is prominent in *A. quadrangularis*, but it is barely discernible in *A. obliqua*. Therefore, this synonymy cannot be accepted.

The single specimen I examined is older and hence more developed than the specimens Hoek studied. All of the differences I observed appear to be related to different stages of growth: the carina projects freely as does the scutum; the articulation between carina and rostrum has more than one single tooth.

Foster & Buckeridge (1995a) described *Altiverruca vertica* from the Straits of Gibraltar. Its opercular valves are identical to those examined here, differing only in the carina-rostrum suture. This suture is straighter than the one observed, but this may be due to ontogenetic differences. Furthermore, the relative length of the rami of cirri I-III and the caudal appendages are similar to the ones I observed. Hoek (1883) did not describe the appendages of *A. obliqua*.

The distribution of this species is restricted to the Northeastern Atlantic, between 34° to 37°N and 7° to 25°W (Fig. 9).

Altiverruca gibbosa (Hoek, 1883) (Figs 2, 10)

Verruca gibbosa Hoek, 1883: 134, pl. 6, figs 17, 18, pl. 11, figs 5-9, pl. 12, figs 1-5.

Verruca (*Altiverruca*) *gibbosa* – Newman & Ross 1971: 135, pl. 14, textfig. 68 (synonymy).

Altiverruca gibbosa – Zevina 1987a: 1813.

MATERIAL EXAMINED. — Stn 6, 1 empty shell, rc: 0.3 cm, MNHN Ci 2550. — Stn 159, 1 specimen, rc: 0.4 cm, MNHN Ci 2584. — Stn 180, 2 specimens, rc: 0.4-0.6 cm, MNHN Ci 2596, MNRJ 8903. — Stn 196, 1 specimen, rc: 0.5 cm, MNHN Ci 2603. — Stn 199, 1 specimen, rc: 0.5 cm, MNHN Ci 2610.

REMARKS

The specimens studied (Fig. 10A, B) do not present any differences from the specimens described by Hoek (1883).

A. gibbosa has a world-wide distribution and was previously recorded in the Eastern Atlantic from off the Straits of Gibraltar, Canaries and Cape Verde Islands and Sierra Leone Rise (Fig. 2) (Gruvel 1902a, as *V. sulcata*; Nilsson-Cantell 1927, as *V. rathbuniana*; Nilsson-Cantell 1928; Foster & Buckeridge 1995a).

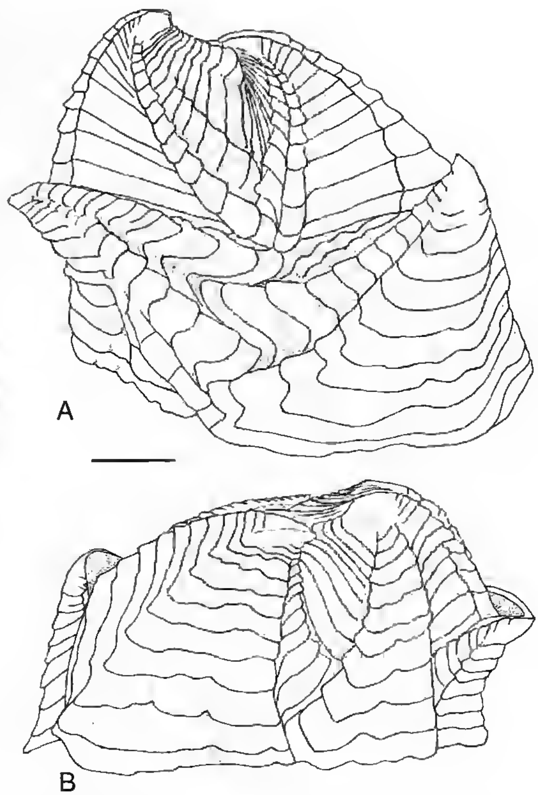

FIG. 10. — *Altiverruca gibbosa* (Hoek). A, top view; B, fixed-tergum and fixed-scutum view. Scale bar: 1 mm.

Genus *Metaverruca* Pilsbry, 1916

Metaverruca aequalis (Aurivillius, 1898)
(Figs 9, 11-12)

Verruca aequalis Aurivillius, 1898: 196. – Gruvel 1905, 176; 1920: 42, pl. 5, figs 28-29, pl. 6, figs 6-7. – Hoek 1907b: 9. – Belloc 1959: 4.

MATERIAL EXAMINED. — Stn 171, 1 specimen, rc: 0.5 cm, MNHN Ci 2589. — Stn 174, 1 specimen, rc: 0.4 cm, MNHN Ci 2591. — Stn 180, 4 specimens, rc: 0.5-0.6 cm, MNHN Ci 2598, MNRJ 8904. — Stn 196, 3 specimens, rc: 0.5-0.6 cm, MNHN Ci 2605, MNRJ 8905.

DESCRIPTION

Shell (Fig. 11A, B) white, nearly smooth, grooves only along the suture between rostrum and carina; growth lines widely spaced, projecting; basal margins thickened, inflected (Fig. 11C). Cuticle hairy, persistent on shell and opercular valves. Opercular valves parallel to base of wall.

Rostrum (Fig. 11A) larger than carina, with small radius-like projection toward fixed scutum; articulation with carina with large upper ridge and undulating downwards; shallow grooves beside ridge; apex projecting. Carina (Fig. 11A) with small radius-like projection toward fixed-tergum, one upper ridge undulating downwards at rostral suture, one groove under the ridge; apex reflexed. Fixed-tergum (Fig. 11A, B) smaller than fixed-rostrum, approximately one half its width, both sides with well developed alar-like projections; apex projecting backwards. Fixed-scutum (Fig. 11A, B) with wide alar-like projection directed toward rostrum, small radii-like projection to fixed-tergum; internally, with well developed myophore, directed downwards.

Tergum (Fig. 11A, D) quadrangular, with three

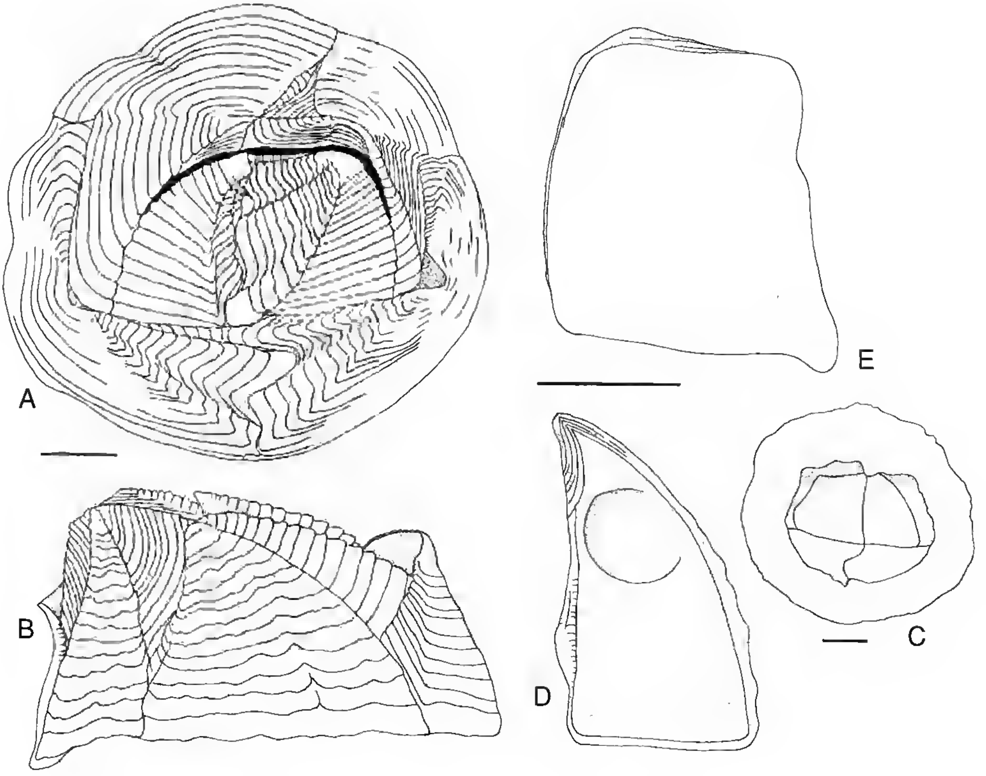

FIG. 11. — *Metaverruca aequalis* (Aurivillius). **A**, top view; **B**, fixed-tergum and fixed-scutum view; **C**, basal view; **D**, **E**, tergum and scutum, internal view. Scale bars: 2 mm.

articular ridges; axial ridge narrowest, well marked, intermediate and upper ridges broad. Internally, smooth; occludent margin slightly undulated. Scutum (Fig. 11A, E) smaller than tergum; with three articular ridges; axial ridge barely developed, near occludent margin, intermediate ridge twice width of upper ridge, latter poorly developed; rostral area smooth. Internally, with conspicuous rounded scar for adductor muscle, especially near articular margin, forming a vertical crest between them; occludent margin nearly straight, except for a protuberance at lower part.

Labrum (Fig. 12A) with series of small teeth (47). Palp (Fig. 12B) short, acuminate, with few simple setae on upper margin and distal region. Mandible (Fig. 12C) with three teeth, distance between first and second more than twice distance between the second and third one; lower angle denticulated. Maxilla I (Fig. 12D) with lower part projecting, shallow concavity apically; two large spines at upper angle, four small spines in concavity, seven to nine unpaired spines on lower portion. Maxilla II (Fig. 12E) rectangular, anterior margin with shallow concavity medially; covered by long simple setae.

Cirrus I (Fig. 12F) with subequal rami, covered with several long simple setae. Cirrus II (Fig. 12G) with anterior ramus two third length of posterior, articles more protuberant; both rami covered by numerous long, simple setae, anterior ramus also with finely bipectinate setae at distal article (Fig. 12H). Rami of cirrus III unequal, anterior shorter than posterior. Rami of cirri IV-VI equal in length. Intermediate articles of cirrus VI (Fig. 12I) with width three quarters of the length, two pairs of setae, longer setae finely pinnate, on anterior margin; one or two short, stout setae on posterior angle, multifid scales at distal margin. Caudal appendage (Fig. 12J) with six articles, one half length of coxopodite; long simple setae on distal margins of articles. Penis about same length as coxopodite, clothed with thin setulae. Number of articles of cirri I-III and caudal appendage is presented in table 5.

TABLE 5. — Number of articles of cirri I-III, and caudal appendage of *Metaverruca aequalis* (Aurivillius), stn 195. I-III, cirri I to III; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri.

	I	II	III	CA
RC	10/9	8/10	14/16	6
LC	10/9	8/10	14/16	6

REMARKS

Metaverruca aequalis was described briefly by Aurivillius (1898), but was subsequently described in detail and figured by Gruvel (1920), based on the same material. The specimens examined herein agree with the description by Gruvel (1920). I can only add that the hairy cuticle is conspicuous in smaller specimens.

Gruvel (1920) did not dissect any specimen. Therefore, he did not describe the internal morphology of the shell, the opercular valves, and the appendages. The presence of a developed myophore on the fixed-scutum, the box-like shape of the wall with its inflected basal margins and the large opercular valves, indicate that the species is a *Metaverruca*.

Metaverruca aequalis is known only from the Azores, between depth of 1022 and 1385 m. All the samples studied are from the same area, but its depth distribution is increased to 3215 m (Fig. 9).

Metaverruca recta (Aurivillius, 1898)

Verruca recta Aurivillius, 1898: 195. – Gruvel 1905: 181; 1912a: 6; 1920: 46, pl. 2, fig. 18, pl. 3, figs 3-4. – Hoek 1907b: 9. – Southward & Southward 1958: 637, fig. 4. – Anderson 1980: 349, figs 1-4.

Verruca sculpta Aurivillius, 1898: 197. – Gruvel, 1905: 175; 1920: 41, pl. 5, figs 26-27. – Hoek 1907b: 9. – Nilsson-Cantell 1929: 461, fig. 1; 1938: 12. – Krüger 1940: 463. – Zevina 1969: 68. – Weisbord 1979: 97. – Foster 1981: 352. – Ren 1984: 166, fig. 1, pl. 1, figs 1-6; 1989: 420, fig. 10.

Verruca linearis Gruvel, 1900b: 243; 1902a: 107, pl. 5, figs 11-12; 1905: 182, fig. 201. – Hoek 1907b: 9.

Verruca capsula Hoek, 1907a: 130, pl. 12, figs 1-3, pl. 13, figs 1-4. – Stubbings 1936: 38. – Weisbord 1979: 98.

Verruca magna Gruvel, 1901: 261; 1902a: 109, pl. 5, figs 1-2; 1905: 184, figs 204-205. – Hoek 1907b: 9. – Gruvel 1920: 50. – Weisbord 1979: 98.

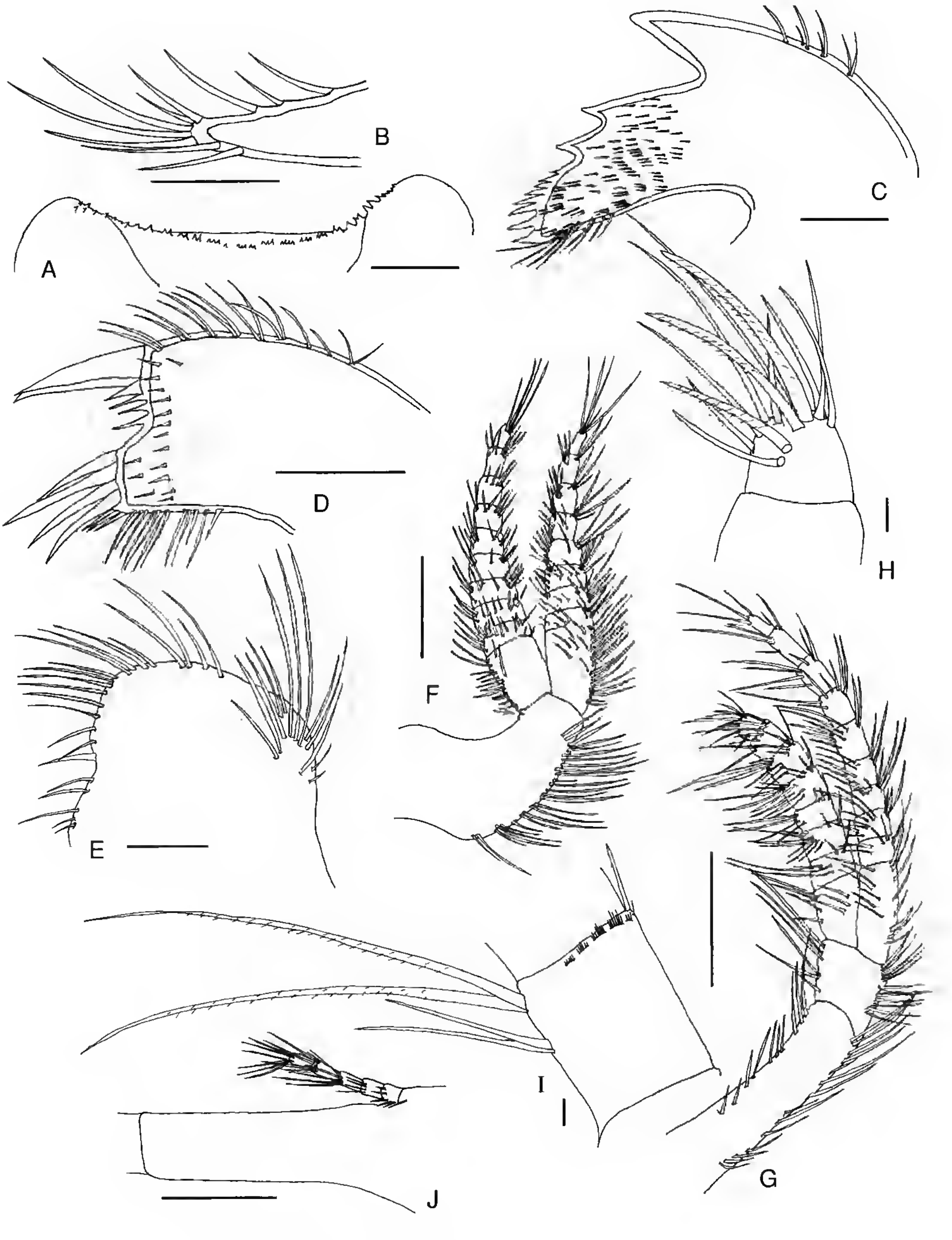

FIG. 12. — *Metaverruca aequalis* (Aurivillius). **A**, labrum; **B**, palp; **C**, mandible; **D**, maxillae I; **E**, maxillae II; **F**, cirrus I; **G**, cirrus II; **H**, distal article of anterior ramus of cirrus II; **I**, intermediate article of cirrus VI; **J**, caudal appendage. Scale bars: A-E, H, I, 0.1mm; F, G, J, 1 mm.

Verruca halotheca Pilsbry, 1907b: 188, pl. 4, figs 9-10; 1916: 46, pl. 8, figs 1-1a. – Kolosváry 1943: 73. – Zullo 1968: 219. – Gordon 1970: 118. – Buckeridge 1975: 129, figs 5. 4-6. – Foster 1978: 69, pl. 8F, fig. 42. – Weisbord 1979: 98.

Verruca coraliophila Pilsbry, 1916: 21, pl. 1, figs 1-5. – Zullo 1968: 219. – Bayer *et al.* 1970: A43. – Weisbord 1979: 96.

Verruca (*Metaverruca*) *sculpta* – Broch 1931: 41. – Buckeridge 1983: 59, fig. 45.

Verruca (*Metaverruca*) *cookei* – Rosell 1981: 299, pl. 11, figs r, s, u, v; 1991: 33 (not *Verruca cookei* Pilsbry, 1927).

Metaverruca recta – Buckeridge 1994: 116, fig. 13a-f. – Foster & Buckeridge 1995a: 182, fig. 15; 1995b: 368, fig. 9C-E.

MATERIAL EXAMINED. — Stn 4, 8 specimens and 10 empty shells, rc: 0.6-0.9 cm, MNHN Ci 2549. — Stn 16, 1 specimen, rc: 0.6 cm, MNHN Ci 2555. — Stn 62, 3 empty shells, rc: 0.6-0.7 cm, MNHN Ci 2560. — Stn 66, 1 empty shell, rc: 0.8 cm, MNHN Ci 2561. — Stn 135, 1 specimen, rc: 0.7 cm, MNHN Ci 2570. — Stn 139, 1 empty shell, rc: 0.7, MNHN Ci 2571. — Stn 148, 101 specimens and 12 empty shells, rc: 0.5-0.9 cm, MNHN Ci 2576, MNRJ 8906. — Stn 150, 2 specimens and 1 empty shell, rc: 0.6-0.6 cm, MNHN Ci 2578. — Stn 151, 27 specimens and 1 empty shell, rc: 0.5-0.9 cm, MNHN Ci 2580, MNRJ 8907. — Stn 159, 1 specimen, rc: 0.3 cm, MNHN Ci 2585. — Stn 161, 1 specimen, rc: 0.7 cm, MNHN Ci 2664. — Stn 168, 9 specimens and 4 empty shells, rc: 0.5-0.8 cm, MNHN Ci 2588. — Stn 180, 19 specimens and 5 empty shells, rc: 0.6-1.2 cm, MNHN Ci 2597, MNRJ 8908. — Stn 181, 4 specimens and 1 empty shell, rc: 0.6-0.7 cm, MNHN Ci 2600. — Stn 196, 10 specimens and 18 empty shells, rc: 0.6-1.0 cm, MNHN Ci 2604. — Stn 197, rc: 0.5-0.8 cm, MNHN Ci 2607. — Stn 199, 1 specimen, rc: 0.4 cm, MNHN Ci 2611. — Stn 218, 2 specimens and 1 empty shell, rc: 0.6-0.7 cm, MNHN Ci 2622. — Stn 231, 1 empty shell, rc: 0.7 cm, MNHN Ci 2626. — Stn 237, 1 specimen and 5 empty shells, rc: 0.6-0.7 cm, MNHN Ci 2629. — Stn 239, 10 specimens and 4 empty shells, rc: 0.6-0.9, MNHN Ci 2632. — Stn 240, 78 specimens and 10 empty shells, rc: 0.5-0.8 cm, MNHN Ci 2634, MNRJ 8909. — Stn 255, 2 specimens, rc: 0.9-1.1 cm, MNHN Ci 2650.

REMARKS

Metaverruca recta is the most common deep-sea verrucid found in the Azores region. It was collected from over several distinct substrates, such as pumice stones, shells, corals, and urchin spines. It has a world-wide distribution, and was recorded many times from the Northeastern Atlantic, including the Azores from 240 to 2100 m (Aurivillius 1898; Gruvel 1912a, 1920; Southward & Southward 1958; Foster & Buckeridge 1995a; Young in press).
The specimens studied do not present significant differences from those observed by other authors. The white shell is totally smooth, and has a straight hinge between the opercular valves and the rostrum and carina, characters which are diagnostic for this species.

Metaverruca trisulcata (Gruvel, 1900b)
(Figs 9, 13-14)

Verruca trisulcata Gruvel, 1900b: 243; 1902a: 96, pl. 5, figs 9-10; 1905: 184, fig. 203; 1912b: 348; 1920: 49. – Hoek 1907b: 9.

Verruca striata Gruvel, 1900b: 244; 1902a: 98, pl. 5, figs 5-6, textfig. 17-18; 1905: 183, fig. 186, 202. – Hoek 1907b: 9. – Stubbings 1967: 251.

not *Metaverruca trisulcata* – Foster & Buckeridge 1995a: 177, figs 10-12; 1995b: 363, fig. 9a-b.

MATERIAL EXAMINED. — Stn 197, 2 specimens, rc: 0.5 cm, MNHN Ci 2608, MNRJ 8910. — Stn 240, 1 specimen, rc: 0.4 cm, MNHN Ci 2635.

DESCRIPTION

Shell (Fig. 13A, B) white, cuticle not persistent, ornamented with several strong longitudinal ridges and spaced growth lines, ridges on opercular plates and at suture of rostrum and carina conspicuous. Opercular plates parallel to basis. Basal margin of wall not inflected.
Fixed-tergum (Fig. 13A, B) smaller than fixed-scutum, apex thickened, recurved outward; with two developed alate projections and triangular central area, with four to five longitudinal ridges.
Fixed-scutum (Fig. 13A, B) having central triangular area with four to five strong longitudinal ridges, well developed alate projection at rostral suture area, radius-like projection at fixed-tergum side; apex thickened, recurved outward. Internally, with well developed myophore.
Carina (Fig. 13A) same size as rostrum, with about ten strong longitudinal ridges and well

developed ridge area at suture with rostrum, with four interlocking teeth, the largest being usually the second; smooth suture with fixed-tergum.
Rostrum (Fig. 13A) with many strong longitudinal ridges, well developed ridged area at suture with carina, with four interlocking teeth, the first one being the largest, smooth suture with fixed-scutum.

Tergum (Fig. 13A, C) larger than scutum, nearly quadrangular, with three articular ridges; axial ridge highest and as wide as second, distance between ridges equal, groove between first and second ridges greater than between second and third ones; no ridges at carinal area. Internally, surface flat and smooth; scutal margin slightly concave, with median tooth.

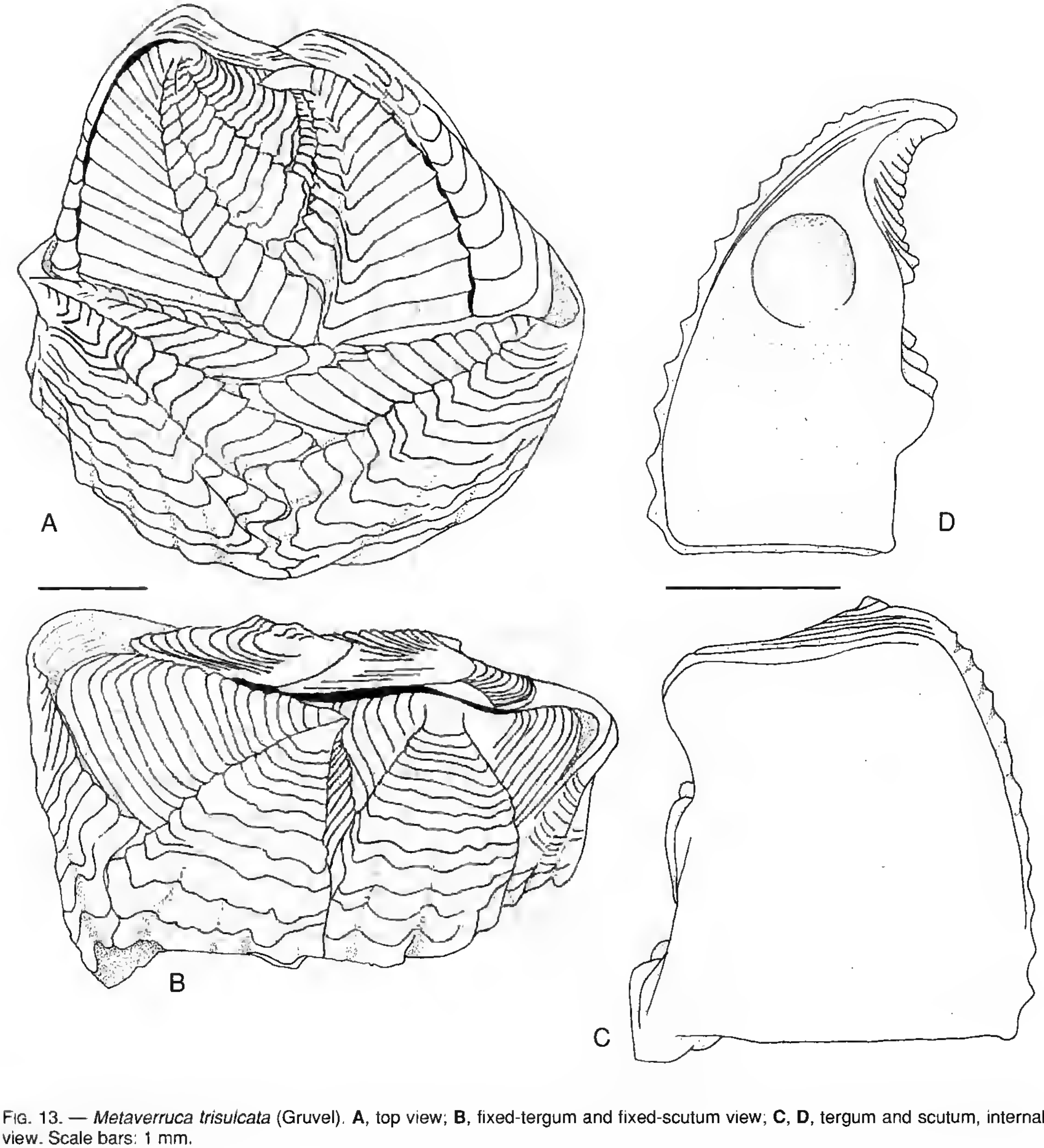

FIG. 13. — *Metaverruca trisulcata* (Gruvel). **A**, top view; **B**, fixed-tergum and fixed-scutum view; **C**, **D**, tergum and scutum, internal view. Scale bars: 1 mm.

Scutum (Fig. 13A, D) with three articular ridges, third ridge thin, sloping continuously to rostral area, no ridges at rostral area; apex pointed, directed toward tergum. Internally, tergal margin nearly straight, with tooth at lower third; surface with conspicuous upper depression, including adductor muscle pit.

Labrum (Fig. 14A) with series of irregular teeth. Palp (Fig. 14a) short, acuminated, with few simple setae on upper margin and distal region. Mandible (Fig. 14B) with three teeth, distance between first and second teeth twice distance between the second and third ones; lower angle denticulated. Maxilla I (Fig. 14C) with lower part projected; two large spines and five small spines on upper edge of cutting edge and thirteen moderate to small unpaired spines on lower part. Second maxilla not observed.

Cirrus I (Fig. 14D) with subequal rami, anterior slightly longer than posterior one; both with protuberant articles covered by long, simple setae. Cirrus II (Fig. 14E) with anterior ramus about two third length of posterior, with articles more protuberant; both rami covered by long, simple setae. Cirri III with unequal rami, anterior shorter than posterior; cirri with rami of IV-VI equal length. Intermediate articles of cirrus VI with width about two third length, three pairs of long setae on anterior margin, two setae on posterior angle. Caudal appendage (Fig. 14F) multiarticulated, seven articles, one half length of coxopodite; long simple setae on distal margins of articles. Number of articles of cirri I-VI and caudal appendage is presented in table 6. The specimens dissected had approximately fifty eggs each (from station 197).

TABLE 6. — Number of articles of cirri I-VI, and caudal appendage of *Metaverruca trisulcata* (Gruvel), stn 197. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri.

	I	II	III	IV	V	VI	CA
RC	11/15	8/12	16/19	21/23	23/25	25/26	7
LC	15/12	8/12	16/19	12+/23	24/24	24/26	7

REMARKS

M. trisulcata was described by Gruvel (1900b, 1902a, 1920) from the Azores, and it was later recorded from the coast of Morocco (Gruvel 1912b). Foster & Buckeridge (1995a, b) recorded it from off the Straits of Gibraltar and La Réunion (Indian Ocean). These authors considered *Verruca imbricata* Gruvel, 1900b, *V. striata* Gruvel, 1900b and *V. radiata* Gruvel, 1901 as synonyms of *M. trisulcata*. Herein I only consider *V. striata* synonymous of *V. trisulcata*, included in the *Metaverruca*. *Verruca imbricata* and *V. radiata* are considered valid and included in *Newmaniverruca* n.g.

The specimens examined are in accordance with the detailed description of the external characters presented by Gruvel (1902a), except the width of the second and third ridges of the tergum are equal, instead of the second being wider. The ornamentation of the rostrum and carina, the ridges of tergum and scutum, and the apex of scutum, serve as a diagnostic of this species.

Gruvel (1900b, 1902a) did not describe the appendages of *V. trisulcata*, which are described herein, but he described the appendages of *V. striata* (Gruvel, 1902c), which is here considered synonymous. The description of the appendages of *V. striata* concord with those I observed, except that of the caudal appendage. Gruvel (1902c) observed nine articles that were longer than coxopodite of cirrus VI, instead of seven articles that are one half the length of the coxopodite. *Verruca striata* also differs from *V. trisulcata*: scutum with apex not curved, with three articular ridges similar in width, and the apices of the carina and rostrum not projecting. Notwithstanding these differences, I agree with Foster & Buckeridge (1995a, b) and consider this species synonymous with *V. trisulcata*.

On the other hand, I do not consider *V. imbricata* and *V. radiata* as synonyms of *M. trisulcata*, due to several differences in the number and form of the ridges of the scutum and tergum, and on the number and development of the radial ridges of the shell. Foster & Buckeridge (1995a, b) stated that the number of ridges between the tergum and the scutum increased with growth, from one to four in specimens of about 6 mm in rostrocarinal length. The three specimens I studied had a length between 0.44 and 0.52 mm and all had a constant number of ridges, as in Gruvel's type. In the specimens from

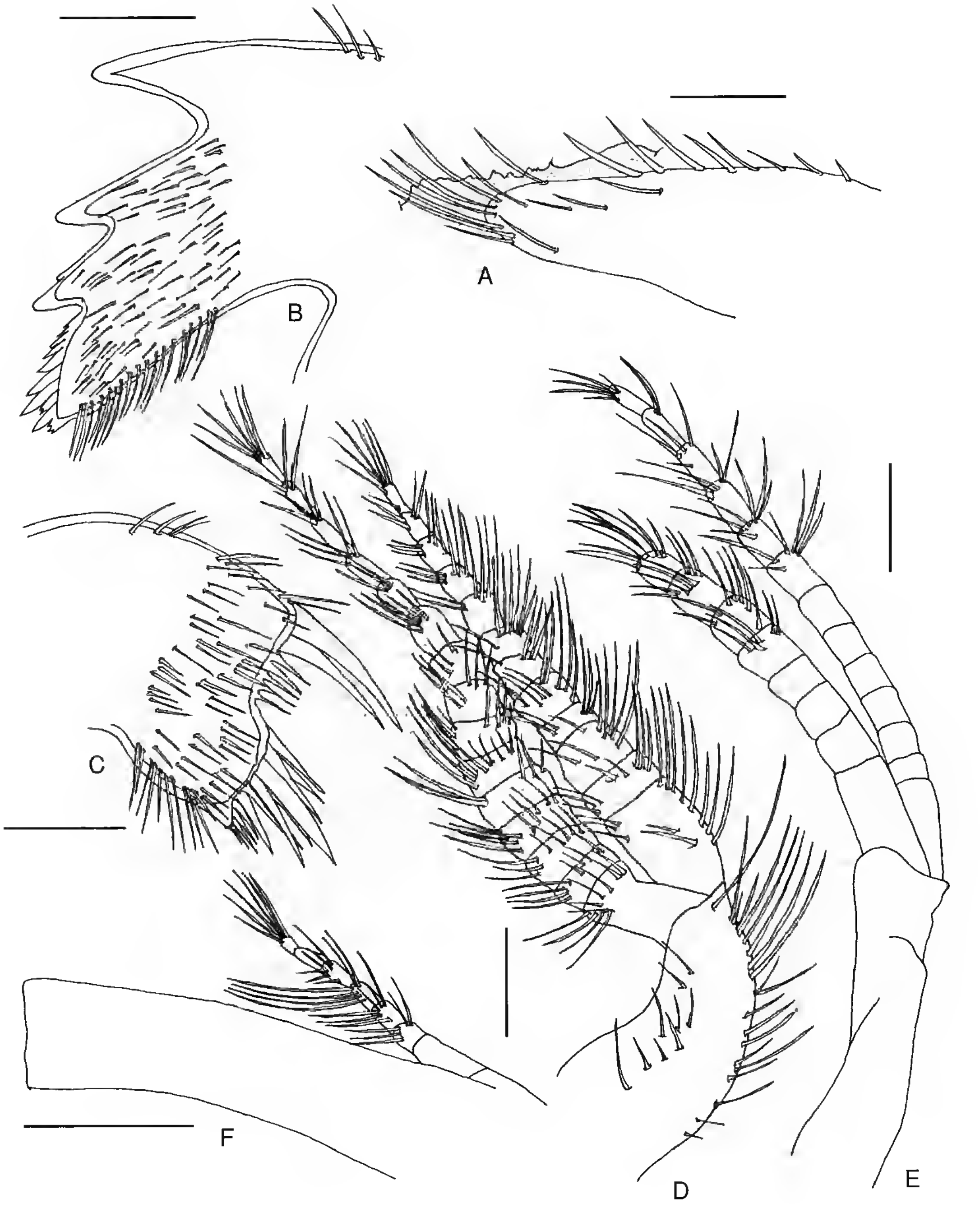

FIG. 14. — *Metaverruca trisulcata* (Gruvel). **A**, detail of labrum and palp; **B**, mandible; **C**, maxilla I; **D**, cirrus I; **E**, cirrus II, only setae of distal articles shown; **F**, caudal appendage. Scale bars: A-C, F, 0.1 mm; D, E, 0.3 mm.

La Réunion (Foster & Buckeridge 1995b), besides the variable number of ridges, the specimens exhibit a plasticity in the form of the shell from *low splayed to quite upstanding*. Cirri I and II have the anterior ramus one half the length of the posterior one and the caudal appendage with *0.66* or *0.5* (sic) the length of cirrus VI. For the specimens from the Straits of Gibraltar, Foster & Buckeridge (1995a) repeated the same description as that fot the La Réunion samples, only adding new figures. Therefore, the differences observed in the shell and appendages of both samples appears to be yet another species, or possibly more than one species due to the high variability desctibed.
The distribution of *M. trisulcata* is restricted to the Azores region and off Morocco (Fig. 9).

Genus *Costatoverruca* n.g.[1]

Costatoverruca cornuta (Aurivillius, 1898)

Verruca cornuta Aurivillius, 1898: 197. – Gruvel 1905: 174; 1912a: 5; 1920: 39, pl. 2, figs 12-13, pl. 3, figs 9-10. – Hoek 1907b: 9. – Belloc 1959: 4.

MATERIAL EXAMINED. — Stn 62, 1 specimen, rc: 0.5 cm, MNHN Ci 2662. — Stn 148, 13 specimens and 1 empty shell, rc: 0.4-0.7 cm, MNHN Ci 2577, MNRJ 8911. — Stn 150, 2 specimens, rc: 0.4 cm, MNHN Ci 2579. — Stn 151, 3 specimens, rl: 0.4-0.5 cm, MNHN Ci 2670. — Stn 157, 5 specimens, rc: 0.5, MNHN Ci 2582. — Stn 159, 1 specimen, rc: 0.4 cm, MNHN Ci 2586. — Stn 161, 25 specimens, rc: 0.2-0.4 cm, MNHN Ci 2587, MNRJ 8912. — Stn 181, 8 specimens, rc: 0.3-0.6 cm, MNHN Ci 2601. — Stn 199, 6 specimens, rc: 0.5 cm, MNHN Ci 2612, MNRJ 8913. — Stn 237, 2 specimens, rc: 0.4 cm, MNHN Ci 2630. — Stn 239, 646-628 m, 1 specimen, rc: 0.4 cm, MNHN Ci 2633.

REMARKS
The external shell characters *C. cornuta* were described by Aurivillius (1898), and later in greater detail by Gruvel (1920), both of which are based on samples from the Azores. Young (in press) redescribes this species, including a description of the appendages, based on new samples from the Azores.
All of the specimens studied were collected in the Azores and at a depth previously recorded, 450 to 1229 m.

1. See the part of the revision of Verrucidae for generic diagnosis.

Genus *Verruca* Schumacher, 1817

Verruca stroemia (Müller, 1776)
(Figs 15-17)

Lepas strömia Müller, 1776: 251.

Verruca strömia – Darwin 1854: 518, pl. 21, fig. 1a-f. – Pilsbry 1916: 24.

Verruca stroemia – Nilsson-Cantell 1978: 48, figs 23-24.

MATERIAL EXAMINED. — Stn 14, 2 specimens on *Dendrophyllia cornigera*, MNHN Ci 2554. — Stn 259, 720 specimens, MNHN Ci 2653, MNRJ 8914.

DESCRIPTION
Shell (Fig. 15A) white or translucent, flattened, usually with rostrum prominent, cuticle not persistent, ornamented with several longitudinal ridges, sometimes nodose, and irregular growth lines; ridges at suture between rostrum and carina and between rostrum and fixed-scutum conspicuous and projecting. Opercular plates (Fig. 15A) parallel with basis, reduced in size, less than one half rostrocarinal diameter. Surface of opercular plates and shell permeated by several rows of tubes in small specimens, tubes parallel to growth lines sealed in larger ones. Basal margin of wall not inflected.
Fixed-tergum (Fig. 15A) same size as fixed-scutum, marginal apex thickened, recurved outward; alate projections to carina, nearly straight sutures to fixed-scutm.
Fixed-scutum (Fig. 15A) nearly quadrangular, upper surface turned toward rostral margin of free scutum; suture with fixed-tergum simple and nearly straight; rostrum having conspicuous ridges; apex marginal, not recurved. Internally, with well developed myophore parallel to basis.
Carina (Fig. 15A) smaller than rostrum, surface with longitudinal ridges knobbed; well developed

ridge area at suture with rostrum, forming deep grooves between ridges, with five interlocking teeth, ridges decreasing slightly in size from apex to basis; with radius-like projection to fixed-tergum.
Rostrum (Fig. 15A) with well developed ridged area at suture with carina, forming deep grooves between ridges, with four to five interlocking teeth, ridges decreasing in size from apex to basis; suture with fixed-scutum also with conspicuous ridges.
Opercular plates with conspicuous and projecting growth lines. Tergum (Fig. 15A, B) larger than scutum, nearly quadrangular, with three articular ridges; axial ridge high, conspicuous at both sides, about same width as second; ridges absent at carinal area. Internally, surface flat, with some visible sealed tubes, scutal margin with deep medial notch, forming articular ridge at upper margin.
Scutum (Fig. 15A, C) with three low articular ridges, axial ridge low and thin, sloping continuously to rostral area; first ridge wider than second; rostral area, slightly medially depressed, ridges absent; width of plate about one third its height. Internally, surface with some sealed tubes and conspicuous upper depression, which includes the adductor muscle pit, tergal margin sinuous.
Labrum with row of simple, sharp teeth. Palp (Fig. 16A) acuminate, simple setae at upper margin. Mandible (Fig. 16B) with three teeth, second and third with subsidiary cusps, denticles on lower angle. Maxilla I (Fig. 16C) with lower anterior border projecting anteriorly; upper border with two large spines, followed by nineteen to twenty moderate and small spines at lower border. Maxilla II (Fig. 16D) bilobed, numerous simple setae along its margins.
Cirrus I (Fig. 16E) with unequal rami, anterior ramus two third length of posterior, both rami with protuberant articles covered by numerous simple setae. Cirrus II (Fig. 16F) with unequal rami, anterior ramus about one quarter length of posterior, both rami covered by numerous simple setae; distal articles of anterior ramus with bipectinate setae. Cirrus III (Fig. 16G) with unequal rami; anterior ramus about one third length of posterior; both rami covered by numerous simple setae, distal articles of anterior ramus with bipectinate setae. Cirri IV to VI with equal rami; intermediate articles (Fig. 16H) with four pairs of setae on anterior margin, one or two setae on posterior angle; width about one half length. Caudal appendage (Fig. 16I) multiarticulated, sixteen articles, three times length of coxopodite of cirrus VI; articles covered by numerous simple setae at distal margins; basal articles with multifid scales. Number of articles cirri I-VI and caudal appendage is presented in table 7.

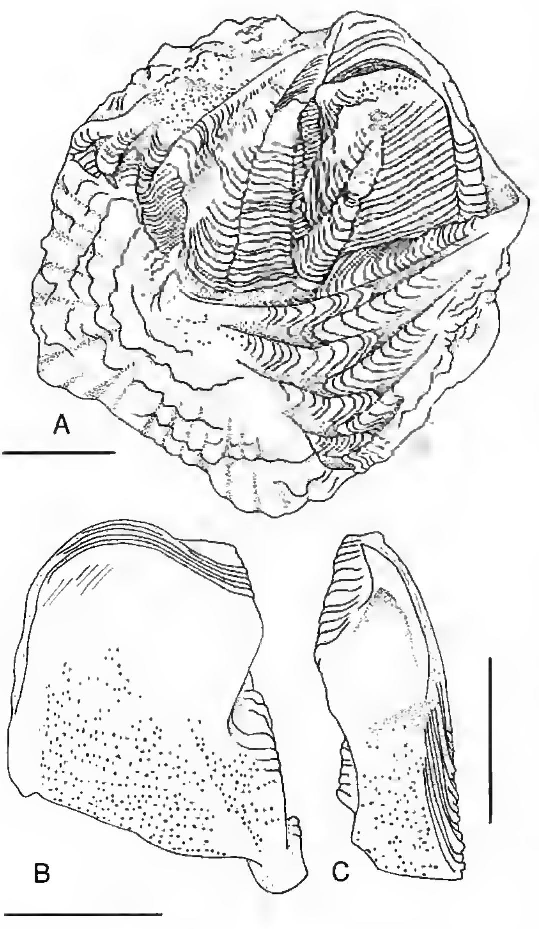

Fig. 15. — *Verruca stroemia* (Müller). **A**, top view; **B**, **C**, tergum and scutum, internal view. Scale bars: 1 mm.

Remarks

Verruca stroemia is a common temperate and polar species from the Northeastern Atlantic,

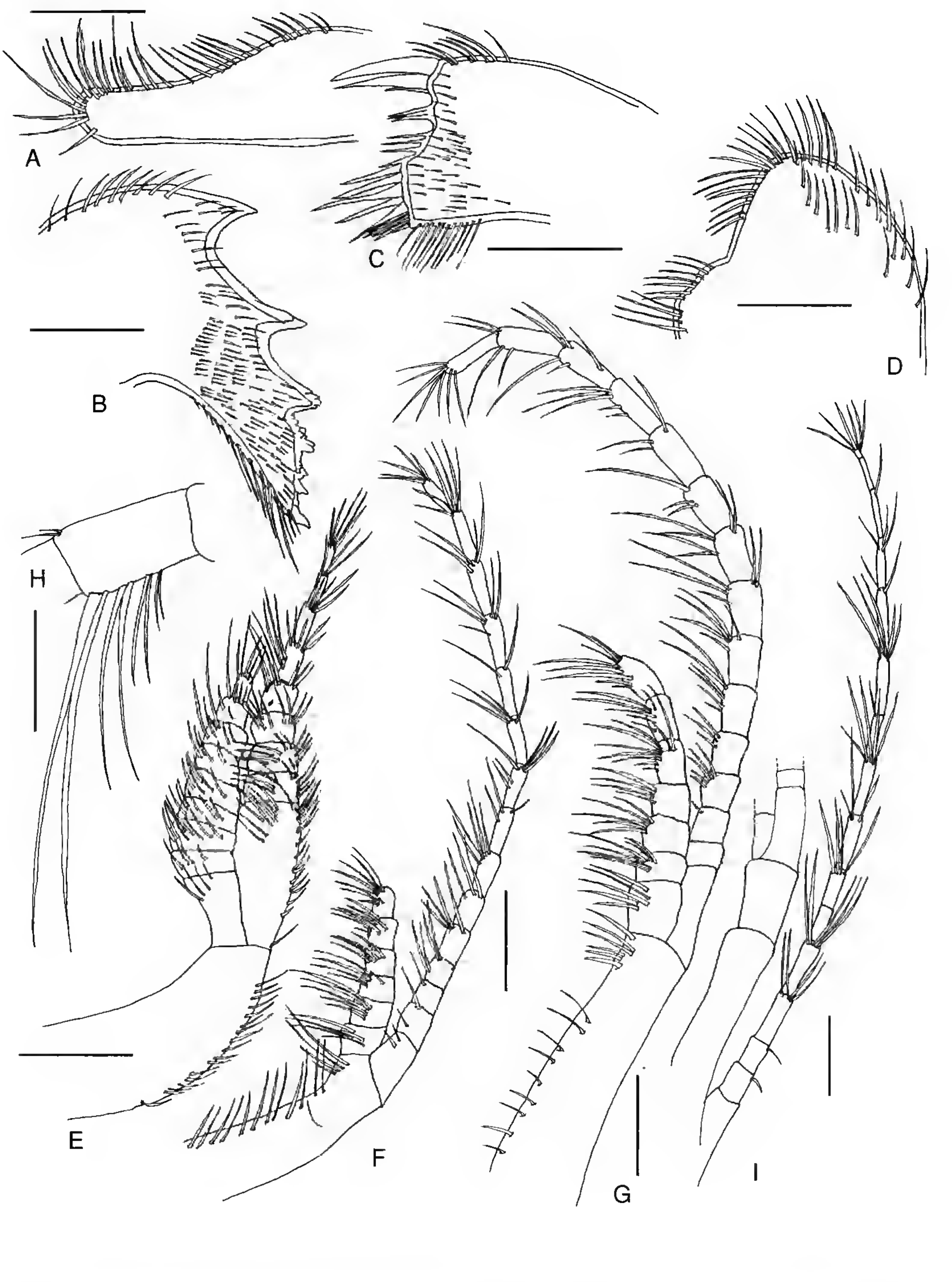

FIG. 16. — *Verruca stroemia* (Müller). **A**, palp; **B**, mandible; **C**, maxilla I; **D**, maxilla II; **E**, cirrus I; **F**, cirrus II; **G**, cirrus III; **H**, intermediate article of cirrus VI; **I**, caudal appendage. Scale bars: A-D, H, 0.1 mm; E-G, I, 0.2 mm.

TABLE 7. — Number of articles of cirri I-VI, and caudal appendage of *Verruca stroemia* (Müller), stn 14. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri.

	I	II	III	IV	V	VI	CA
RC	9/9	6/15	7/15	17/21	21/22	23/25	16
LC	9/8	6/16	8/18	18/19	21/22	24/26	16

where it occurs from the intertidal zone to 548 m, with doubtful records from 960-998 and 2600 m. The latter record was from the Azores region, which is the most southern record for this species (Gruvel 1902a, 1920).

In several samplings by the *Meteor* (Young in press) and the *Jean Charcot* expeditions in the Azores, not a single specimen of *V. stroemia* has been collected. However, *V. spengleri*, a species similar to *V. stroemia*, is common in this region, but it does not occur at the depths cited by Gruvel. It appears that the Gruvel (1902a, 1920) records represent other verrucids species.

The specimens of *V. stroemia* studied herein were collected off Portugal, which is accepted here as the southern limit of its distribution.

Verruca stroemia has been recotded from the Spitsbergen, Greenland, Iceland, the Faeroe Islands, Great Britain, and the Norwegian to Portugal coasts (Nilsson-Cantell 1978), with scattered records along the European coast of the Mediterranean Sea, from France to the Adriatic Sea (Fischer 1871; Kolosváry 1947, 1951; Relini 1969). There is also one doubtful record from the Red Sea (Darwin 1854; Fig. 17). Due to the superficial similarity between *V. stroemia* and *V. spengleri* all records from the Mediterranean need to be reviewed (see remarks under *V. spengleri*).

Verruca spengleri Darwin, 1854
(Figs 17-19)

Verruca spengleri Darwin, 1854: 521, pl. 21, fig. 2. – Weltner 1897: 274. – Hoek 1883: 133. – Gruvel 1905: 182, fig. 200; 1920: 48. – Hoek 1907b: 9. – Pilsbry 1916: 40. – Baker 1967: 47. – Buckeridge 1994: 90.

Verruca stroemia – Ruggieri 1953: 46 (not *V. stroemia* Müller).

? *Verruca spengleri* – Tarasov & Zevina 1957: 151, figs 49-50. – Zevina 1963: 73. – Ruggieri 1977: 71k, figs 3-5.

MATERIAL EXAMINED. — Stn L8, 1 specimen, MNHN Ci 2541. — Stn P3, 42 specimens, MNHN Ci 2507. — Stn P4, 46 specimens, MNHN Ci 2509. — Stn P6, 218 specimens, MNHN Ci 2511. — Stn P7, more than 100 specimens, MNHN Ci 2513, MNRJ 8915. — Stn P8, more than 100 specimens, MNHN Ci 2516, MNRJ 8916. — Stn P9, 30 specimens, MNHN Ci 2518. — Stn P12, 86 specimens, MNHN Ci 2521. — Stn P13, 1 specimen, MNHN Ci 2522. — Stn P17, 4 specimens, MNHN Ci 2658. — Stn P19, 110 specimens, MNHN Ci 2525. — Stn P23, 68 specimens, MNHN Ci 2526. — Stn P24, 98 specimens, MNHN Ci 2527. — Stn P27, 280 specimens, MNHN Ci 2528, MNRJ 8917. — Stn P29, 298 specimens, MNHN Ci 2529, MNRJ 8918. — Stn P30, 1 specimen, MNHN Ci 2660. — Stn P33, 86 specimens, MNHN Ci 2532. — Stn 1, 52 specimens, MNHN Ci 2547. — Stn 61, 69 specimens, MNHN Ci 2558. — Stn 142, 22 specimens, MNHN Ci 2572. — Stn 143, 1 specimen, MNHN Ci 2573. — Stn 216, 62 specimens, MNHN Ci 2619. — Stn 224, 16 specimens, MNHN Ci 2623.

DESCRIPTION

Shell (Fig. 17A) white or translucent; cuticle not persistent; flattened; usually with rostrum more prominent, ornamented only with irregular growth lines; ridges at suture between rostrum and carina conspicuous and projecting. Opercular plates (Fig. 17B) parallel to basis, reduced in size, less than one half rostrocarinal diameter. Surface of opercular plates (Fig. 17A-D) and shell permeated by several persistent rows of tubes, parallel ro growth lines. Basal margin of wall not inflected.

Fixed-tergum (Fig. 17A) smaller than fixed-scutum, marginal apex thickened, recurved outward; alate projections absent, sutures essentially straight or with small ridge at carinal suture.

Fixed-scutum (Fig. 17A) nearly quadrangular, upper surface turned toward rostral margin of scutum; suture areas simple and nearly straight, small to large ridge at suture of rostrum; apex marginal, not recurved outward. Internally, with well developed myophore parallel to the basis.

Carina (Fig. 17A) smaller than rostrum, well developed ridge area at suture with rostrum

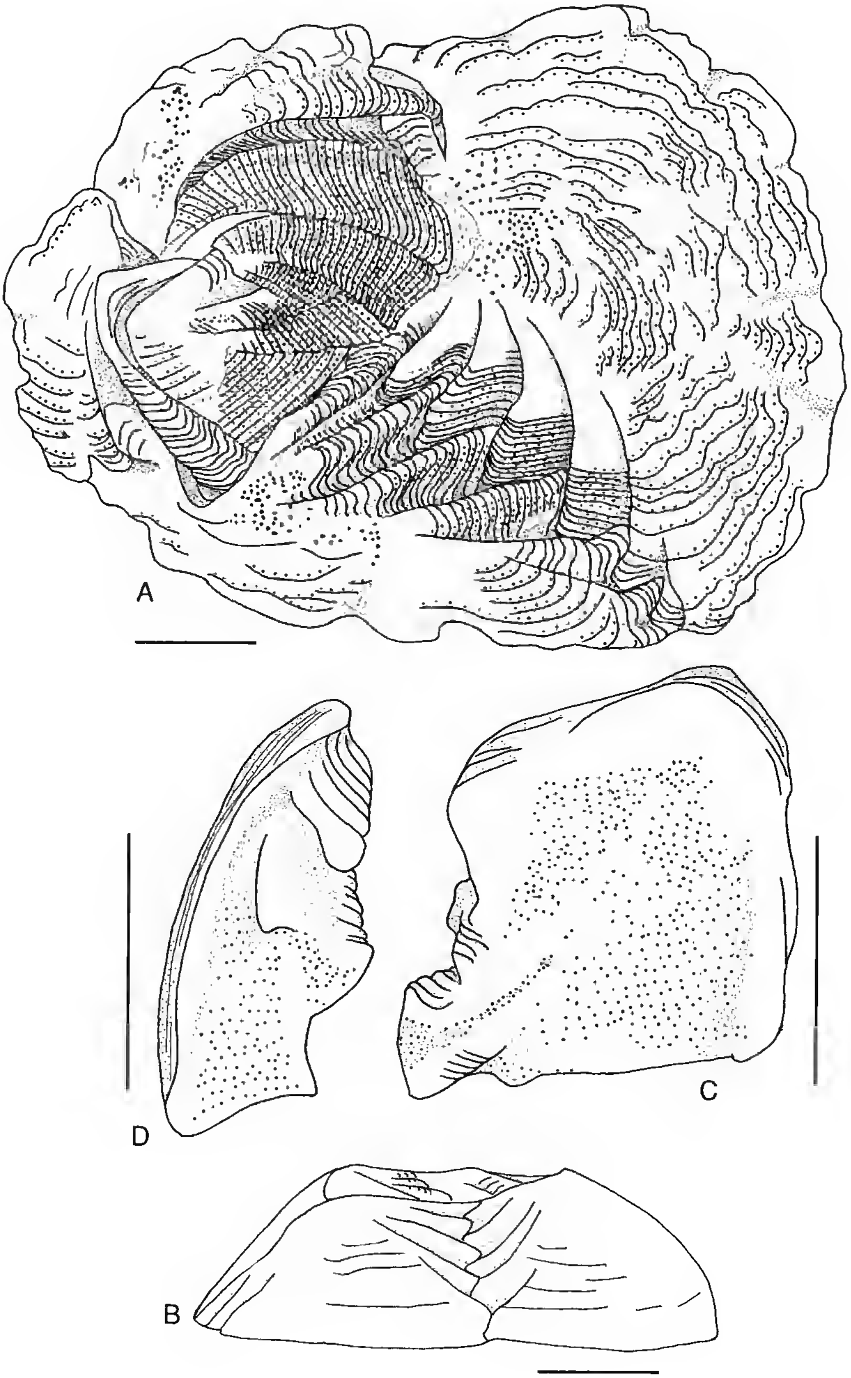

FIG. 17. — *Verruca spengleri* Darwin. **A**, top view; **B**, carino-rostral view; **C**, **D**, tergum and scutum, internal view. Scale bars: 1 mm.

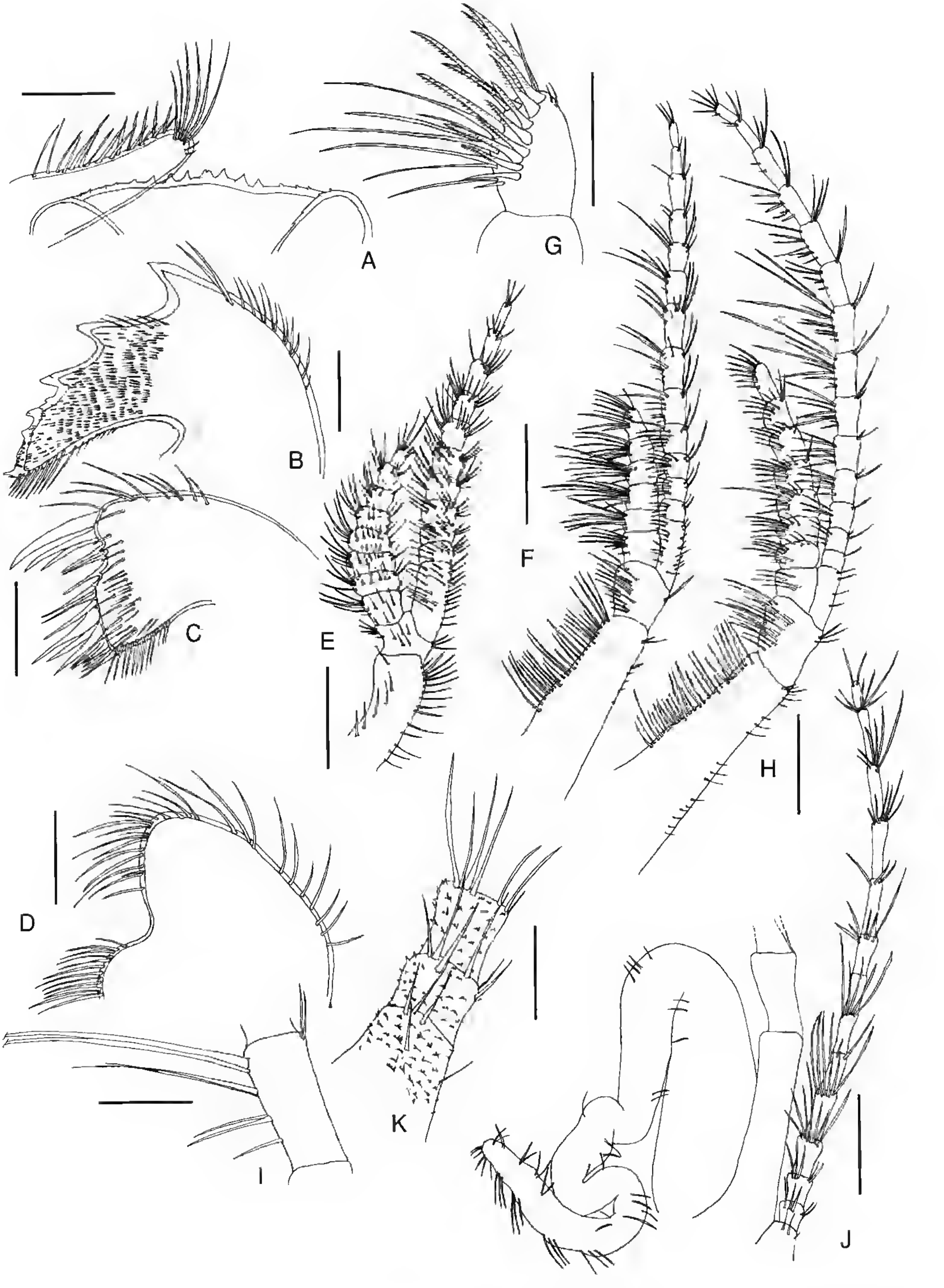

FIG. 18. — *Verruca spengleri* Darwin. **A**, labrum and palp; **B**, mandible; **C**, maxilla I; **D**, maxilla II; **E**, cirrus I; **F**, cirrus II; **G**, distal article of anterior ramus of cirrus II; **H**, cirrus III; **I**, intermediate article of cirrus VI; **J**, caudal appendage and penis; **K**, basal articles of caudal appendage. Scale bars A-D, G, I, K, 0.1 mm; E, F, H, J, 1.0 mm.

forming deep grooves between ridges, five ro seven interlocking teeth, ridges decreasing slightly in size from apex ro basis; suture with fixed-tergum wirh low ridges.

Rostrum (Fig. 17A) with well developed ridged area at suture with carina, forming deep grooves between ridges, four to six interlocking teeth, ridges decreasing slightly in size from apex to basis; suture with fixed-scutum nearly smooth or depressed for fixed-scutum tooth.

Opercular plates with growth lines conspicuous, but not projecting. Tergum (Fig. 17C) larger than scutum, nearly quadrangular, three articular ridges; axial ridge elevated, conspicuous at both sides, as wide as second, distance between ridges equal, groove between first and second larger than that between second and third; without ridges at carinal area. Internally, surface flat, some sealed tubes visible; scutal margin sinuous.

Scutum (Fig. 17D) with three low articular ridges, axial ridge low, thin, sloping continuously ro rostral area; first and second ridges equal in width or latter wider, no ridges at rostral area; greater width of plate about one half scutum height. Internally, surface with some sealed tubes visible, adductor ridge conspicuous; tergal margin sinuous.

Labrum (Fig. 18A) with row of twenty-four simple, sharp teeth. Palp (Fig. 18A) acuminate, simple setae at upper margin. Mandible (Fig. 18B) with three teeth, second and third usually with subsidiary cusps at upper margin, low denticles on lowet angle. Maxilla I (Fig. 18C) with lower anterior border projecting anteriorly; upper border with two or three large spines, followed by fifteen to twenty-four intermediate to small spines at lower border. Maxilla II (Fig. 18D) bilobed, with numerous simple setae along its margins.

Cirrus I (Fig. 18E) with unequal rami, anterior ramus one half length of posterior, anrerior ramus with protuberant articles, covered by numerous simple setae, posterior ramus with slightly protuberant articles.

Cirrus II (Fig. 18F) with unequal rami, anterior ramus about one third length of posterior, both rami covered by numerous simple setae, distal articles of anterior ramus with bipectinate setae (Fig. 18G).

Cirrus III (Fig. 18H) with unequal rami, anterior ramus about one half length of posterior, borh rami covered by numerous simple setae, distal articles of anterior ramus with bipectinate setae. Cirri IV to VI with equal rami; intermediate articles (Fig. 18I) with four pairs of setae on anterior margin, one or two setae on posterior angle, small spinules on distal margin, length about one half width. Caudal appendage (Fig. 18J) multiarticulated, with fourteen articles, two and one half times length of coxopodite of cirrus VI; articles covered by numerous simple setae at distal margins; basal articles (Fig. 18K) with spinules and multifid scales.

Number of articles of cirri I-VI and caudal appendage is presented in table 8.

TABLE 8. — Number of articles of cirri I-VI, and caudal appendage of *Verruca spengleri* Darwin, stn P6. **I-VI**, cirri I to VI; **CA**, caudal appendage; **RC**, right cirri; **LC**, left cirri; **+**, broken ramus.

	I	II	III	IV	V	VI	CA
RC	8/11	6/13	7/15	17/18	16+/21+	23+/22+	+
LC	8/11	6/14	8/15	18/18	20/21	23/22	14

REMARKS

Darwin (1854) described and figured specimens of *V. spengleri*, bur he only illustrated the internal view of the scutum. This species is similar to *V. stroemia*, but the well developed adductor ridge of the movable scutum in *V. spengleri* readily separates these species. Otherwise, both species can be distinguished by *V. spengleri* having a relatively narrower scutum, the first and second ridges being of equal width, the shell being permeated by tubes, and lacking longitudinal ridges. *Verruca spengleri* was first described from Madeira Island (Darwin, 1854) and later, from the Azores (Gruvel 1920; Baker 1967) and Black Sea (Tarasov & Zevina 1957). Darwin (1854) noted that "from geographical considerations" *V. spengleri* probably was rhe species found in the Mediterranean. Ruggieri (1977) cited this species in Southern Italy, and also noted that probably all of the citations of *Verruca* from the Mediterranean Sea were actually *V. spengleri*. Ruggieri (1977) did not describe his specimens, bur his

figures 3 and 4 show the scutum with a developed adductor ridge, a thin first external ridge, and a width/height ratio of one half, which agrees with the description of *V. spengleri*.
Tarasov & Zevina (1957) cited *V. spengleri* as common in the Black Sea, between 20 and 50 m. The specimens described are similar to those I observed, but the scutum is relatively larger and the axial ridge is placed in the middle of the basal margin (Tarasov & Zevina 1957, fig. 49). In addition, the caudal appendage has only nine articles. Therefore, I consider the identification of the Black Sea specimens of *V. spengleri* as dubious, and in need of further confirmation. Due to the large differences between the specimens from the Azores-Madeira Archipelagos and the Black Sea, I suspect that the Mediterranean specimens may well be an undescribed species.
Verruca spengleri is common in the Madeira and Azores Archipelagos, from between the intertidal zone and 103 m. Gruvel (1920) also recorded it from 130 to 440 m (Fig. 19).

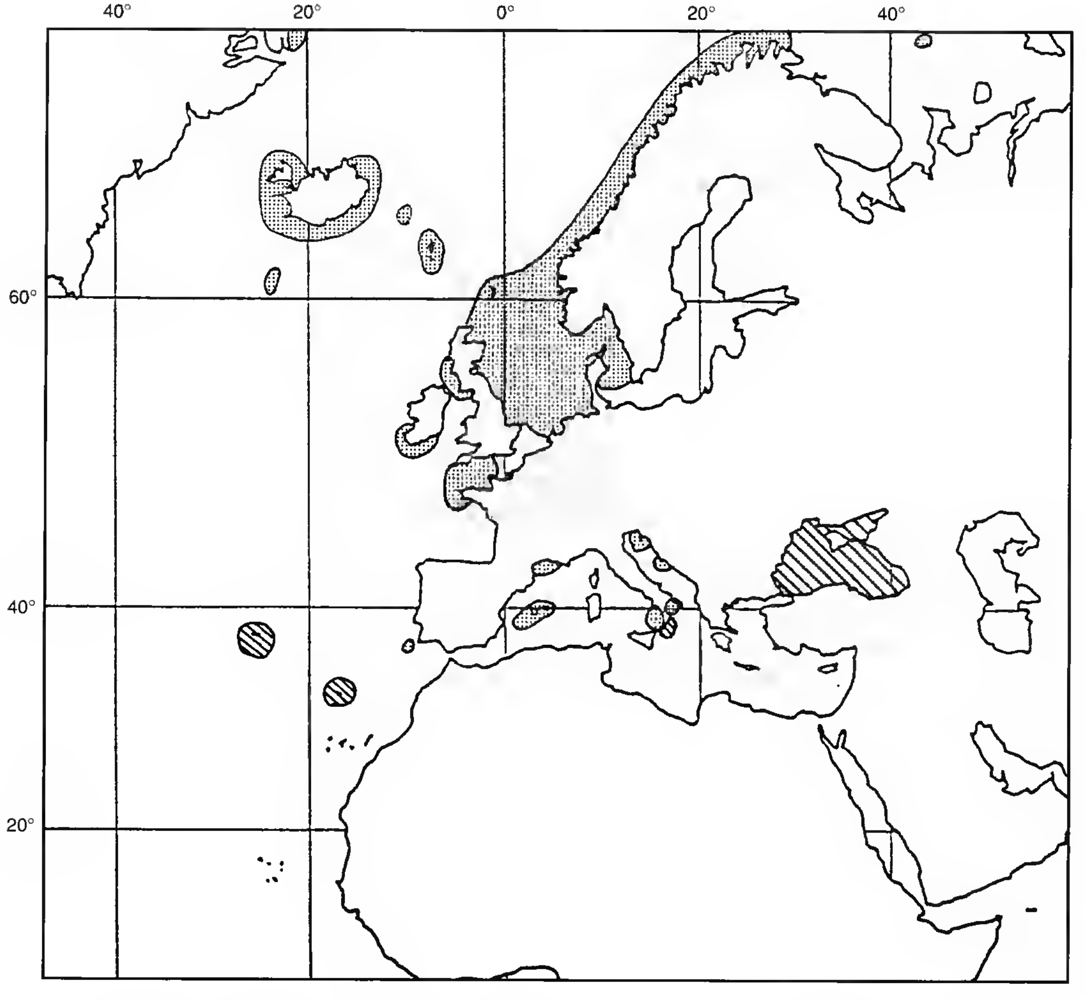

FIG. 19. — Geographic distribution of *Verruca stroemia* (Müller) (dotted) and *Verruca spengleri* Darwin (hatched).

Suborder BALANOMORPHA Pilsbry, 1916
Family CHTHAMALIDAE Darwin, 1854
Genus *Chthamalus* Ranzani, 1817

Chthamalus stellatus (Poli, 1791)

Lepas stellatus Poli, 1791: 29, pl. 5, figs 18-20.

Chthamalus stellatus – Darwin 1854: 45, pl. 18, figs 1a, c, e-f, h (part). – Southward 1976: 1009, text-figs 1-2, 6, pl. 1, figs c-d, f-g, pl. 2, figs a-b, d (synonymy).

Chthamalus stellatus stellatus – Pilsbry 1916: 302, pl. 71, figs 1-4a. – Nilsson-Cantell 1921: 281.

MATERIAL EXAMINED. — Stn L5, 96 specimens, MNHN Ci 2537, MNRJ 8919. — Stn L11, 3 specimens, MNHN Ci 2657.

DIAGNOSIS AND DESCRIPTION. — See Southward 1976: 1009.

REMARKS
The present specimens conform to the description of the shell and appendages formulated by Southward (1976). *Chthamalus stellatus* is widely distributed from the northern Scottish coast and English Channel, to the Mediterranean Sea, to the tropical coast of West Africa, Mauritania and with some doubtful records south of the Cameroons (Stubbings 1967; Southward 1976). It was also recorded from Madeira, Cape Verde and Azores Islands (Darwin 1854; Stubbings 1964; Baker 1967). It is abundant between the Low Water Mark and the splash zone on all rocky shores of the São Jorge Island (Baker 1967). The *Jean Charcot* Expedition collected this species at Santa Maria and Faial Island; thus it has a wide distribution within the Azores Archipelago.

Family BATHYLASMATIDAE Newman *et* Ross, 1971
Genus *Bathylasma* Newman *et* Ross, 1971

Bathylasma hirsutum (Hoek, 1883)

Balanus hirsutus Hoek, 1883: 158, pl. 13, figs 8-15.

Bathylasma hirsutum – Newman & Ross 1971: 149, textfig. 73, pl. 23-24 (synonymy).

MATERIAL EXAMINED. — Stn 6, eroded shell fragments, MNHN Ci 2551. — Stn 46, 9 pieces of eroded and disarticulated plates of the shell, MNHN Ci 2556. — Stn 180, 1 scutum, MNHN Ci 2667. — Stn 240, 1 eroded carina, MNHN Ci 2668. — Stn 255, 13 specimens fragmented, rc: 1.4-2.4 cm, MNHN Ci 2651, MNRJ 8920. — Stn 260, 3 specimens, rc: 1.5-2.8 cm, MNHN Ci 2655.

REMARKS
Bathylasma hirsutum appears to be one of the most common Northern Hemisphere deep-sea balanomorph barnacles. It has been recorded several times in the Northeast Atlantic, from the Faeroe Islands to the Azores, from depths of 944 to 1829 m (Hoek 1883, 1913; Pilsbry 1916; Gruvel 1920; Southward & Southward 1958; Utinomi 1965; Newman & Ross 1971). The present samples are from 570 to 940 m, and occur on rocks and on echinoid spines. *Bathylasma hirsutum* was redescribed in detail by Newman & Ross (1971).

Genus *Hexelasma* Hoek, 1913

Hexelasma americanum Pilsbry, 1916
(Figs 1, 20-21)

Hexelasma americanum Pilsbry, 1916: 330, pl. 69. – Utinomi 1965: 12.

Aaptolasma americanum – Newman & Ross 1971: 161, pl. 22a-b, 36-37; 1976: 46.

MATERIAL EXAMINED. — Stn 180, 1 specimen, with the shell plates disarticulated (lacking one latera), MNHN Ci 2599.

DESCRIPTION
Shell conic, color white or pale orange, aperture toothed. Plates (Fig. 20A, B) with spaced and conspicuous growth lines; cuticle persistent only on opercular plates, in larger specimens, pilose along growth lines; alae well developed, with fine lines, radii absent; basal margin of wall sometimes undulated. Sheath (Fig. 20B) adpressed, well defined. Internally (Fig. 20B) lamina with thin longitudinal striae; spaces between striae covered by chitin in larger specimens. Carino-lateral narrow, 0.13 width of carina and 0.22 width of lateral.
Scutum (Fig. 20C) higher than wide, height 1.4 to width; apex recurved outwards, tergal segment narrow, with wide and strong longitudinal

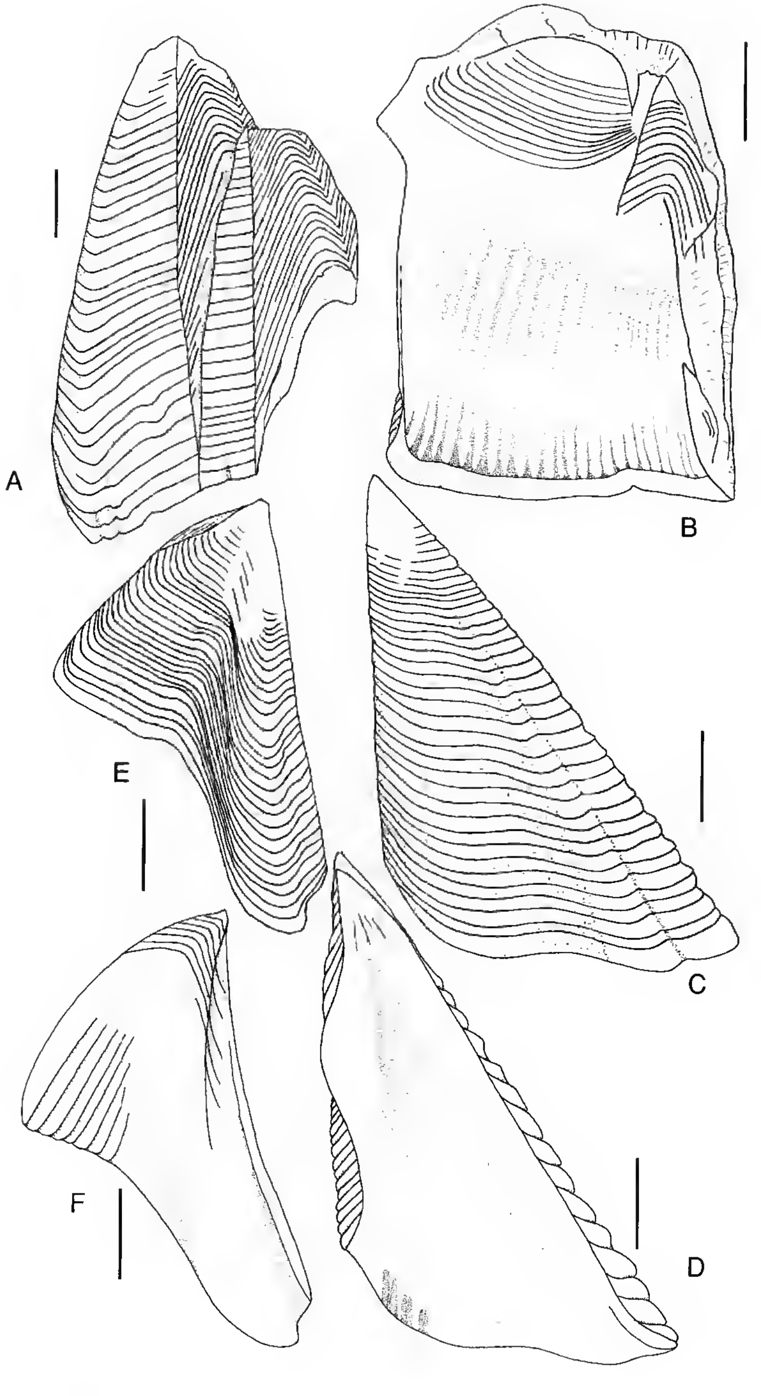

FIG. 20. — *Hexelasma americanum* Pilsbry. **A**, lateral view of carina and carino-lateral; **B**, lateral, internal view; **C**, **D**, scutum, external and internal view; **E**, **F**, tergum, external and internal view. Scale bars: A, B, 0.3 mm; C-F, 0.2 mm.

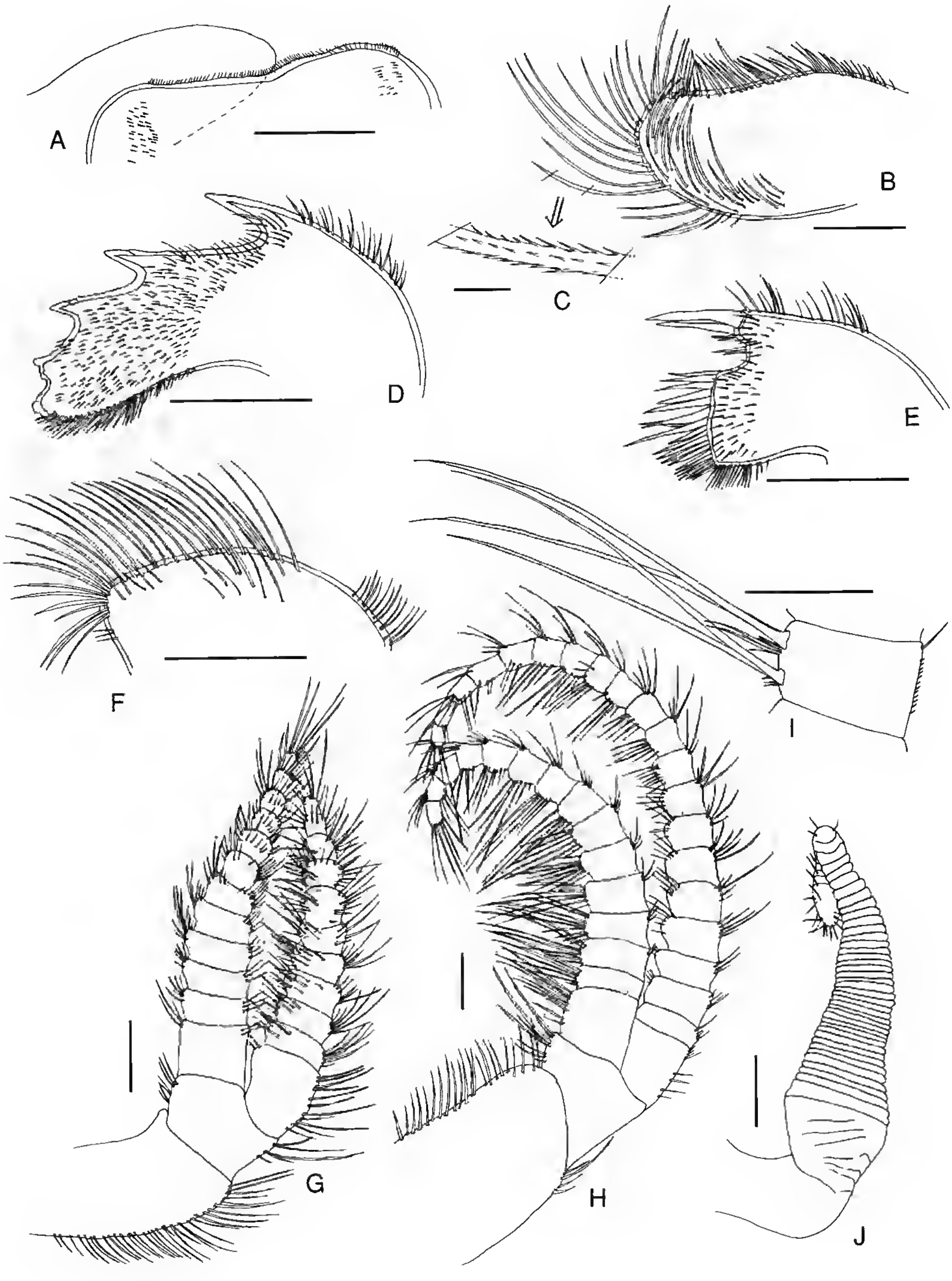

FIG. 21. — *Hexelasma americanum* Pilsbry. **A**, labrum and palp; **B**, palp; **C**, detail of the palp setae; **D**, mandible; **E**, maxilla I; **F**, maxilla II; **G**, cirrus I; **H**, cirrus II; **I**, intermediate article of cirrus VI; **J**, penis. Scale bars: A, B, D-J, 0.5 mm; C, 0.02 mm.

apico-basal rib near occludent margin; articular margin straight, basal margin sinuous; occludent margin straight; growth lines conspicuous and elevated. Internally (Fig. 20D), adductor ridge absent, articular ridge rounded, medial to articular margin; forming shallow articular furrow; six lateral depressor muscle crests poorly developed; articular and occludent margins thickened, leaving depressed triangular area medially.
Tergum (Fig. 20E, F) triangular, with spur near basi-scutal angle, spur furrow open; spur distally rounded, curving continuously to basal margin; eight crests for depressor muscles, projecting; articular ridge elevated, not curved.
Labrum (Fig. 21A) hirsute, lacking teeth, with shallow medial concavity. Palp (Fig. 21B, C) club-shaped, large, with numerous fine pectinate setae. Mandible (Fig. 21D) with four teeth, distance between first and second twice that between second and third, second to fourth with subsidiary cusps, lower angle obtuse. Maxilla I (Fig. 21E) with two large spines followed by conspicuous, large notch, twelve to thirteen moderate and eight to nine small spines along cutting edge. Maxilla II (Fig. 21F) triangular, with long simple setae.
Cirrus I (Fig. 21G) with subequal rami, anterior ramus slightly longer than posterior; both with protuberant articles covered by long simple setae, distally with fine pinnate setae. Cirrus II (Fig. 21H) with equal rami, articles protuberant, with clusters of simple setae on protuberance and distal angle; distal articles with fine pinnate setae. Cirri III-VI with equal rami. Intermediate article of cirrus VI (Fig. 21I) with length 0.60 width, with two pairs of long, fine, pinnate setae on anterior margin, small setulae below these pairs; one or two short simple setae on posterior angle, small scales on posterior margin. Penis (Fig. 21J) short, annulated, setuale on distal portion. Number of articles of cirri I-VI is presented in table 9.

REMARKS
Foster (1981) considered *Aaptolasma* Newman & Ross synonymous with *Hexelasma* Hoek and proposed an emended diagnosis. His diagnosis stated that the scutum and tergum have no articular ridge, but a tergal ridge is present on the tergum of *H. americanum*. Therefore, Foster's diagnosis has to be emended to include the tergal articular ridge as absent or present.
Hexelasma americanum is the only species of this genus recorded from the Atlantic. It was collected off South Carolina, Blake Plateau, between 512 and 770 m (Pilsbry 1916; Newman & Ross 1971).
The specimen dredged by the *Jean Charcot* Expedition is similar to that described by Pilsbry (1916) and Newman & Ross (1971) except for the following characters: The shell has a pilose cuticle, the spur of the tergum is distally rounded, the mandible has an obtuse angle and the penis has setulae at the distal portion. These characters may be individual variations due the very few number of specimens described. Pilsbry (1916) described only one complete and three incomplete specimens, and herein I add another specimen. All of the other characters of the shell, opercular plates and cirri agree with the descriptions by Pilsbry (1916) and Newman & Ross (1971), including the details on the growth lines of the plates described by the latter.
The record of this species from the Azores greatly expands the distribution of *Hexelasma americanum* (Fig. 1). The depth range of this species is extended from 770 to 1235-1069 m.

TABLE 9. — Number of articles of cirri I-VI of *Hexelasma americanum* Pilsbry, stn 180. **I-VI**, cirri I to VI; **RC**, right cirri; **LC**, left cirri.

	I	II	III	IV	V	VI
RC	12/11	15/20	29/29	43/44	47/49	46/49
LC	13/13	13/24	16+/33	37/41	48/42	46/50

Family TETRACLITIDAE Gruvel, 1903
Genus *Tesseropora* Pilsbry, 1916

Tesseropora arnoldi n.sp.
(Figs 22-23)

? *Tetraclita squamosa* var. *elegans* – Baker 1967: 46 (not *T. squamosa elegans* Darwin,1854).

MATERIAL EXAMINED. — Holotype: stn P9, 1 broken specimen, rc: 0.7 mm, MNHN Ci 2520.
Paratypes: stn L9, 1 broken specimen, MNHN

Ci 2544. — Stn L11, 6 specimens, rc: 0.2-0.4 cm, MNHN Ci 2545, USNM 282803, MNRJ 8921. — Stn P29, 15 specimens, rc: 1.0-4.0 mm, MNHN Ci 2531, MNRJ 8922. — Stn 216, 5 empty shells, 0.3- 0.5 mm, MNHN Ci 2621.

ETYMOLOGY. — Named in honor of Dr Arnold Ross, in appreciation of his contributions to our knowledge of the Tetraclitoidea.

DIAGNOSIS

Shell and sheath white; radii incomplete; tubes irregular, radially lengthened, with striae on inner side of outer lamina. Scutum higher than wide, adductor ridge separated from articular ridge. Labrum hairy; three or four conspicuous teeth on each side of medial notch. Intermediate article of cirrus VI with four pairs of setae on anterior margin.

DESCRIPTION

Shell (Fig. 22A, B) conic, white, aperture smooth or little toothed, cuticle usually persistent, when present finely pilose. Plates with uniformly thin ribs, growth lines thin; alae developed, smooth; radii incomplete, best developed in lateral plate. Sheath (Fig. 22C) adpressed, well defined. Inner lamina with thin longitudinal striae in small specimens to well developed striated ribs over septa in larger ones. Tubes irregular, radially lenghtened, with striae on inner side of outer lamina. Base calcareous, thin.

Scutum (Fig. 22D) higher than wide, straight, growth lines conspicuous; articular and basal margins convex, occludent margin straight and toothed. Internally, adductor ridge thin, well developed, apical portion separated from articular ridge; articular ridge long, almost length of articular margin, articular groove shallow; rostral and lateral muscle depressor pits conspicuous, shallow, five rostral and lateral depressor crests, adductor muscle pit small, rounded, supramedial.

Tergum (Fig. 22E) elongated, with spur near basi-scutal angle, distal end rounded, curving continuously to basal margin; longitudinal furrow open and broad; six crests for depressor muscles prominent; articular ridge slightly prominent in upper portion.

Labrum (Fig. 23A) hairy; three or four conspicuous teeth on each side of shallow medial notch. Palp (Fig. 23B) club-shaped, large, with numerous fine pectinate setae on upper margin. Mandible (Fig. 23C) with five teeth, second to fourth with conspicuous subsidiary cusps, especially fourth; strongly denticulated between fourth and fifth and at lower angle. Maxilla I (Fig. 23D) with one or two large spines followed by a conspicuous notch, seven to nine moderate and five to seven small spines along cutting border; in notch small spines seldom present. Maxilla II (Fig. 23E) bilobed with long simple setae.

Cirrus I (Fig. 23F) with subequal rami, anterior twice length of posterior; posterior one with protuberant articles; articles of both rami covered by several long, simple, fine, pinnate setae. Cirrus II (Fig. 23G) with equal rami, articles protuberant, clothed with simple, fine pinnate setae; protopodite with plumose setae. Cirrus III (Fig. 23H) with anterior ramus 1.35 length of posterior, articles with numerous bipectinate setae, few simple and pinnate setae and multifid scales near setae (Fig. 23I-K); protopodite with plumose setae (Fig. 23L). Cirri IV-VI with rami of equal length. Intermediate article of cirrus VI (Fig. 23M) equidimensional, four pairs of setae on anterior margin, one to four simple setae on posterior angle. Penis short, annulated, with few setuale. Number of articles of cirri I-VI is presented in table 10.

TABLE 10. — Number of articles of cirri I-VI of *Tesseropora arnoldi* n.sp. (Holotype). **I-VI**, cirri I to VI; **RC**, right cirri; **LC**, left cirri.

	I	II	III	IV	V	VI
RC	9/6	6/6	10/8	16/15	13/15	16/17
LC	9/5	6/6	10/7	16/16	13/14	16/16

REMARKS

Tesseropora atlantica was previously the only species of this genus recorded from the Atlantic Ocean, having been reported from Bermuda and the Azores (Newman & Ross 1977) and on Saint Paul Rocks (Edwards & Lubbock 1983a, b). The description of Newman & Ross (1977) appears to be based exclusively on the Bermuda specimens, including all of their figures. But, in their

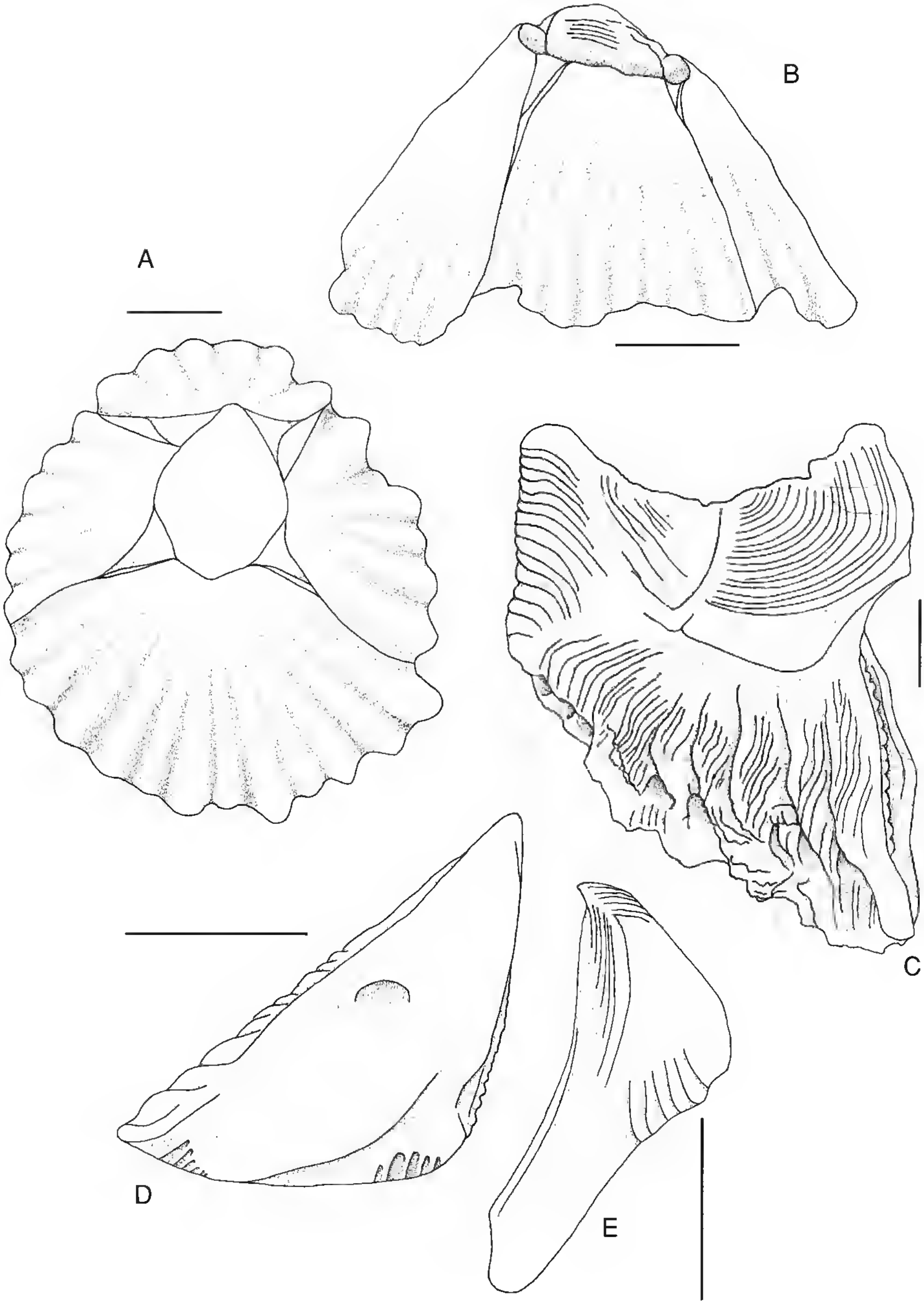

FIG. 22. — *Tesseropora arnoldi* n.sp. **A**, **B**, paratype (stn 216); **A**, top view; **B**, lateral view; **C**, **D**, holotype, **C**, lateral, internal view; **D**, **E**, scutum and tergum, internal view. Scale bars: 1 mm.

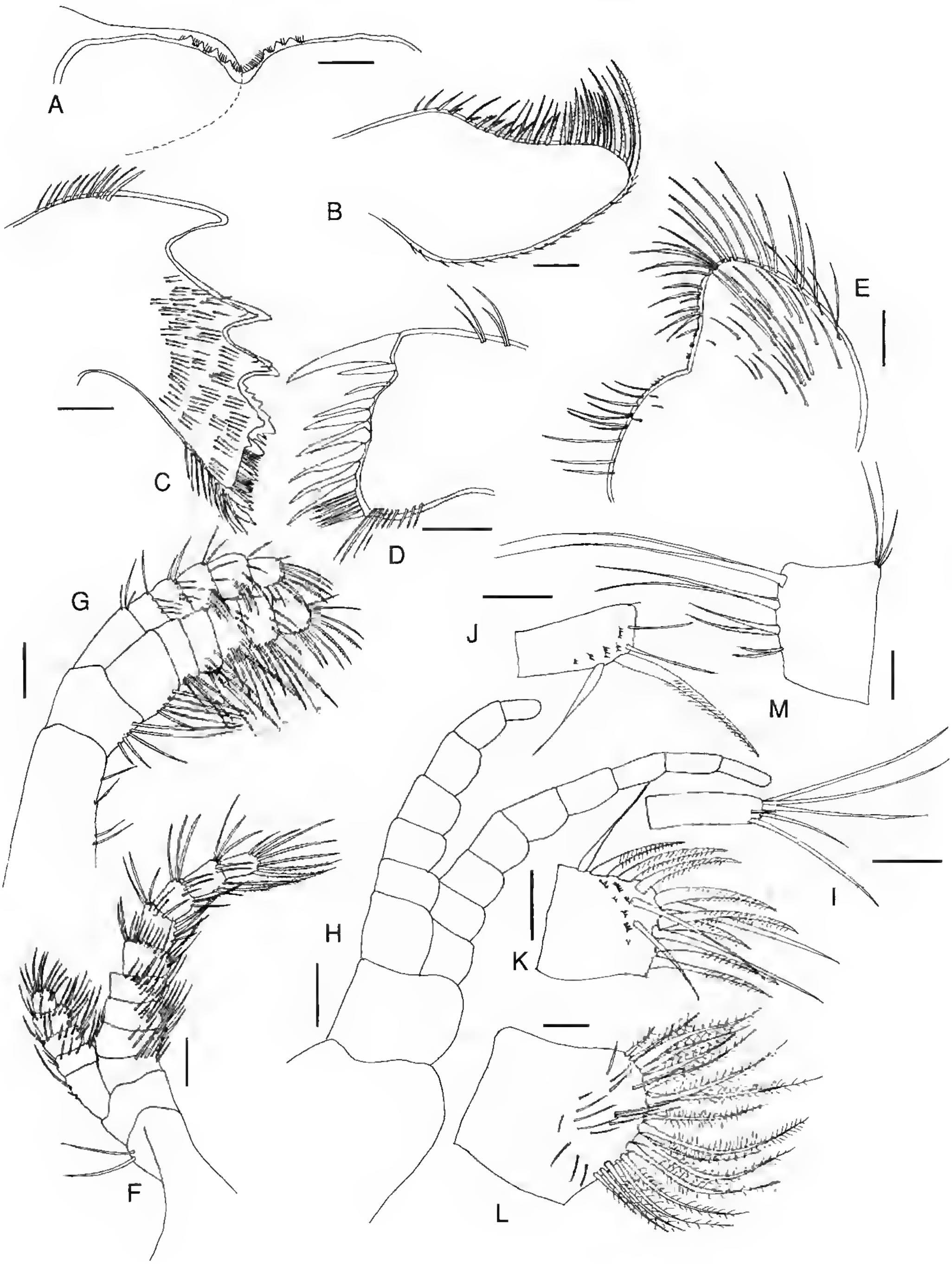

FIG. 23. — *Tesseropora arnoldi* n.sp. **A**, labrum and palp; **B**, palp; **C**, mandible; **D**, maxilla I; **E**, maxilla II; **F**, cirrus I; **G**, cirrus II; **H**, cirrus III; **I-K**, detail of articles of anterior ramus of cirrus III; **L**, detail of article of protopod of ramus III; **M**, intermediate article of cirrus VI. Scale bars: A-E, I-M, 0.05 mm; F-H, 0.1 mm.

material examined, they cite the specimens studied by Baker (1967) from the Azores.

The samples from the *Jean Charcot* Expedition show that the species of *Tesseropora* from the Azores is conspicuously distinct from that described from Bermuda. The inner lamina of the plates have ribs well developed continuously from the base to the sheath, intercalated by numerous fine ribs, instead of only small numerous fine ribs. The adductor ridge of the scutum is removed from the articular ridge, whereas *T. atlantica* has the adductor ridge continuous with the articular ridge. The labrum has conspicuous teeth on the crest, contrary to the lack of teeth in *T. atlantica*. The articles of cirrus III have multifid scales and no curved spines or denticles on the anterior margin. The intermediate articles of cirrus VI have only four pairs of paired setae, instead of five pairs as in *T. atlantica*.

The specimens examined are smaller than those observed by Newman & Ross (1977); most are about 5 mm in carino-rostral diameter and only one specimen is 7 mm.

Tesseropora arnoldi n.sp. can be distinguished from Pacific *Tesseropora* [*T. rosea* (Krauss) and *T. wireni* (Nillson-Cantell)], by the color of the sheath, the development of the radii and the parietal tubes and the structure of the cirri. *Tesseropora rosea* has the sheath dirty white tinted pink; the radii are moderately wide, and the intermediate articles of cirrus VI have three pairs of setae and numerous short setae in dense bunches below the two major pairs (Newman & Ross 1977). *T. wireni* has the sheath usually pink; the parietal tubes are divided into secondary and tertiary rows basally, and the intermediate articles of cirrus VI have three pairs of setae and a few short setae in dense bunches below the two major pairs (Newman & Ross 1977).

Tesseropora arnoldi n.sp. was collected intertidally to about 25 m depth, usually attached to *Megabalanus azoricus* and mollusc shells. Several samples were taken in the Azores in intertidal and shallow waters, but the species was not common in these samples. It was collected only on Faial and São Miguel Islands. All the dissected specimens were incubating nauplii. Baker (1967) observed that *Tetraclita squamosa* var. *elegans* Darwin (? = *T. arnoldi* n.sp.) was "very abundant in a single situation at Urzelina in 1 m. of water" at São Jorge Island.

Family BALANIDAE Leach, 1817
Genus *Balanus* Da Costa, 1778

Balanus trigonus Darwin, 1854

Balanus trigonus Darwin, 1854: 223, pl.3, fig. 7a-f. – Pilsbry 1916: 111, pl. 26, figs 1-13e (synonymy). – Baker 1967: 47.

MATERIAL EXAMINED. — Stn L8, 1 specimen, MNHN Ci 2542. — Stn P3, 1 specimen, MNHN Ci 2508. — Stn P4, 1 specimen, MNHN Ci 2510. — Stn P6, 31 specimens, MNHN Ci 2512. — Stn P7, > 170 specimens, MNHN Ci 2514, MNRJ 8923. — Stn P8, shells fragments, MNHN Ci 2517. — Stn P9, 5 empty shells, MNHN Ci 2519. — Stn P14, 31 specimens, MNHN Ci 2524. — Stn P15, 10 specimens, MNHN Ci 2546. — Stn P17, 25 specimens, MNHN Ci 2652. — Stn P29, 2 specimens, MNHN Ci 2530. — Stn P34, 1 specimen, MNHN Ci 2533. — Stn P41, 6 specimens, MNHN Ci 2661. — Stn 1, more than 160 specimens, MNHN Ci 2548, MNRJ 8924. — Stn 10, 5 empty shells, MNHN Ci 2552. — Stn 11, 2 empty shells, MNHN Ci 2553. — Stn 60, 8 empty shells, MNHN Ci 2557. — Stn 143, more than 100 specimens, MNHN Ci 2574.

REMARKS

Balanus trigonus has a world-wide distribution, and is widespread in the Eastern Atlantic, occurring from the Mediterranean African coast to South Africa (Stubbings 1967). It was previously recorded from the Azores by Baker (1967) and Young (in press).

Genus *Megabalanus* Hoek, 1913

Megabalanus azoricus (Pilsbry, 1916)

Balanus tintinnabulum azoricus Pilsbry, 1916: 62, figs 8, 11c, pl. 12, figs 2-2b. – Baker 1967: 46.

Megabalanus azoricus – Newman & Ross 1976: 67. – Henry & McLaughlin 1986: 21, figs 1a, 3d-e, 6a-d.

MATERIAL EXAMINED. — Stn L9, 10 specimens, rc: 0.4-2.7 cm, MNHN Ci 2543, MNRJ 8925. — Stn P7, 3 specimens, rc: 1.6-2.8 cm, MNHN

Ci 2515. — Stn P38, 7 specimens, rc: 2.8-3.8 cm, MNHN Ci 2534, MNRJ 8926. — Stn P41, 2 specimens, rc: 2.9 cm, MNHN Ci 2535. — Stn 186, more than 50 empty shells, rc: 0.5-3.5 cm, MNHN Ci 2602. — Stn 216, 1 empty shell, rc: 3.1 cm, MNHN Ci 2620.

REMARKS

The wall and opercular plates of *M. azoricus* were redescribed by Henry & McLaughlin (1986) who reported it from the Azores and St. Helena Island. The type locality of this species is Terceira Island (Pilsbry 1916), but it is also reported from São Jorge Island (Baker 1967). The *Jean Charcot* sampled this species from the Faial and São Miguel Islands and, also, off Santa Maria Island. Therefore, this species appears to be well distributed in the Azores Archipelago, from the intertidal to infralittoral zones. The record from 80-90 m off Santa Maria Island is based on one empty eroded shell, which probably fell down to this depth.

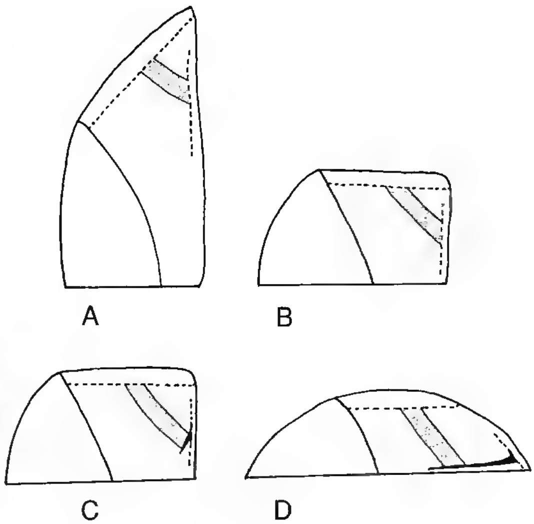

FIG. 24. — Schematic representation of the relative position of the opercular plates and size of the adductor ridge of selected genera of Verrucidae, viewed from rostral side. **A**, *Altiverruca*; **B**, *Newmaniverruca* n.g.; **C**, *Metaverruca*; **D**, *Verruca* s.s.

THE GENERIC REVISION OF THE VERRUCIDAE
(Figs 24-25)

REMARKS

Pilsbry (1916) proposed four sections to separate the genus *Verruca*, i.e., *Metaverruca*, *Verruca*, *Cameraverruca* and *Altiverruca*. He also described four species groups in the *Verruca* section, *viz*: group of *V. stroemia*, *V. alba*, *V. nexa* and *V. calotheca*. All of the characters in this arrangement were based almost wholly on the structure of the shell. He also included some differences on the relative lengths of the rami of cirri I to III.

All of Pilsbry's sections have subsequently been accorded generic status (Zevina 1978), and the following genera *Rostratoverruca* Broch, 1922, *Brochiverruca* Zevina, 1993b and *Spongoverruca* Zevina, 1987a have been added to the Verrucidae (Broch 1931; Zevina 1987a, 1993b; Buckeridge 1994). *Rostratoverruca* encompasses the *V. nexa* group recognized by Pilsbry (1916).

Young (in press) questions the validity of the genus *Metaverruca*, since many of its diagnostic characters are present in other genera. Additionally the presence of a myophore, the most used feature to characterize this genus, is also well developed in *V. stroemia*, the type species of *Verruca*.

Buckeridge (1997) recognized the problem of the myophore as a diagnostic character, but proposed maintaining the genus, and added new characters for the diagnosis. Besides the thickened basal ledge, the well developed myophore, and the top flattened as described by Pilsbry (1916), he added the box-like shape of the shell, and a D-shaped orifice as diagnostic for this genus.

The greatest problem defining the genera within the Verrucidae is the diagnosis of *Verruca* s.str. Pilsbry (1916) diagnosed this genus as "Top flattened, the plane of the movable plates not far from parallel with that of the base; radio-alar area between parieties of fixed scutum and tergum small and linear". Buckeridge (1994) defined this genus as "Verrucids with apices of rostrum and carina marginal; fixed scutum without myophore; operculum parallel to base." The diagnosis of Buckeridge (1994: 90) is in error when he cites the absence of a myophore since *V. stroemia*, type species of *Verruca*, has a well developed myophore, as do several other *Verruca* species.

With the reassignment of many species of *Verruca* s.l. to other genera (*Metaverruca*, *Rostratoverruca*, *Cameraverruca*, etc.), the species which remain in *Verruca* s.s. do not appear to be closely related. In studying the shell characters of several species of *Verruca* s.s., two transformation series can be observed.

The first transformation series is based on the shape of the shell and the development of the myophore[2] (Fig. 24). The first stage of development is attained in the species of *Altiverruca*. This is characterized by a steep shell with the opercular plates nearly parallel to the fixed scutum and tergum (Fig. 24A). The adductor muscles are attached directly to the inner side of the wall, without the scutum lacking an adductor ridge and also with a poorly developed adductor pit.

If we compare this pattern with an outgroup reference, the lepadomorphs, this character can be considered plesiomorphic in the verrucids. Both scuta of the lepadomorphs are usually parallel, and fail to develop an adductor ridge.

Considering the steep pattern of *Altiverruca* as plesiomorphic, an evolutionary trend can be vizualized when the shell becomes more inclined and flatter, which implies a change in the relative position between the movable scutum and fixed-scutum: The angle between these plates enlarges from narrowly acute to a right angle (Fig. 24A, B). The change in position of these plates also necessitates a change in the attachment of the adductor muscle. The development of the adductor ridge ranges from a small low ridge to a projecting tongue-myophore (e.g. *V. stroemia*; Fig. 24C, D). The development of an adductor ridge makes it possible to maintain the same area for muscle fixation.

The other transformation series is in the development of the secondary ridges on the rostrum and the carina, directed toward the opercular valves. The supposedly plesiomorphic position of the umbos is marginal (apical), with a linear hinge line between the movable opercular valves and the rostrum-carina, as can be observed in basal

2. Sometimes, it is difficult to define the limits between "adductor ridge" and "myophore". The myophore is defined as a "tongue-shaped adductor ridge" (Pilsbry 1916: 21).

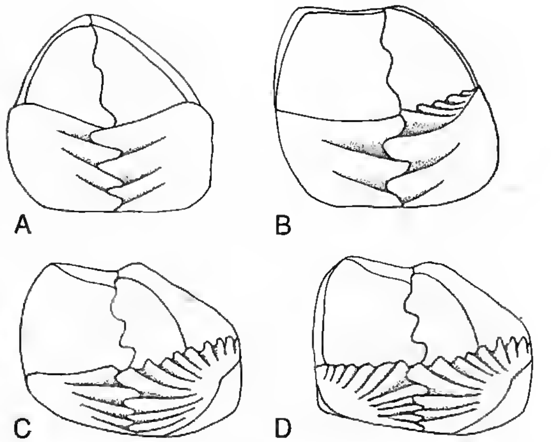

Fig. 25. — Schematic representation of the rostra and carina ridges of selected genera of Verrucidae, viewed from rostro-carinal side. **A**, *Newmaniverruca* n.g.; **B**, *Costatoverruca* n.g.; **C**, *Rostratoverruca*; **D**, *Brochiverruca*.

pedunculates (Fig. 25A). This stage is seen in several species included in *Verruca* s.l. (e.g. *V. entobapta*, *V. albatrossiana*, *V. scrippsae*).

The secondary ridges are first developed on the rostrum, beginning at the umbo and moving up to the scutum basis (Fig. 25B). This state is also seen in some species of *Verruca* s.l. (*V. alba*, *V. xanthia*, *V. floridana*). The umbo of the rostrum is displaced from the margin (Fig. 25C). The species with this state comprise the genus *Rostratoverruca*. Subsequently, the umbo of the carina is also displaced from the margin (Fig. 25D), which is representative of the species of *Brochiverruca*.

Based on these considerations, I propose dividing *Verruca* into three genera: *Newmaniverruca* n.g., *Costatoverruca* n.g. and *Verruca* s.s. *Newmaniverruca* n.g. contains the box-like species with the opercular plates nearly parallel to the basis, with marginal umbos of rostrum and carina, without any secondary ridges and without a myophore. *Costatoverruca* n.g. encompasses the box-like species with the opercular plates nearly parallel to the basis, secondary ridges developed on the rostrum, and rarely with an adductor ridge or myophore. *Verruca* s.s. contains the derived species with the shell flattened, the opercular valves parallel, and the myophore strongly developed.

Therefore, *Metaverruca* is redefined to include the box-like species with a well developed myophore, without secondary ridges on the fixed rostrum. Also, the adults develop a ledge at the base of the wall.

The genus *Spongoverruca* was described to isolate *V. spongicola*, which lives in sponges. Gruvel (1911, 1912b) presented a short description with no diagnostic character that allows the separation of this species in a new genus, appart from being the only species occurring in sponges. The perpendicular position of the opercular valves in relation to the basis mandates inclusion of this species in *Altiverruca*. Although Buckeridge (1994: 89) questioned the validity of this genus, I consider *Spongoverruca* as a synonym of *Altiverruca*.

Broch (1931: 45) presented the name *Eu-verruca* as a subgenus of *Verruca* to separate in the following way *Verruca* s.str. from the other subgenera he described. He justified this new name due to "The central group of the genus is better marked by fixing the prefix Eu- to the genus name than using the latter alone; this may serve to bring confusion about." Therefore *Euverruca* is an objective synonym of *Verruca*.

Key to the genera of the family Verrucidae

1a. Form erect; opercular plates perpendicular to base; without adductor ridge or myophore on fixed-scutum .... *Altiverruca*
1b. Form not erect; opercular plates at no more than 45° to base; with or without adductor ridge or myophore on fixed-scutum 2

2a. Fixed tergum and rostrum medially expanded, forming internal partitioned cavities; opercular plates 45° to base; with adductor ridge on movable scutum .... *Cameraverruca*
2b. Fixed tergum and rostrum not medially expanded, without internal cavities; opercular plates less than 45° to base; without adductor ridge on movable scutum 3

3a. Shell box-like; opercular plates proportionally large, their width one half or more the width of shell; with or without myophore 4
3a. Shell flattened; opercular plates proportionally small, their width less than one half the width of shell; with a strong myophore .... *Verruca*

4a. Umbo of rostrum and carina marginal 5
4b. Umbo of rostrum not marginal, umbo of carina marginal or displaced from margin 6

5a. Rostrum without secondary ridges directed toward tergal base; without myophore; basal margin of shell not thickened .... *Newmaniverruca* n.g.
5b. Rostrum with secondary ridges; with or without myophore; basal margin of shell not thickened .... *Costatoverruca* n.g.
5c. Rostrum without secondary ridges directed toward tergal base; with myophore; basal margin of shell thickened .... *Metaverruca*

6a. Umbo of rostrum displaced from margin .... *Rostratoverruca*
6b. Umbo of rostrum and carina displaced from margin .... *Brochiverruca*

Genus *Altiverruca* Pilsbry, 1916

Verruca Section D: *Altiverruca* Pilsbry, 1916: 40.

Verruca (*Altiverruca*) – Broch 1931: 45. – Foster 1978: 68.

Altiverruca – Zevina 1987a: 1813. – Buckeridge 1994: 92.

Spongoverruca Zevina, 1987a: 1813.

TYPE SPECIES. — *Verruca hoeki* Pilsbry, 1907a, by original designation (Pilsbry, 1916: 40), Recent, Anegada Passage, 18°30'N - 63°31'W, 496 fathoms.

SPECIES INCLUDED. — *A. gibbosa* (Hoek, 1883), *A. incerta* (Hoek, 1883), *A. nitida* (Hoek, 1883), *A. quadrangularis* (Hoek, 1883), *A. obliqua* Hoek, 1883, *A. sulcata* (Hoek, 1883), *A. crenata* (Aurivillius, 1898), *A. costata* (Aurivillius, 1898) n. comb. (?= *A. gibbosa*), *A. inermis* (Aurivillius, 1898) n. comb., *A. erecta* (Gruvel, 1900b), *A. longicarinata* (Gruvel, 1900b), *A. cristallina* (Gruvel, 1907), *A. plana* (Gruvel, 1907), *A. mitra* (Hoek, 1907b) (= *A. gibbosa*), *A. darwini* (Pilsbry, 1907a) (= *A. gibbosa*), *A. hoeki* (Pilsbry, 1907a) (= *V. quadrangularis*), *A. joubini* (Gruvel, 1912a), *A. cassis* (Hoek, 1913) (= *A. cristallina*), *A. casula* (Hoek, 1913), *A. navicula* (Hoek, 1913), *A. bicornuta* (Pilsbry, 1916) (= *A. gibbosa*), *A. rathbuniana* Pilsbry, 1916 (= *A. gibbosa*), *A. cristallina laevis* (Broch, 1922) (= *V. cristallina*), *A. ornata* Nilsson-Cantell, 1929, *A. regularis* Nilsson-Cantell, 1929, *A. gibbosa somaliensis* (Nilsson-Cantell, 1929) (= *A. gibbosa*), *A. allisoni* (Rao *et* Newman, 1972), *A. aves* (Zevina, 1975), *A. angustiterga* Zevina, 1987a, *A. galapagosa* Zevina, 1987a, *A. gira* (Zevina, 1987b), *A. sculpturata* Zevina, 1987a, *A. sublima* Zevina, 1987a, *A. longa* Zevina, 1988, *A. tchesunovi* Zevina, 1988, *A. vitrea* Zevina, 1988, *A. galkini* Zevina, 1990, *A. mollae* Zevina, 1990, *A. beringiana* Zevina *et* Galkin, 1992, *A. laeviscuta* Buckeridge, 1994, *A. vertica* Foster *et* Buckeridge, 1995a (= *A. obliqua*) and *A. spongicola* (Gruvel, 1911) n. comb.

DIAGNOSIS

Form erect; opercular plates erect, perpendicular to base; fixed scutum without adductor ridge or myophore; suture between rostrum and carina from linear to imbricate; bases of plates not inflected.

REMARKS

In this genus I include *V. inermis* Aurivillius, 1898, which is described in detail by Gruvel (1920). Its steep pattern of growth, poorly developed imbricating suture between the rostrum and the carina places this species in *Altiverruca*. Due to the placement of *Spongoverruca* as a junior subjective synonym of *Altiverruca*, I have also included *Spongoverruca spongicola* (Gruvel, 1911).

Genus *Cameraverruca* Pilsbry, 1916

Verruca Section C: *Cameraverruca* Pilsbry, 1916: 39.

Verruca (*Cameraverruca*) – Foster 1978: 68.

Cameraverruca – Zevina 1987a: 1813. – Buckeridge 1994: 103.

TYPE SPECIES. — *Verruca euglypta* Pilsbry, 1907a, by original designation (Pilsbry, 1916: 39), Recent, off Fernandina, Florida, 30°44'N, 79°26'W, 440 fathoms.

SPECIES INCLUDED. — *C. euglypta* Pilsbry, 1907a, *C. nodiscuta* Buckeridge, 1994.

DIAGNOSIS

Form with opercular plates forming angle of 45° with base; apical cavities of fixed tergum and rostrum partitioned off, forming recesses of general body cavity. Movable scutum with adductor ridge.

Genus *Newmaniverruca* n.g.

Verruca Section B: *Verruca*, Group of *Verruca alba* Pilsbry, 1916: 25 (in part).

Verruca Section B: *Verruca*, Group of *Verruca calotheca* Pilsbry, 1916: 30 (in part).

Verruca (*Verruca*) – Foster 1978: 68 (in part). – Zevina 1987a: 1812 (in part). – Buckeridge 1994: 90 (in part).

TYPE SPECIES. — *Verruca albatrossiana* Pilsbry, 1912; Recent, east of Luzon, Philippines, 310 fathoms.

SPECIES INCLUDED. — *N. imbricata* (Gruvel, 1900b), *N. radiata* (Gruvel, 1901), *N. multicostata* (Gruvel, 1907), *N. albatrossiana* (Pilsbry, 1912), *N. barbadensis* (Pilsbry, 1916), *N. entobapta* (Pilsbry, 1916), *N. flavidula* (Pilsbry, 1916), *N. grex* (Hoek, 1913) (= *N. albatrossiana*) and, *N. scrippsae* (Zullo, 1964).

ETYMOLOGY. — Named in honor of Dr William A. Newman, who is largely responsible for my studies on cirripeds, and for his interesting discussions about barnacles.

Diagnosis

Form box-like, opercular plates parallel or almost parallel with base; umbo of carina and rostrum marginal, without secondary ridges and myophore.

Remarks

The species *N. albatrossiana* (Pilsbry, 1912) is designated herein as the type species of *Newmaniverruca* n.g. because it is the first well recognised species. The species described by Gruvel (*N. imbricata*, *N. radiata*, and *N. multicostata*) are too briefly described and have not been collected again (Gruvel 1900b, 1901, 1907).

I am assigning specific status to the subspecies of *calotheca* and *alba*, because many of these subspecies become separated at the generic level (*Newmaniverruca* n.g. and *Costatoverruca* n.g.) in the classification formulated here. The species described by Gruvel are tentatively included in this genus by the absence of the secondary ridges on the rostrum; no information was cited on the internal surface of the fixed-scutum.

Key to species :

1a. Shell with conspicuous radial ridges directed toward the base of the plates 2
1b. Shell without radial ridges on the plates, only those directed to the rostrum-carina articulation 3

2a. Rostral area of scutum smooth; carina smaller than rostrum .... *N. multicostata* (Gruvel)
2b. Rostral area of scutum transversely grooved; carina larger than rostrum .... *N. albatrossiana* (Pilsbry)

3a. Opercular plates nearly parallel with base of shell 4
3b. Opercular plates forming an angle with base of shell .... *N. flavidula* (Pilsbry)

4a. Tergum with three articular ridges .... *N. barbadensis* (Pilsbry)
4b. Tergum with four articular ridges 5
4c. Tergum with five articular ridges .... *N. imbricata* (Gruvel)

5a. Scutum with three articular ridges .... *N. scrippsae* (Zullo)
5b. Scutum with four articular ridges 6

6a. All four articular ridges well developed .... *N. entobapta* (Pilsbry)
6b. Only the two lower articular ridges well developed .... *N. radiata* (Gruvel)

Genus *Costatoverruca* n.g.

Verruca Section B: *Verruca*, Group of *Verruca alba* Pilsbry, 1916: 25 (in part).

Verruca Section B: *Verruca*, Group of *Verruca calotheca* Pilsbry, 1916: 30 (in part).

Verruca (*Verruca*) – Foster 1978: 68 (in part). – Zevina 1987a: 1812 (in part). – Buckeridge 1994: 90 (in part).

Type species. — *Verruca alba* Pilsbry, 1907a; Recent, Straits of Florida, 24°25'45"N - 81°46'45"W, 45 fathoms.

Species included. — *C. cornuta* (Aurivillius, 1898), *C. alba* (Pilsbry, 1907a), *C. calotheca* (Pilsbry, 1907a), *C. grimaldi* (Gruvel, 1912a), *C. caribbea* (Pilsbry, 1916), *C. heteropoma* (Pilsbry, 1916), *C. floridana* (Pilsbry, 1916), *C. xanthia insculpta* (Pilsbry, 1916), *C. xanthia* (Pilsbry, 1916), *C. niasiensis*

(Nilsson-Cantell, 1929), *C. pacifica* (Buckeridge, 1994), and *C. sinuosa* (Foster *et* Buckeridge, 1995b).

ETYMOLOGY. — from the Greek *costata* (ridge), referring to the presence of secondary ridges on the rostrum.

DIAGNOSIS

Form box-like, opercular plates parallel or almost parallel with base; umbo of carina and rostrum marginal, rostrum with secondary ridges, seldom on carina; with pit for adductor muscle, usually adductor ridge or myophore.

REMARKS

C. alba (Pilsbry, 1907a) is designated as the type species of *Costatoverruca* n.g. because it is the first species described and illustrated. Aurivillius (1898) presented a brief description of *V. cornuta*, with no illustrations.

The species *C. cornuta* and *C. pacifica* were previously included in *Metaverruca* due to the presence of the myophore (Buckeridge 1994; Young in press), but both species have well developed secondary ridges on the rostrum, the diagnostic feature of *Costatoverruca* n.g.

KEY TO SPECIES :

1a. Rostral area of scutum smooth 2
1b. Rostral area of scutum with longitudinal ridges 3

2a. Scutum with two thin articular ridges; tergum with four articular ridges .... *C. grimaldi* (Gruvel)
2b. Scutum with three articular ridges, only the axial thin; tergum with three articular ridges .... *C. xanthia* (Pilsbry)
2c. Scutum and tergum with only a minute axial ridge .... *C. sinuosa* (Foster *et* Buckeridge)

3a. Tergum with three articular ridges 4
3b. Tergum with four or more articular ridges 7

4a. Well developed myophore present 5
4b. Myophore absent 6

5a. Scutum smaller than tergum; fixed-scutum with a well developed upper triangular area .... *C. cornuta* (Aurivillius)
5b. Scutum larger than tergum; without upper triangular area .... *C. xanthia insculpta* (Pilsbry)

6a. Caudal appendage with twenty-three articles, more than three times length of protopod .... *C. floridana* (Pilsbry)
6b. Caudal appendage with fourteen articles, 1.5 times length of protopod .... *C. heteropoma* (Pilsbry)

7a. Carina without secondary ridges; caudal appendage twice or less the length of protopod 8
7b. Carina with secondary ridges; caudal appendage more than 2.5 times length of protopod .... *C. alba* (Pilsbry)

8a. Interlocking ridges of carina and rostrum subequal 9
8b. Interlocking ridges of carina and rostrum conspicuously larger in the upper portion 10

9a. Cirri I and II with anterior about one third length of posterior rami; caudal appendage with twenty-seven articles .... *C. caribbea* (Pilsbry)
9b. Cirrus I and II with rami of nearly equal length; caudal appendage with twenty-one articles .... *C. niasiensis* (Nilsson-Cantell)

10a. Articular margins of scutum and tergum, in internal view, sinuous; caudal appendage with fourteen articles, slightly longer than protopod .... *C. calotheca* (Pilsbry)
10b. Articular margins of scutum and tergum, in internal view, essentially straight, with only one tooth above; caudal appendage with 24-26 articles, more than twice length of protopod .... *C. pacifica* (Buckeridge)

Genus *Rostratoverruca* Broch, 1922

Verruca Section B: *Verruca*, Group of *V. nexa* Pilsbry, 1916: 29.

Verruca Section *Rostratoverruca* Broch, 1922: 298.

Verruca (*Rostratoverruca*) – Broch 1931: 46. – Foster 1978: 68.

Rostratoverruca – Zevina 1987a: 1813. – Buckeridge 1994: 118.

TYPE SPECIES. — *Verruca nexa* Darwin, 1854, by subsequent designation Zevina (1987a: 1813); Recent, West Indies, on a gorgonian.

SPECIES INCLUDED. — *R. nexa* (Darwin, 1854), *R. koehleri* (Gruvel, 1907), *R. conchula minor* (Hoek, 1913), *R. intexta* (Pilsbry, 1912), *R. conchula* (Hoek, 1913) (= *R. intexta*), *R. nexa multiradiata* (Nilsson-Cantell, 1921), *R. kruegeri* (Broch, 1922), *R. kruegeri multisculpta* (Hiro, 1933), *R. murrayi* (Stubbings, 1936) (= *R. intexta*), *R. sewelli* (Stubbings, 1936), and *R. malevichi* Zevina, 1988.

DIAGNOSIS

Form box-like, opercular plates parallel with base; umbo of carina marginal; umbo of rostrum displaced from margin; myophore absent.

Genus *Brochiverruca* Zevina, 1993b

Brochiverruca Zevina, 1993b: 9. – Buckeridge 1994: 105.

TYPE SPECIES. — *Verruca dens* Broch, 1931, by original designation (Zevina 1993b); Recent, Key Islands, 05°46'S - 132°51'E, 348 meters, on a Madreporarian coral.

SPECIES INCLUDED. — *B. dens* (Broch, 1931), *B. margulisae* Zevina, 1993b, and *B. polystriata* Buckeridge, 1994.

DIAGNOSIS

Form box-like, opercular plates parallel with base; umbo of carina and rostrum displaced from margin; myophore absent.

Genus *Metaverruca* Pilsbry, 1916

Verruca Section A: *Metaverruca* Pilsbry, 1916: 21.

Verruca (*Metaverruca*) – Broch 1931: 41. – Foster 1978: 68.

Metaverruca – Zevina 1987a: 1812. – Buckeridge 1994: 108.

TYPE SPECIES. — *Verruca coraliophila* Pilsbry, 1916, by original designation; Recent, between Bahamas and Cape Fear (see Pilsbry 1916: 22, footnote).

SPECIES INCLUDED. — *M. recta* (Aurivillius, 1898), *M. sculpta* (Aurivillius, 1898) (= *M. recta*), *M. aequalis* (Aurivillius, 1898), *M. linearis* (Gruvel, 1900b) (= *M. recta*), *M. trisulcata* (Gruvel, 1900b), *M. striata* (Gruvel, 1900b) (= *M. trisulcata*), *M. magna* (Gruvel, 1901) (= *M. recta*), *M. halotheca* (Pilsbry, 1907b) (= *M. recta*), *M. capsula* (Hoek, 1913) (= *M. recta*), *M. coraliophila* (Pilsbry, 1916) (= *M. recta*), *M. corrugata* (Broch, 1931), *M. macuni* (Stubbings, 1936), *M. tarasovi* (Zevina, 1971), *M. lepista* (Zevina, 1987b), *M. seriola* (Zevina, 1987b), *M. pallida* Zevina, 1990, *M. defayeae* Buckeridge, 1994, *M. norfolkensis* Buckeridge, 1994, *M. plicata* Buckeridge, 1994, and *M. reunioni* Foster *et* Buckeridge, 1995b.

Diagnosis

Form box-like, opercular plates parallel with base; umbo of carina and rostrum marginal, without secondary ridge; myophore well developed, basal margin of plates enlarged, sometimes fused.

Key to species :

1a. Shell with conspicuous radial ridges 2
1b. Shell without radial ridges 4

2a. Numerous fine radial ridges, with eleven or more ridges on each plate 3
2b. Few large radial ridges, with ten or fewer ridges on each plate .... *M. trisulcata* (Gruvel)

3a. Caudal appendage with seven articles, shorter than protopod .... *M. corrugata* (Broch)
3b. Caudal appendage with twenty-seven articles, more than twice length of protopod .... *M. plicata* Buckeridge

4a. Opercular valves with or without a barely defined articular ridge 5
4b. Opercular valves with at least one articular ridge conspicuous 6

5a. Opercular plates small in relation to the shell, carina and rostrum with a straight articulation .... *M. pallida* Zevina
5b. Opercular plates large in relation to the shell, carina and rostrum with a single large articular ridge .... *M. reunioni* Foster *et* Buckeridge

6a. Opercular plates nearly parallel with the base of the wall 7
6b. Opercular plates forming a distinct angle with the base of the wall 12

7a. Tergum with three articular ridges 8
7b. Tergum with four articular ridges 9

8a. Shell smooth; carina and rostrum apical margins straight .... *M. recta* (Aurivillius)
8b. Shell with grooves between the opercular valves ridges; carina and rostrum margins concave .... *M. aequalis* (Aurivillius)

9a. Scutum with three articular ridges 10
9b. Scutum with four articular ridges 11

10a. Rostrum and carina articulation with three ridges; radii-process of fixed scutum small .... *M. macani* (Stubbings)
10b. Rostrum and carina articulation with four ridges; radii-process of fixed scutum large .... *M. tarasovi* (Zevina)

11a. Rostrum and carina articulation with as many as three ridges; mandible with five teeth .... *M. defayeae* Buckeridge

11b. Rostrum and carina articulation with as many as five ridges; mandible with three teeth .... *M. norfolkensis* Buckeridge

12a. Scutum with a beaked apex; caudal appendage with six articles .... *M. lepista* (Zevina)
12b. Scutum with an obtuse apex; caudal appendage with eleven articles .... *M. seriola* (Zevina)

Genus *Verruca* Schumacher, 1817

Verruca Schumacher, 1817: 35. – Darwin 1854: 496 (in part).

Verruca Section B: *Verruca*, Group of *V. strömia* Pilsbry, 1916: 23.

Verruca (*Eu-Verruca*) Broch, 1931: 45.

Verruca (*Verruca*) – Foster 1978: 68 (in part). – Zevina 1987a: 1812 (in part). – Buckeridge 1994: 90 (in part).

TYPE SPECIES. — *Lepas stroemia* Müller, 1776, by monotypy; Recent, no locality (Schumacher, 1817: 91).

SPECIES INCLUDED. — *V. stroemia* (Müller, 1776); *V. spengleri* Darwin, 1854; *V. laevigata* (Sowerby, 1827), and *V. cookei* Pilsbry, 1927.

DIAGNOSIS
Form depressed, opercular plates parallel with base, proportionately small; umbo of carina and rostrum marginal, without secondary ridge; myophore well developed, projecting parallel to base.

KEY TO SPECIES :

1a. Movable scutum with adductor ridge 2
1b. Movable scutum without adductor ridge 3

2a. Caudal appendage with nine articles, one half length of cirrus VI .... *V. spengleri* Darwin
2b. Caudal appendage with eleven articles, two third length of cirrus VI .... *V. cookei* Pilsbry

3a. Width of scutum less than its length, the second articular ridge narrower than the first articular ridge .... *V. stroemia* Müller
3b. Width of scutum more than its length, the second articular ridge broader than the first articular ridge .... *V. laevigata* Sowerby

THE AZORES FAUNA

Including the species reported herein and those of previous studies on the Azores Region (Hoek 1883; Aurivillius 1898; Gruvel 1900a, b, 1902a, 1920; Pilsbry 1916; Zevina 1976; Baker 1967; Newman & Ross 1977; Young in press) there are a total of sixty-one taxa in this region. Twelve of these taxa are considered synonymous, *viz*: *S. edwardsi* and *S. alboranense* (= *Neoscalpellum debile*), *S. erectum* and *S. velutinum* (= *Arcoscalpellum michelottianum*), *S. striatum* (= *Amigdoscapellum rigidum*), *S. molle* (= *Trianguloscalpellum regium*), *S. gigas* Gruvel, 1902 (= *Trianguloscalpellum ovale*, not *S. gigas* Hoek), *V. sculpta* and *V. linearis* (= *Metaverruca recta*), *S. vitreum* Zevina, 1976 (= *S. rigidum*); *T. squamosa elegans* Baker, 1967, and *Tesseropora atlantica* Newman *et* Ross, 1977 (part, specimens from Azores) (= *Tesseropora arnoldi* n.sp.).

Within the remaining fifty-one species, four records are probably misidentifications by Gruvel (1905, 1920): *V. stroemia*, *B. amphitrite*, *B. spongicola* and *B. crenatus*: *Verruca stroemia* and *B. crenatus* are northern shallow water species and were only recorded once from the Azores Region. *Balanus amphitrite* and *B. spongicola* have not been recorded again since Gruvel (1905, 1920).

The species of *Poecilasma* are poorly defined and, therefore, there is the possibility that the three species recorded are synonymous. Two species, *P. aurantia* and *P. crassum*, are definitely known in this region. The list of species is, therefore, reduced to forty-five, which includes twenty-eight lepadomorphs, eleven verrucomorphs and six balanomorphs (Appendix 2).

The endemism of the Azores appears to be high, fourteen species (31%). Three species occur in the Azores and Madeira Islands, and Great Meteor Bank, which gives an endemism of this larger area to 38%. Furthemore, four species occur at the Iberian Basin, with records also off the Iberian Peninsula and Morocco coast, which expands the endemism ratio to 47%. The remaining species usually have a Northeastern Atlantic distribution or greater (Appendix 2). The Azores fauna does not share any species with Tropical Africa.

Conversely, it is interesting to note the low species richness in shallow waters (less than 200 m). *Tesseropora arnoldi* and *M. azoricus* are endemic to the Azores, *V. spengleri* occurs also in Madeira. *Chthamalus stellatus* is recorded along the European and North African coasts and *B. trigonus*, which has a world-wide distribution, may have been recently introduced to the Atlantic (Zullo 1992).

In the Northeastern Atlantic the deep sea species are reasonably well sampled along the Azores-Madeira-Great Meteor area (Iberian and Canary Basins) and the North Sea (Norwegian Basin) but they are still poorly sampled in the West European Basin.

The deep sea faunas of the Norwegian Basin and of the Iberian/Canarian Basins do not share any common species, except for *Scalpellum scalpellum*, a species with a wide depth range of 10-540 m, but usually between 30 and 200 m. It is recorded from shallow waters of the Iberian Peninsula and scattered localities along the North African coast (Nilsson-Cantell 1978).

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APPENDIX 1

List of species per station. The numbers preceded by the letters L and P concern respectively intertidal hand collecting and scuba diving. The numbers without a letter refer to the stations from the *Jean Charcot*.

Station	Date	Location	Species
L5	2.X.1971	Santa Maria Island (South), Praia	*Chthamalus stellatus.*
L7	5.X.1971	Praia de Santos, "E. Roque", sur tube rejeté	*Lepas anatifera,* *L. pectinata.*
L8	8.X.1971	Terceira Island, West of Monte Brazil	*Verruca spengleri,* *Balanus trigonus.*
L9	11.X.1971	Faial Island, Horta	*Tesseropora arnoldi* n.sp., *Megabalanus azoricus.*
L11	11.X.1971	Faial Island, Caldeira do Inferno (South)	*Chthamalus stellatus,* *Tesseropora arnoldi* n.sp.
P3	1.X.1971	Santa Maria Island, Ponta Malbusca, 12-25 m	*Verruca spengleri,* *Balanus trigonus.*
P4	2.X.1971	Santa Maria Island, Ponta do Casteleto, 12-15 m	*Verruca spengleri,* *Balanus trigonus.*
P6	7.X.1971	J. do Castro Bank, 28°13'N - 26°36'W, 25-35 m	*Lepas anatifera,* *Balanus trigonus.*
P7	8.X.1971	Terceira Island, Ponta de S. Diego (West of Monte Brazil), 5-40 m	*Verruca spengleri,* *Balanus trigonus,* *Megabalanus azoricus.*
P8	10.X.1971	Faial Island, Horta (Port), 0-18 m	*Verruca spengleri,* *Balanus trigonus.*
P9	11.X.1971	Faial Island, Monte da Guia (East of Caldeira do Inferno), 5-15 m	*Verruca spengleri,* *Tesseropora arnoldi* n.sp., *Balanus trigonus.*
P12	13.X.1971	Faial Island, Ponta Furada, 0-7 m	*Verruca spengleri.*
P13	13.X.1971	Faial Island, Horta, 3-18 m	*Verruca spengleri.*
P14	15.X.1971	S. Jorge Island, West of Cabo Monteiro, 40 m	*Balanus trigonus.*
P15	15.X.1971	S. Jorge Island, West of Cabo Monteiro, 27 m	*Balanus trigonus.*
P17	16.X.1971	Graciosa Island, Calle de Folga, 2-8 m	*Verruca spengleri,* *Balanus trigonus.*
P19	18.X.1971	Faial Island, Monte da Guia, 20 m	*Verruca spengleri.*
P23	22.X.1971	Flores Island, North of Santa Cruz, 15 m	*Verruca spengleri.*
P24	22.X.1971	Flores Island, Ilheu da Muda, 22-30 m	*Verruca spengleri.*
P27	27.X.1971	São Miguel Island, Caloura (South), 0-10 m	*Verruca spengleri.*
P29	28.X.1971	São Miguel Island, Ponta da Galera (South), 7-18 m	*Verruca spengleri,* *Tesseropora arnoldi* n.sp., *Balanus trigonus.*
P30	29.X.1971	São Miguel Island, Caloura (S.), 0-6 m	*Verruca spengleri.*
P33	30.X.1971	São Miguel Island, Santa Clara, Ponta Delgada (South), 7-15 m	*Verruca spengleri.*
P34	31.X.1971	São Miguel Island, Ponta de Galera (Southeast), 10-12 m	*Balanus trigonus.*
P38	2.XI.1971	São Miguel Island, Ilheu dos Mosteiros (W.), 2-37 m	*Megabalanus azoricus.*
P41	4.XI.1971	São Miguel Island, Morro das Capelas (N.), 15-20 m	*Balanus trigonus,* *Megabalanus azoricus.*
P44	8.XI.1971	Formigas Island, 35-45 m	*Oxynaspis celata.*
1	7.X.1971	38°13'N - 26°36'W, 40-50 m	*Verruca spengleri,* *Balanus trigonus.*
4	7.X.1971	38°11,5'N - 28°38,5'W, 1200-1080 m	*Metaverruca recta.*
6	7.X.1971	38°14'N - 26°38,5'W, 570 m	*Altiverruca gibbosa,* *Bathylasma hirsutum.*

Station	Date	Location	Species
10	8.X.1971	38°39'N - 27°14,5'W, 28-33 m	*Balanus trigonus.*
11	8.X.1971	38°30'N - 27°14,5'W, 105-76 m	*Balanus trigonus.*
14	4.XII.1968	47°56,3'N - 07°32,8'W, 214-235 m	*Verruca stroemia.*
16	8.X.1971	38°39'N - 27°21'W, 990-880 m	*Metaverruca recta.*
46	12.X.1971	37°34'N - 28°54'W, 784 m	*Bathylasma hirsutum.*
60	14.X.1971	38°33,5'N - 28°33'W, 66-70 m	*Balanus trigonus.*
61	14.X.1971	38°34'N - 28°32,5'W, 77 m	*Verruca spengleri.*
62	14.X.1971	38°39,5'N - 28°37,5'W, 800-736 m	*Poecilasma aurantia,* *Metaverruca recta,* *Costatoverruca cornuta.*
66	15.X.1971	38°34,5'N - 28°19,5'W, 1260-1225 m	*Metaverruca recta,* *Arcoscalpellum tritonis.*
73	15.X.1971	38°30'N - 27°51,5'W, 245 m	*Heteralepas microstoma.*
89	17.X.1971	39°04,5'N - 28°07,5'W, 358-406 m	*Oxynaspis patens.*
105	20.X.1971	39°35'N - 31°23'W, 1550 m	*Arcoscalpellum michelottianum.*
120	22.X.1971	39°03,5'N - 32°43,5'W, 2100 m	*Lepas pectinata.*
129	23.X.1971	38°58'N - 33°26,5'W, 3056-3000 m	*Trianguloscalpellum regium,* *Teloscalpellum luteum.*
131	24.X.1971	39°04,5'N - 32°43,5'W, 2120 m	*Lepas pectinata,* *Neoscalpellum debile.*
135	25.X.1971	39°24,5'N - 31°05,5'W, 860-760 m	*Metaverruca recta.*
139	26.X.1971	38°36,5'N - 28°17,5'W, 1260 m	*Metaverruca recta.*
142	30.X.1971	37°41,5'N - 25°31'W, 103 m	*Verruca spengleri.*
143	30.X.1971	37°42'N - 25°32'W, 69-61 m	*Verruca spengleri,* *Balanus trigonus.*
148	30.X.1971	37°34,5'N - 25°34,5'W, 847-870 m	*Poecilasma aurantia,* *Metaverruca recta,* *Costatoverruca cornuta.*
150	30.X.1971	37°37'N - 25°35'W, 600-550 m	*Metaverruca recta,* *Costatoverruca cornuta.*
151	30.X.1971	37°37,5'N - 25°39,5'W, 788-780 m	*Metaverruca recta,* *Costatoverruca cornuta.*
157	31.X.1971	37°33,5'N - 25°43,5'W, 826-787 m	*Poecilasma aurantia,* *Costatoverruca cornuta.*
159	31.X.1971	37°26'N - 25°51'W, 600-525 m	*Poecilasma aurantia,* *Metaverruca recta,* *Altiverruca gibbosa,* *Costatoverruca cornuta.*
161	31.X.1971	37°39,5'N - 25°50,5'W, 590 m	*Metaverruca recta,* *Costatoverruca cornuta*
168	1.XI.1971	37°48,5'N - 25°54'W, 800-665 m	*Metaverruca recta.*
171	1.XI.1971	37°58,5'N - 26°07'W, 3215 m	*Metaverruca aequalis.*
174	2.XI.1971	38°06'N - 26°15'W, 3094-3038 m	*Amigdoscalpellum rigidum,* *Metaverruca aequalis.*
176	2.XI.1971	38°00,5'N - 26°21,5'W, 2720-2440 m	*Amigdoscalpellum rigidum.*
179	3.XI.1971	38°05,5'N - 25°46'W, 1665-1590 m	*Smilium acutum.*
180	3.XI.1971	37°57,5'N - 25°33'W, 1235-1069 m	*Glyptelasma hamatum,* *Poecilasma aurantia,* *Arcoscalpellum michelottianum,* *Altiverruca obliqua,* *A. gibbosa,* *Metaverruca aequalis,* *M. recta,* *Bathylasma hirsutum,* *Hexelasma americanum.*
181	3.XI.1971	37°53'N - 25°35,5'W, 620-450 m	*Metaverruca recta,* *Costatoverruca cornuta.*
186	4.XI.1971	37°51,5'N - 25°40'W, 455-370 m	*Megabalanus azoricus.*
196	5.XI.1971	37°50'N - 24°55,5'W, 1191-1146 m	*Metaverruca recta.*

Station	Date	Location	Species
197	5.XI.1971	37°49,5'N - 25°01,5'W, 815 m	*Arcoscalpellum michelottianum*, *Altiverruca gibbosa*, *Metaverruca aequalis*. *Metaverruca recta*, *M. trisulcata*.
199	5.XI.1971	37°54,5'N - 25°08'W, 800-770 m	*Poecilasma aurantia*, *Altiverruca gibbosa*, *Metaverruca recta*, *Costatoverruca cornuta*.
202	6.XI.1971	37°26,5'N - 25°00'W, 2900 m	*Glyptelasma hamatum*, *Neoscalpellum debile*, *Catherinum recurvitergum*, *Amigdoscalpellum rigidum*, *Trianguloscalpellum regium*.
206	7.XI.1971	37°21'N - 25°28,5'W, 2047 m	*Amigdoscalpellum rigidum*.
216	8.XI.1971	37°16,5'N - 24°46,5'W, 80-90 m	*Verruca spengleri*, *Tesseropora arnoldi* n.sp., *Megabalanus azoricus*.
218	8.XI.1971	36°54'N - 25°08'W, 772-800 m	*Metaverruca recta*.
224	9.XI.1971	37°03'N - 25°05'W, 60 m	*Verruca spengleri*.
227	10.XI.1971	37°10'N - 25°19,5'W, 2160-2180 m	*Glyptelasma hamatum*, *Amigdoscalpellum rigidum*.
231	10.XI.1971	36°55'N - 25°10'W, 440-380 m	*Metaverruca recta*.
237	11.XI.1971	37°21,5'N - 25°45,5'W, 759 m	*Poecilasma aurantia*, *Metaverruca recta*, *Costatoverruca cornuta*.
239	11.XI.1971	37°28,5'N - 25°45'W, 646-628 m	*Metaverruca recta*, *Costatoverruca cornuta*.
240	12.XI.1971	37°35'N - 25°32,5'W, 825-810 m	*Metaverruca recta*, *M. trisulcata*, *Bathylasma hirsutum*.
245	14.XI.1971	40°57'N - 22°16'W, 4270 m	*Neoscalpellum debile*, *Planoscalpellum limpidus*, *Catherinum recurvitergum*, *Amigdoscalpellum rigidum*, *Trianguloscalpellum regium*.
249	16.XI.1971	45°50'N - 17°32,5'W, 4620-4690 m	*Neoscalpellum debile*, *Arcoscalpellum eponkos* n.sp., *Planoscalpellum limpidus*, *Trianguloscalpellum ovale*.
250	16.XI.1971	45°54,5'N - 17°29,5'W, 4631 m	*Neoscalpellum debile*.
251	18.XI.1971	47°38'N - 08°56'W, 3600-3360 m	*Arcoscalpellum tritonis*, *Amigdoscalpellum rigidum*, *Trianguloscalpellum regium*.
255	18.XI.1971	47°47'N - 07°56,5'W, 900-960 m	*Metaverruca recta*, *Bathylasma hirsutum*.
259	19.XI.1971	48°07,5'N - 07°51,5'W, 190 m	*Verruca stroemia*.
260	19.XI.1971	47°46'N - 08°04'W, 940-820 m	*Scalpellum scalpellum*, *Bathylasma hirsutum*.
Ponta Delgada		on the hull of the *Jean Charcot*	*Conchoderma auritum*.

APPENDIX 2

Cirriped species with present taxonomic status and geographical distribution and references citing them in the Azores Region. *, herein.

Species (Names used by the authors)	Authors	Present taxonomic status	Geographical distribution
HETERALEPADIDAE			
Heteralepas microstoma	Young, in press; *	same	Azores, Madeira, Great Meteor.
OXYNASPIDIDAE			
Oxynaspis celata	*	same	Cosmopolitan
O. patens	*	same	North Atlantic
POECILASMATIDAE			
Dichelaspis sessilis	Hoek, 1883	same	Azores
Glyptelasma hamatum	*	same	Circumtropical
Poecilasma aurantia	Gruvel, 1920; *	same	Eastern Atlantic
P. carinatum	Gruvel, 1920	*Glyptelasma carinatum*	Cosmopolitan
P. crassum	Gruvel, 1920	same	Circumtropical
P. kaempferi	Gruvel, 1920	? = *P. aurantia*	–
P. unguiculus	Aurivillius, 1894	? = *P. aurantia*	–
CALANTICIDAE			
Scalpellum acutum	Hoek, 1883; Gruvel, 1920; *	*Smilium acutum*	Cosmopolitan
S. calyculus	Aurivillius, 1898; Gruvel, 1920	*Aurivilialepas calyculus*	Azores
S. falcatum	Aurivillius, 1898; Gruvel, 1920	*Aurivilialepas falcata*	Azores, Great Meteor, off Portugal
S. Grimaldii	Aurivillius, 1898; Gruvel, 1920	*Scillaelepas grimaldi*	Azores
SCALPELLIDAE			
SCALPELLINAE			
Scalpellum vulgare	Gruvel, 1920	*Scalpellum scalpellum*	Northeastern Atlantic
SCALPELLIDAE			
MEROSCALPELLINAE			
Scalpellum alboranense	Gruvel, 1920	= *N. debile*	–
S. debile	Aurivillius, 1898; Gruvel, 1920; *	*Neoscalpellum debile*	North Atlantic
S. Edwardsii	Gruvel, 1900a; 1902a	= *N. debile*	–
SCALPELLIDAE			
ARCOSCALPELLINAE			
Arcoscalpellum michelottianum	Zevina, 1976; *	same	Cosmopolitan
Arcoscalpellum tritonis	*	same	Northeastern Atlantic
Planoscalpellum limpidus	Zevina, 1976; *	same	Northeastern Atlantic and Subantarctic
Scalpellum anceps	Aurivillius, 1898; Gruvel, 1920	*Teloscalpellum anceps*	Azores
S. atlanticum	Gruvel, 1900a; 1902a; 1920	*Teloscalpelum atlanticum*	Azores, off Portugal

Species (Names used by the authors)	Authors	Present taxonomic status	Geographical distribution
S. erectum	Aurivillius, 1898	= *A. michelottianum*	–
S. gigas	Gruvel, 1905	= *T. ovale* (not *S. gigas* Hoek)	North Atlantic
S. gracile	Gruvel, 1920	*Teloscalpellum gracile*	Northeastern Atlantic
S. incisum	Aurivillius, 1898; Gruvel, 1920	*Teloscalpelum incisum*	Azores
S. luteum	Gruvel, 1900a; 1902a; *	*Teloscalpellum luteum*	Azores
S. mamillatum	Aurivillius, 1898; Gruvel, 1920	*Amigdoscalpellum mamillatum*	Azores
S. molle	Aurivillius, 1898	(= *T. regium*)	–
S. pusillum	Aurivillius, 1898; Gruvel, 1920	*Weltnerium pusillum*	Newfoundland and Azores
S. recurvitergum	Gruvel, 1905; *	*Catherinum recurvitergum*	Azores, ?East Africa
S. regium	Gruvel, 1900a; 1902a	*Trianguloscalpellum regium*	North Atlantic
S. rigidum	Aurivillius, 1898	*Amigdoscalpellum rigidum*	Northeastern Atlantic
S. striatum	Gruvel, 1905; 1920	= *A. rigidum*	–
S. velutinum	Gruvel, 1920	= *A. michelottianum*	–
S. vitreum	Zevina, 1976	= *A. rigidum* (not *S. vitreum* Hoek)	
VERRUCIDAE			
Verruca inermis	Aurivillius, 1898; Gruvel, 1920	*Altiverruca inermis*	Azores
V. costata	Aurivillius, 1898; Gruvel, 1920	*Altiverruca costata*	North Atlantic
V. crenata	Aurivillius, 1898; Gruvel, 1920	*Altiverruca crenata*	Azores
V. erecta	Gruvel, 1900b; 1902a	*Altiverruca erecta*	Azores
Altiverruca gibbosa	*	same	Cosmopolitan
A. obliqua	*	same	Azores; off Spain
Verruca recta	Aurivillius, 1898; Gruvel, 1920; *	*Metaverruca recta*	Cosmopolitan
V. sculpta	Aurivillius, 1898; Gruvel, 1920	= *M. recta*	–
V. linearis	Gruvel, 1900b; 1902a; 1920	= *M. recta*	–
V. aequalis	Aurivillius, 1898; Gruvel, 1920; *	*Metaverruca aequalis*	Azores
V. trisulcata	Gruvel, 1900b; 1902a; 1920; *	*Metaverruca trisulcata*	Azores
V. cornuta	Aurivillius, 1898; Gruvel, 1920; *	*Costatoverruca cornuta*	Azores, Great Meteor
V. strömia	Gruvel, 1902a	probably a misidentification	–
V. spengleri	Gruvel, 1920; Baker, 1967; *	same	Azores, Madeira, Black Sea?
CHTHAMALIDAE			
Chthamalus stellatus	Pilsbry, 1916; Gruvel, 1920; Baker, 1967; *	same	Northeastern Atlantic
TETRACLITIDAE			
Tesseropora arnoldi n.sp.	*	same	Azores
Tetraclita squamosa elegans	Baker, 1967	= *T. arnoldi*, not *T. elegans* Darwin	–
Tesseropora atlantica	Newman and Ross, 1977	= *T. arnoldi* (in part, specimens from Azores)	–

Species (Names used by the authors)	**Authors**	**Present taxonomic status**	**Geographical distribution**
BATHYLASMATIDAE			
Balanus hirsutus	Gruvel, 1920; *	*Bathylasma hirsutum*	Northeastern Atlantic
BALANIDAE			
B. crenatus	Gruvel, 1920	probably a misidentification	–
B. amphitrite	Gruvel, 1920	probably a misidentification	–
B. trigonus	Pilsbry, 1916; Gruvel, 1920; Baker, 1967; *	same	Cosmopolitan
B. spongicola	Gruvel, 1920	probably a misidentification	–
B. tintinnabulum azoricus	Pilsbry, 1916; Gruvel, 1920; Baker, 1967; *	*Megabalanus azoricus*	Azores

Isopodes terrestres de Nouvelle-Calédonie. II. Sur une nouvelle espèce du genre *Pseudolaureola* (Crustacea, Oniscidea)

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MOTS CLÉS
Crustacea,
Isopoda,
Oniscidea,
Nouvelle-Calédonie,
espèce nouvelle.

RÉSUMÉ
Une espèce nouvelle, *Pseudolaureola deharvengi* n.sp., est décrite de Nouvelle-Calédonie (Province Nord, Kaala-Gomen). Elle est caractérisée par des tubercules dorsaux particulièrement développés portant de longues et très nombreuses soies. Une diagnose émendée du genre est proposée.

KEY WORDS
Crustacea,
Isopoda,
Oniscidea,
New Caledonia,
new species.

ABSTRACT
Terrestrial Isopoda *from New Caledonia. II. A new species of the genus* Pseudolaureola *(Crustacea, Oniscidea).* A new species, *Pseudolaureola deharvengi* n.sp., is described from New Caledonia (Northern Province, Kaala-Gomen). It is characterized by particularly well-developed dorsal tubercules, bearing numerous long setae. An emended diagnosis of the genus is given.

En 1995, L. Deharveng et A. Bedos ont mené des recherches de terrain dans différentes régions du sud-ouest Pacifique. Parmi le matériel collecté en Nouvelle-Calédonie figurait une nouvelle espèce d'isopode terrestre, assez remarquable par son ornementation. Sa description fait l'objet de la présente note qui s'intègre dans une étude déjà commencée sur la faune des isopodes terrestres de Nouvelle-Calédonie (Dalens 1993).

ABRÉVIATIONS

MNHN	Muséum national d'Histoire naturelle, Paris ;
A1	antennule ;
A2	antenne ;
Mx1	maxillule ;
Mxp	maxillipède.

Famille ARMADILLIDAE Verhoeff, 1917
Sous-famille AKERMANIINAE Vandel, 1973
Genre *Pseudolaureola*
Kwon, Ferrara *et* Taiti, 1992

ESPÈCE-TYPE. — *Pseudolaureola atlantica* (Vandel, 1977).

ESPÈCES INCLUSES. — *P. wilsmorei* (Nicholls *et* Barnes, 1926), *P. hystrix* (Barnard, 1958), *P. deharvengi* n.sp.

DIAGNOSE ÉMENDÉE

Pleurépimères, à l'exception du premier, et parfois néopleurons, prolongés en pointe donnant un aspect foliacé aux représentants de ce genre ; exopodites du premier pléopode mâle très réduit ou même absent ; exopodite de l'uropode absent ou très réduit quand il est présent.

Pseudolaureola deharvengi n.sp.
(Figs 1-3)

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie.** Province Nord, Kaala-Gomen, altitude 250 m, forêt sèche sur calcaire, 18.XII.1995, A. Bedos & L. Deharveng legs, 5 ♂♂ et 7 ♀♀.

MATÉRIEL-TYPE. — L'holotype (MNHN-Is 5064), conservé intact, est représenté par une femelle de 4,1 mm, ce qui constitue la taille maximale des échantillons examinés. L'holotype (MNHN-Is 5064) et une partie des paratypes (MNHN-Is 5065) sont déposés au Muséum national d'Histoire naturelle, Paris. Quelques paratypes sont conservés dans la collection de l'auteur. Des paratypes mâles de 2,2 mm paraissent bien différenciés pour ce qui est des pièces génitales.

ÉTYMOLOGIE. — Cette espèce est dédiée à mon collègue L. Deharveng qui, avec A. Bedos, a récolté ces échantillons.

RÉPARTITION. — Bien que de nombreux prélèvements aient été effectués dans différentes régions de l'île, cette espèce n'est connue que d'une seule station.

DESCRIPTION

Coloration

Les animaux vivants sont jaunâtres avec, par endroits, des taches brunes. Les pleurépimères sont toujours plus pâles. Il existe des variations dans l'intensité de la coloration suivant les individus et le réseau pigmentaire est rarement homogène. En alcool, la coloration s'atténue fortement et, par endroits, peut même disparaître totalement.

Appareil oculaire

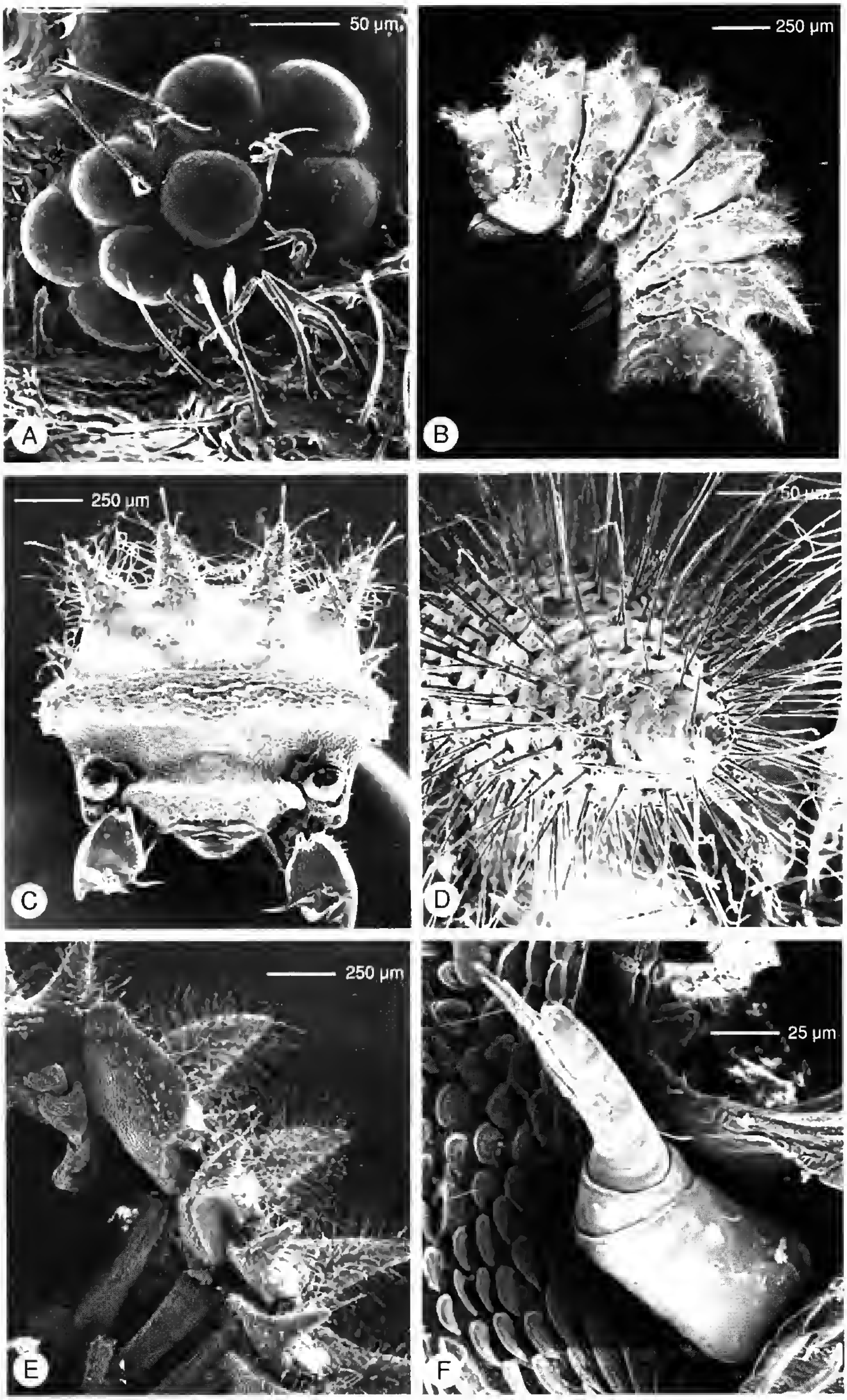
Il est formé de neuf ommatidies (Fig. 1A). Ce nombre se réduit toutefois à six chez les individus de petite taille.

Morphologie somatique

Il s'agit d'une forme volvationnelle (Fig. 1B), dont le céphalon et le péréion sont hérissés de tubercules plus ou moins longs qui portent sur toute leur surface de nombreuses et longues soies. Le pléon est très raccourci et tombe subverticalement, si bien qu'en vue latérale, ou même dorsale, il passe pratiquement inaperçu.

Sur le céphalon (Fig. 1C), les tubercules sont au nombre de huit, disposés en deux rangées transversales. La première est formée de quatre tubercules très petits situés immédiatement en arrière de la ligne frontale ; la seconde est également formée de quatre tubercules, mais beaucoup plus développés et situés en avant du bord postérieur du vertex, lequel est très nettement plus large que long. La lame frontale dépasse de très peu le vertex. On relève par ailleurs une ébauche d'écus-

FIG. 1. — *Pseudolaureola deharvengi* n.sp., **A**, massif oculaire gauche ; **B**, animal *in toto* en vue latérale ; **C**, céphalon vu de face ; **D**, tubercule du premier péréionite ; **E**, système d'engrenage volvationnel des premier et second péréionites en vue ventrale ; **F**, A1 gauche.


50 µm
A
250 µm
B
250 µm
C
D
250 µm
E
25 µm
F

son, dont le revêtement écailleux se différencie nettement de celui du reste de la plaque frontale.

Sur les péréionites, les tubercules se disposent en treize rangées parallèles :

1. Tout d'abord, une rangée médiane de tubercules situés près du bord postérieur de chacun des péréionites ; très petits, avec l'apex recourbé vers l'arrière du corps, ils montrent néanmoins un léger gradient de développement croissant suivant l'axe antéro-postérieur.

2. Ensuite, sur chaque demi-péréionite, on trouve, à droite comme à gauche, six rangées de tubercules de développement très inégal ; on observe :
– Flanquant la rangée médiane, une rangée paramédiane, que nous qualifierons d'interne, formée de tubercules situés plus près du bord antérieur du péréionite, de développement prononcé et sensiblement identique sur tous les péréionites.
– Une rangée, que nous appellerons paramédiane externe, formée de tubercules dont le développement est légèrement plus réduit que chez les tubercules de la zone médiane, de positionnement identique à ceux-ci, mais dont le développement diminue progressivement suivant un axe antéro-postérieur et qui n'est plus perceptible sur le septième péréionite.
– Plus latéralement encore et au niveau de la zone de courbure des tergites péréiaux, une rangée de tubercules très développés et qui croissent régulièrement en taille de l'avant vers l'arrière du corps ; croissance particulièrement nette sur les trois derniers péréionites et que l'on peut qualifier d'hypertélique sur le septième péréionite.
– Latéralement enfin, trois rangées, dont deux sont parallèles et formées de petits tubercules disposés sur le pleurépimère, alors que la plus externe se trouve tout à fait en bordure externe et ceinture le corps de l'animal. Les deux rangées internes sont de développement sensiblement identique aux tubercules de la zone médiane. La rangée la plus interne a les tubercules situés plus près de la bordure postérieure des tergites, ceux de la rangée externe sont, par contre, situés tout à fait antérieurement sur la bordure même du péréionite.

3. Enfin, en ce qui concerne les tubercules de bordure du corps, ils sont plus développés et subhorizontaux. Sur le premier péréionite le tubercule s'étale d'ailleurs sur la majeure partie de la bordure épimérale et forme une lame plate. Sur les péréionites II et III, ces tubercules sont situés sur la partie antérieure de la zone épimérale ; sur les péréionites suivants, ils se déplacent progressivement vers la partie arrière de la zone épimérale. Tous ces tubercules, grands ou petits, portent sur toute leur surface de longues soies (Fig. 1D), en nombre d'autant plus grand que le tubercule est plus développé.

L'ensemble des tergites comprend une partie protergale lisse, aussi développée que la partie métatergale et normalement recouverte par le métatergite du segment antérieur. Protergite et métatergite sont séparés par une très légère crête, formée de soies-écailles redressées qui paraissent constituer en fait le bord antérieur du segment péréial. Le bord postérieur de chaque métatergite est également souligné sur toute sa longueur par une crête de même type.

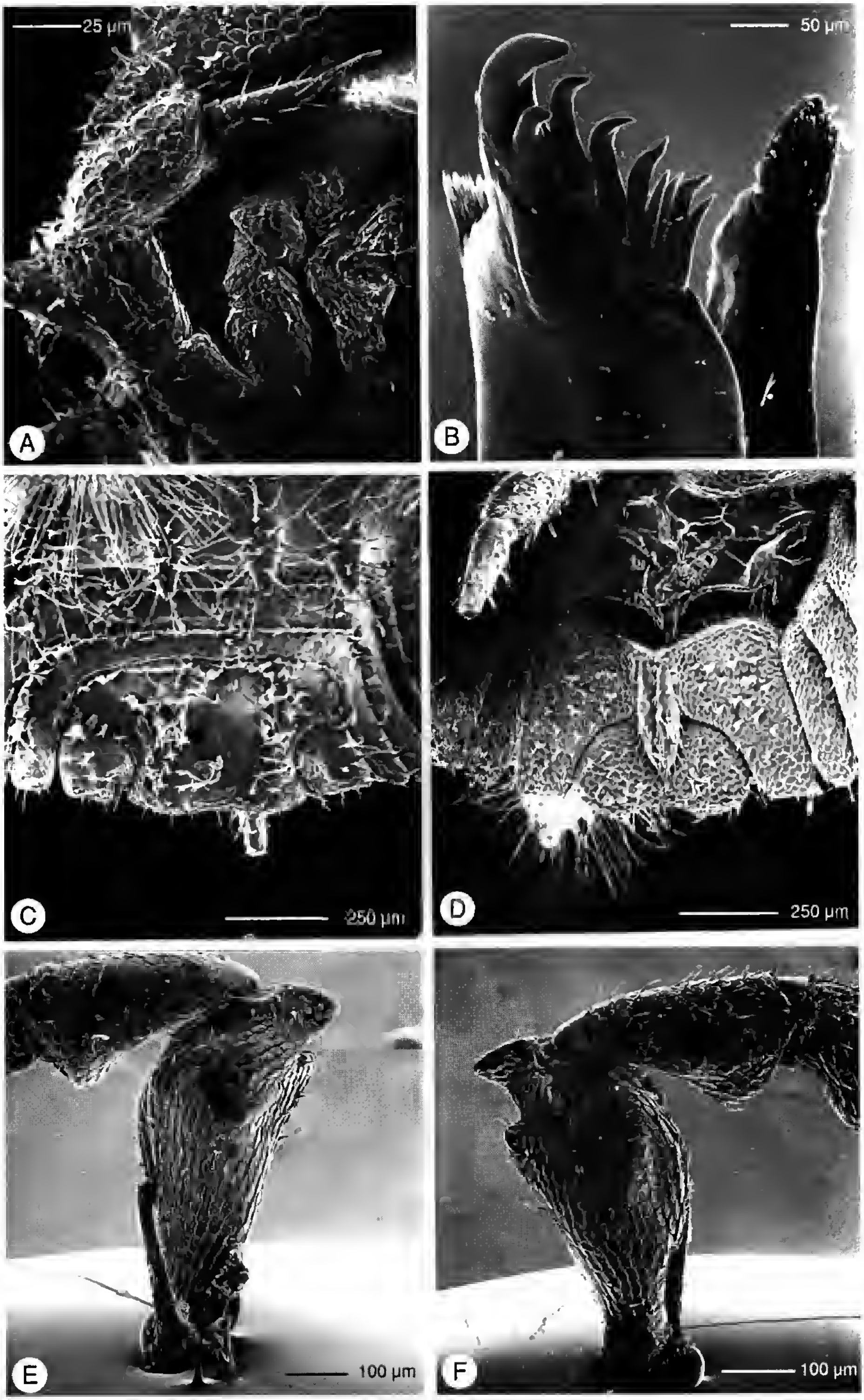
Le système d'engrenage (Fig. 1E) est limité aux deux premiers péréionites avec un schisma sur le bord latéral du péréionite I, lequel ne porte toutefois aucune trace de sillon longitudinal. La face interne des pleurépimères I et II ne porte aucune différenciation en forme de dent ou de replat qui puisse être liée à la volvation. Sur le pléon où existent premier et deuxième pléonites, même s'ils sont parfois difficilement visibles, l'ornementation est réduite à quelques touffes de longues soies, qui paraissent signaler des tubercules dont le développement est si réduit qu'ils passent inaperçus. Les néopleurons 3, 4 et 5 sont recourbés à l'horizontale et leur extrémité porte quelques soies.

Appendices

A1 de trois articles (Fig. 1F), le second très court et le troisième portant quatre aesthétascs, l'un à mi-hauteur de l'article, les trois autres à l'apex.

A2 (Fig. 2A) courtes, massives et recouvertes d'écailles imbriquées, avec un flagelle antennaire de deux articles dont le distal, trois fois plus long environ que le basal, porte deux aesthétascs.

FIG. 2. — *Pseudolaureola deharvengi* n.sp., **A**, A2 gauche ; **B**, Mx1 ; **C**, telson en vue dorsale ; **D**, telson en vue ventrale ; **E**, ♂, basis VII en vue caudale ; **F**, ♂, basis VII en vue rostrale.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Mandibule droite avec deux pénicilles dont un très petit presque accolé au pénicille molaire ; mandibule gauche à trois pénicilles, deux intermédiaires et un molaire.
Mx1 (Fig. 2B) avec endite interne portant deux pénicilles assez massifs et endite externe pourvu de onze dents toutes entières mais dont deux sont très petites et difficilement visibles.

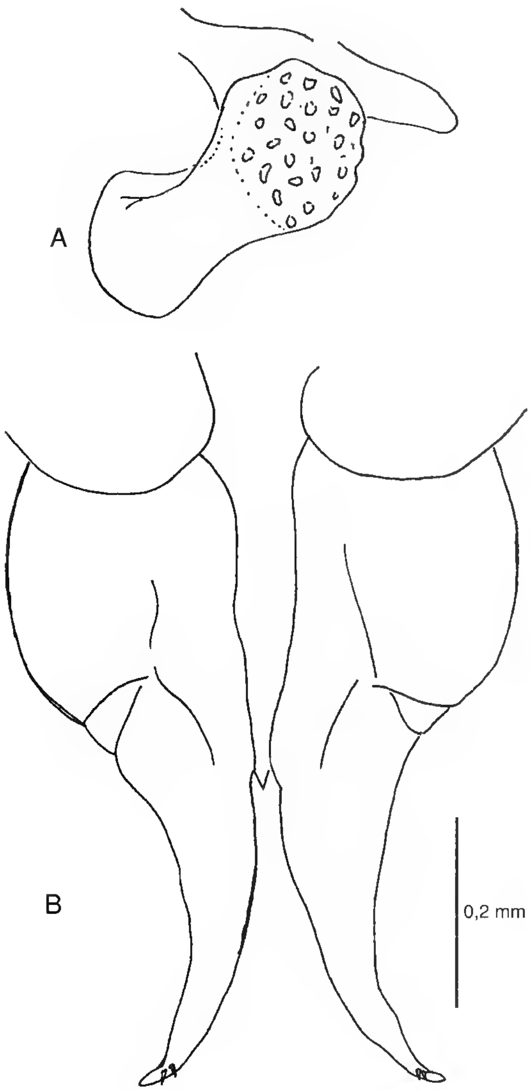

FIG. 3. — *Pseudolaureola deharvengi* n.sp., ♂, exopodite (**A**) et endopodites (**B**) de la première paire de pléopodes.

Mxp sans particularités notables. Pléopodes au nombre de cinq paires, la première paire étant toutefois très réduite chez le mâle. Tous les pléopodes sont pourvus de pseudotrachées qui paraissent rappeler certaines structures rencontrées chez des Eubelidae (Ferrara, Paoli & Taiti 1990). Telson (Fig. 2C, D) en forme de sablier, à partie distale nettement plus étroite que la partie basale et portant quelques soies très courtes. Basipodites des uropodes très développés, endopodites relativement courts et n'atteignant pas le bord postérieur du telson ; quant aux exopodites situés postérieurement sur le bord interne des basipodites, ils sont particulièrement réduits.

Caractères sexuels mâles
Au niveau des péréiopodes, une différenciation particulièrement nette affecte les péréiopodes VII du mâle, dont le basis (Fig. 2E, F) porte des excroissances particulièrement développées. En ce qui concerne les pléopodes, la première paire montre des exopodites de développement très réduit, tandis que les endopodites présentent une partie basale très élargie (Fig. 3). Les endopodites de la seconde paire sont particulièrement longs et fins (Fig. 4).

DISCUSSION
Par sa morphologie, cette espèce se place manifestement dans les Akermaniinae, sous-famille d'Armadillidae créée par Vandel (1973), pour ranger des formes que l'auteur pensait dérivées de lignées différentes, mais parvenues selon lui au terme de l'évolution armadillienne, essentiellement caractérisée par un phénomène de dévolvation. Non valable sur un plan phylétique, cette subdivision rassemble toutefois des formes qui se caractérisent toutes par une ornementation très développée de tubercules, d'épines ou même d'aiguilles.
En ce qui concerne l'affectation générique, nous rattachons cette espèce au genre *Pseudolaureola* Kwon, Ferrara *et* Taiti, 1992, en privilégiant comme caractère discriminant majeur, celui retenu par Vandel (1977), à savoir l'aspect foliacé et la terminaison en pointe des pleurépimères et des néopleurons.
Ce rattachement n'est peut-être que provisoire, mais dans l'attente d'une meilleure connaissance,

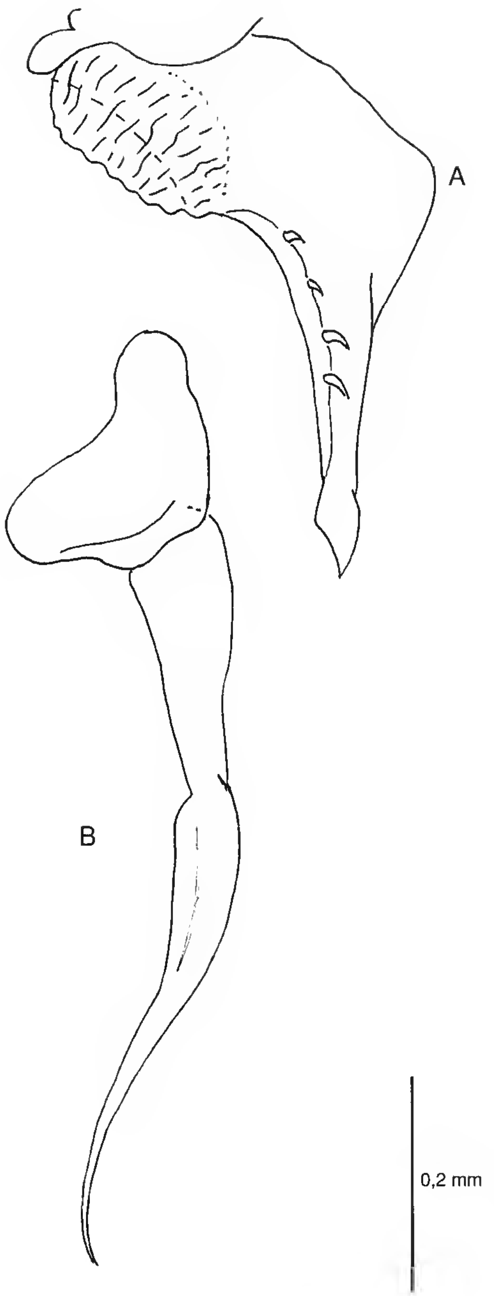

FIG. 4. — *Pseudolaureola deharvengi* n.sp., ♂, exopodite (**A**) et endopodite (**B**) de la seconde paire de pléopodes.

sinon d'une révision des Akermaniinae, et tout spécialement des espèces regroupées dans les genres *Akermania* Collinge, 1919, *Laureola* Barnard, 1960 et *Pseudolaureola* Kwon, Ferrara *et* Taiti, 1992 cette solution nous a paru préférable à celle de la création d'un nouveau genre. Le problème majeur concernant le rattachement de la nouvelle espèce au genre *Pseudolaureola* était relatif à l'existence d'exopodites 1 mâles, certes réduits, mais présents chez *P. deharvengi*, alors qu'ils étaient indiqués comme absents dans la description originale de l'espèce-type *P. atlantica*. Un examen minutieux d'exemplaires de cette dernière espèce, présents dans la collection Vandel, nous a, en fait, convaincu que chez cette espèce également, existaient chez le mâle des exopodites 1 certes très réduits et difficilement observables mais réellement présents, ce qui rendait notre affectation générique tout à fait plausible. N'ayant toutefois pu réexaminer l'ensemble des espèces regroupées dans ce genre et pour ne pas préjuger des observations faites par les auteurs précédents, nous avons donc modifié légèrement la diagnose du genre donnée par Vandel (1977).

Le nom générique de *Pseudolaureola* fut utilisé pour la première fois par Schmalfuss & Ferrara (1983) pour regrouper trois espèces que Vandel avait auparavant réunies dans le genre *Laureola*, mais ces auteurs ne désignent pas pour autant l'espèce-type. C'est donc Kwon, Ferrara & Taiti (1992) qui valident ce nom en désignant *Laureola atlantica* Vandel, 1977 comme l'espèce-type. Outre l'espèce-type qui vit dans l'île de Sainte-Hélène, ils incluent dans le genre *Pseudolaureola*, *P. wilsmorei* (Nicholls *et* Barnes, 1926) de l'ouest de l'Australie et *P. hystrix* (Barnard, 1958) de Madagascar, espèces auxquelles il convient donc d'ajouter *P. deharvengi* n.sp., de Nouvelle-Calédonie.

Remerciements

Le matériel étudié a été récolté dans le cadre du programme Diversitas-Nouvelle-Calédonie animé par le Muséum national d'Histoire naturelle de Paris. Nous remercions M. Papineau, responsable du Service de l'Environnement de la Province Nord, pour l'aide qu'il a apportée aux collecteurs.

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A new species of hermit crab of the family Parapaguridae (Decapoda, Anomura) from French Polynesia

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ABSTRACT
A new deep-water hermit crab species of the family Parapaguridae, *Oncopagurus oimos*, is described from Moruroa (French Polynesia, Tuamotu Archipelago). The new species is distinguished primarily by its distinctive colour pattern (still visible in alcohol-preserved specimens after one year), and consisting of broad stripes on the left cheliped and ambulatory legs. Other diagnostic characters of the new species are: (1) males lacking first pleopods and having reduced unpaired left second pleopods; (2) slender left cheliped; (3) rounded mesial face of the right chela. The new species is compared to another congeneric species, *O. tuamotu* Lemaitre, 1994 that also occurs in French Polynesia, as well as to other species of the genus in which males lack first pleopods.

KEY WORDS
deep-water hermit crab, new species, Parapaguridae, *Oncopagurus*, French Polynesia, Tuamotu Archipelago.

RÉSUMÉ
Une espèce nouvelle de pagure de la famille des Parapaguridae (Decapoda, Anomura) de Polynésie française. Une espèce nouvelle de pagure d'eau profonde, appartenant à la famille des Parapaguridae, *Oncopagurus oimos*, est décrite de Moruroa (Polynésie française, archipel des Tuamotu). Cette espèce nouvelle se distingue en particulier par la couleur (encore visible après un an de conservation en alcool) des bandes longitudinales sur le chélipède gauche et les pattes ambulatoires. D'autres caractères distinctifs sont : (1) la présence, chez les mâles, d'un seul deuxième pléopode gauche ; (2) le chélipède gauche grêle ; (3) la face mésiale de la pince droite arrondie. Cette nouvelle espèce est comparée à une autre espèce du genre, *O. tuamotu* Lemaitre, 1994 qui se trouve également en Polynésie française, ainsi qu'aux autres espèces du genre dont les mâles n'ont pas de premiers pléopodes.

MOTS CLÉS
pagure d'eau profonde, nouvelle espèce, Parapaguridae, *Oncopagurus*, Polynésie française, archipel des Tuamotu.

Study of parapagurid samples, obtained from French Polynesia since Lemaitre's (1994) report on the species of this family from the area, has revealed the existence of an undescribed species. This new species belongs in the recently proposed genus *Oncopagurus* Lemaitre, 1996, the species of which are characterized primarily by: (1) presence of upward curved epistomial spine; (2) phyllobranch gills; (3) operculate tight chela; (4) males having poorly to moderately developed first and second pleopods, with first sometimes absent (Lemaitre 1996).

In the material examined section, the length of the shield of the specimens is indicated in parenthesis, measured (to the nearest 0.1 mm) from the tip of the rostrum to the midpoint of the posterior region of the shield. The term "semichelate" is used for the fourth pereopod in accordance with the definition provided by McLaughlin (1997). The spelling of the island locality where this new species was found is according to Motteler (1986). A summary of deep-water collecting activities in French Polynesia, including a list of crustacean species and station data, can be found in Poupin (1996).

Oncopagurus oimos n.sp.
(Figs 1-3)

MATERIAL EXAMINED. — **French Polynesia.** Tuamotu Archipelago, Moruroa atoll, *Marara*, stn 499, 21°47,6'S - 138°55,7'W, trapped, 200 m, 5.V.1996: holotype ♂ (2.8 mm) MNHN-Pg 5505; paratypes, 1 ♂ (2.4 mm), 1 ♀ (2.7 mm) MNHN-Pg 5506; 1 ♂ (2.9 mm) USNM 276085.

ETYMOLOGY. — The specific name is from the Greek *oimos*, meaning stripe, used as a noun in apposition, and refers to the distinctive colour pattern of this species.

DISTRIBUTION. — Known so far only from Moruroa atoll, on the Tuamotu Archipelago, French Polynesia. Depth: 200 m.

HABITAT. — Gastropod shells.

DESCRIPTION

Shield (Fig. 1A) as broad as long; dorsal surface evenly calcified, with scattered short setae; anterior margins weakly concave; lateral projections subtriangular, terminating acutely; anterolateral margins sloping; posterior margin broadly rounded. Rostrum broadly rounded, weakly produced, and with short mid-dorsal ridge. Ventrolateral margins of shield each with small spine (not visible in dorsal view, and often only on one side). Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, with dorsal row of setae. Cornea weakly dilated. Ocular acicles subtriangular, terminating in strong spine; separated basally by less than basal width of one acicle.

Antennular peduncle long, slender, exceeding distal margin of cornea by entire length of ultimate segment; ventral flagellum with five to six articles. Ultimate segment twice as long as penultimate segment, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed with one or two small spines, and strong spine proximally.

Antennal peduncle (Fig. 1B) exceeding distal margin of cornea by about one third length of fifth segment. Flagellum long, exceeding extended right cheliped and ambulatory legs, articles with setae less than one to two flagellar articles in length (Fig. 1C). Fifth segment unarmed, but with scattered setae. Fourth segment with strong spine on dorsolateral distal angle. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, simple spine; mesial margin with spine on dorsolateral distal angle. First segment with unarmed lateral face; ventromesial angle produced, with three to four small spines laterally. Antennal acicle slightly curved outward (in dorsal view), at most slightly exceeding distal margin of cornea, terminating in strong spine; mesial margin with row of eight to thirteen spines, setose.

Mandible (Fig. 2A) with three-segmented palp. Maxillule (Fig. 2B) with external lobe of endopod weakly developed, internal lobe with long terminal seta. Maxilla (Fig. 2C) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 2D) with endopod exceeding exopod in distal extension. Second maxilliped (Fig. 2E) with exopod about seven times as long as broad. Third maxilliped (Fig. 2F) with distal two segments each twice as long as wide; crista dentata with about twelve corneous-tipped teeth; coxa and basis each with one tooth mesially. Sternite of third maxillipeds with small spine on each side of midline.

Chelipeds markedly dissimilar. Right cheliped (Fig. 1D-F) massive, with sparse setation. Fingers curved ventromesially, each terminating in corneous claw; cutting edges with irregularly-sized calcareous teeth. Dactyl approximately as long as mesial margin of palm, and set at strongly

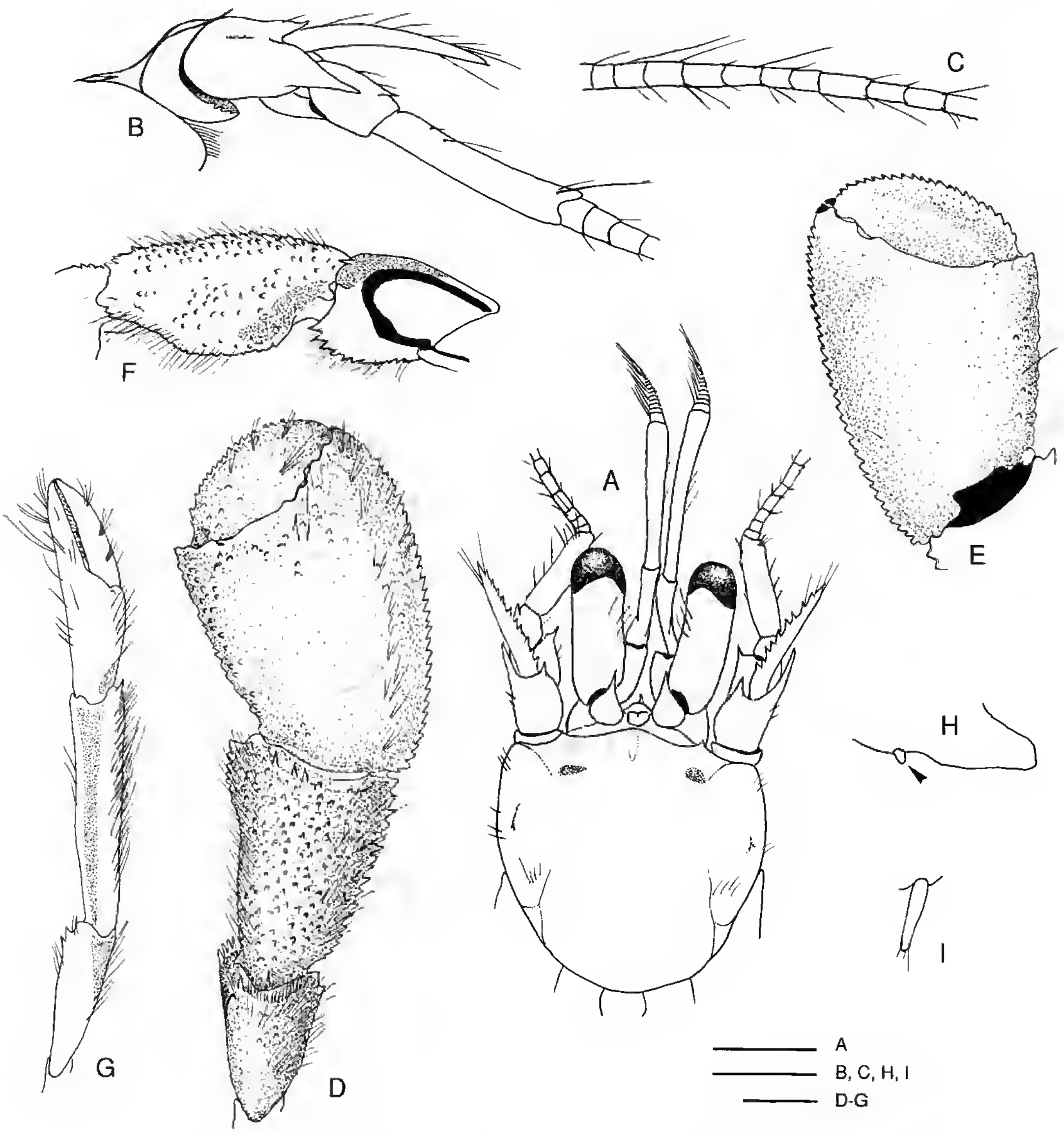

FIG. 1. — *Oncopagurus oimos* n.sp., *Marara*, stn 499, Moruroa atoll: A-H, holotype ♂ (2.8 mm) (MNHN-Pg 5505); **I**, paratype ♂ (2.9 mm) (USNM 276085). **A**, shield and cephalic appendages; **B**, right antennal peduncle (lateral view); **C**, proximal portion of flagellum of same; **D**, right cheliped (dorsal view); **E**, right chela of same (ventral view); **F**, merus and carpus of same (mesial view); **G**, left cheliped; **H**, left second pleopod (arrow) and portion of pleuron (lateral view); **I**, left second pleopod (lateral view). Stippled areas on shield (**A**), merus and carpus of right cheliped (**F**), and left cheliped (**G**) indicate reddish colour pattern. Scales bars: A, D-G, 1 mm; B, C, H, I, 0.5 mm.

oblique angle to longitudinal axis of palm; mesial margin broadly curved, well defined by row of spines (corneous-tipped on distal half); dorsal face with scattered small spines proximally; ventral face smooth; ventromesial face concave. Fixed finger broad at base; lateral margin well defined by row of spines (corneous-tipped on distal half); dorsal face with scattered small spines or tubercles; ventral face smooth. Palm broader than long; lateral margin broadly rounded, well delimited by row of blunt to sharp spines; dorsomesial margin marked by row of small spines; mesial face rounded, with small spines or tubercles; dorsal surface smooth except for scattered small tubercles; ventral surface smooth. Carpus with lateral margin well delimited by row of spines; dorsal face with numerous small spines; dorsodistal margin with row of spines; ventromesial distal margin slightly expanded mesially, with row of spines; ventral face with scattered small tubercles. Merus with dorsal row of small spines; ventromesial margin with row of spines. Ischium with ventromesial row of small spines. Coxa with one or two small spines on ventromesial and ventrolateral margins, and ventromesial row of setae.

Left cheliped (Fig. 1G) slender, with chela as long as carpus; well calcified. Fingers terminating in small corneous claws; dorsal and ventral surfaces unarmed except for scattered tufts of setae; cutting edge of dactyl and fixed finger each with row of minute corneous teeth. Dactyl subequal to palm in length. Palm unarmed or at most with inconspicuous tubercle on dorsomesial angle, and scattered setae; ventral face smooth except for scattered setae. Carpus with strong dorsodistal spine; dorsal margin with moderate setation; ventral face smooth. Merus with setae on dorsal margin; ventrolateral distal margin with row of spines; ventral face smooth. Ischium unarmed, with setose ventral face. Coxa with one spine on ventromesial and ventrolateral distal margins, and ventromesial row of setae.

Ambulatory legs (Fig. 3A-C) similar from right to left, reaching approximately to, or just beyond, tip of extended right cheliped. Dactyl slightly less than twice as long as propodus, terminating in sharp corneous claw; with dorsal and dorsomesial rows of setae, and ventromesial row of about ten to fourteen corneous spines; lateral and mesial faces with shallow, longitudinal sulcus on proximal half (deeper on mesial face). Propodus with row of setae on dorsal and ventral margins. Carpus with small dorsodistal spine and setae dorsally and ventrally. Merus unarmed, with setae on dorsal and ventral margins. Ischium and coxa unarmed. Anterior lobe of sternite of third pereopods setose, subsemicircular, armed with simple terminal spine.

Fourth pereopod (Fig. 3E) semichelate. Dactyl terminating in sharp corneous claw; with ventrolateral row of small corneous spinules. Propodus longer than dorsoventral width, rasp formed of one row of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 3F) chelate. Propodal rasp extending to mid-length of segment.

Uropods and telson (Fig. 3G-I) markedly asymmetrical. Telson lacking transverse suture; dorsal surface with scattered setae; terminal margin with shallow median cleft separating left and right lobes, each with several marginal corneous spines.

Male lacking first pleopods; with unpaired reduced second left pleopod (Fig. 1H, I) consisting of minute bud or very short segment with few terminal setae. Female lacking vestigial second right pleopod.

Colour pattern (Figs 1A, F, G, 3A, B)

No observations of colour in life were made of this species. However, after approximately one year in alcohol, a distinctive reddish colour pattern was still visible in the specimens. The shield has two small reddish spots (Fig. 1A) on the anterior half, one just behind each lateral projection. On both chelipeds (Fig. 1F, G), the dorsodistal portions of the meri are reddish. The carpus of the right cheliped has a reddish area on the proximal portion of the lateral and mesial faces. The carpus of the left cheliped has a distinctive broad reddish stripe on the dorsolateral and mesial faces; the dorsomesial margin of the palm is light reddish; the dactyl is reddish. The ambulatory legs (Fig. 3A, B) have a reddish colour dorsodistally on the meri; the carpi each have a reddish stripe on the lateral and mesial faces, and the stripes of the carpi continue on the

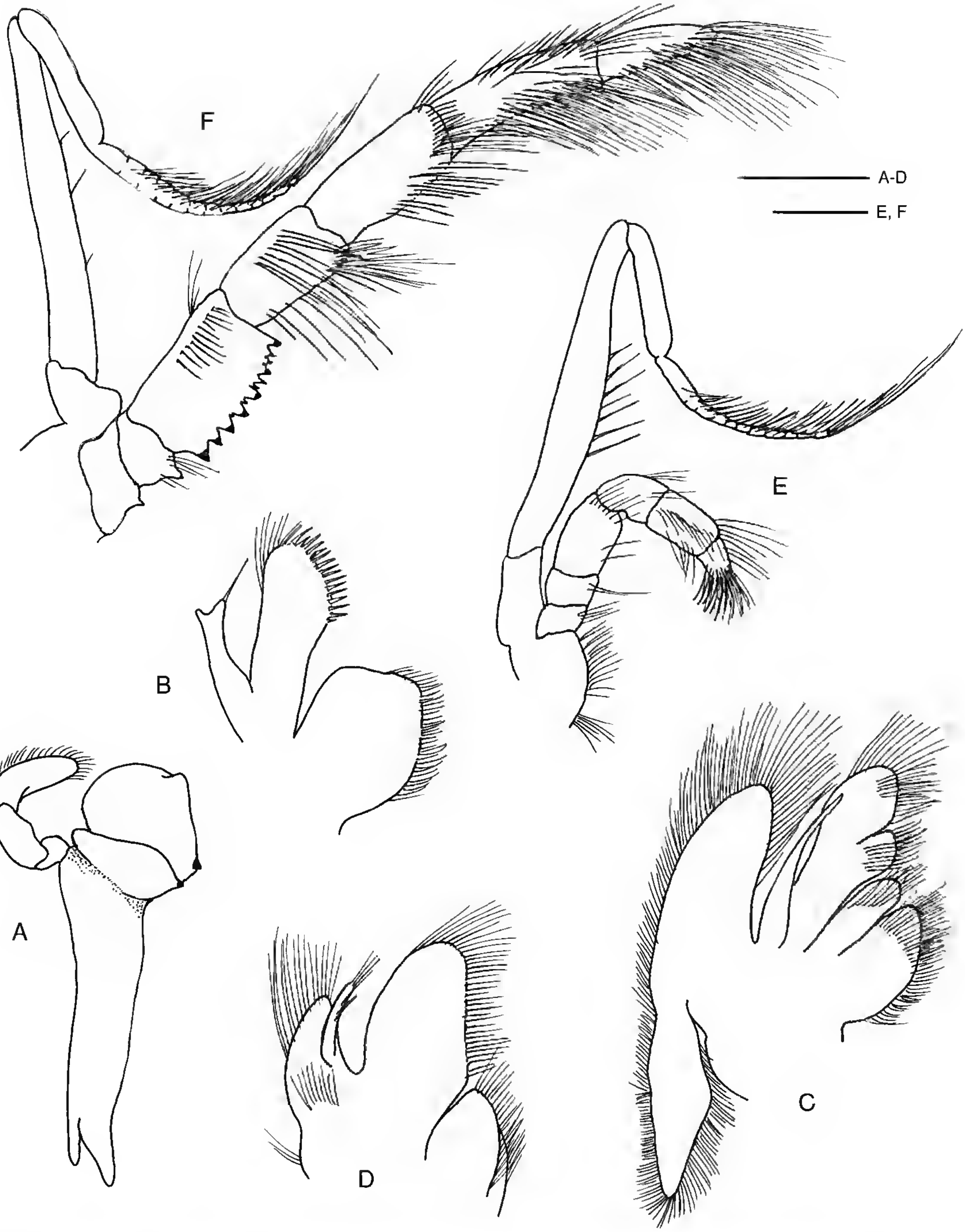

FIG. 2. — *Oncopagurus oimos* n.sp., *Marara* stn 499, Moruroa atoll, paratype ♂ (2.4 mm) (MNHN-Pg 5506). Left mouthparts (internal view): **A**, mandible; **B**, maxillule; **C**, maxilla; **D**, first maxilliped; **E**, second maxilliped; **F**, third maxilliped. Scale bars: 0.5 mm.

meri but only on the lateral faces; the dactyls have reddish dorsal faces.

REMARKS

This new species is the fifth in the genus *Oncopagurus* in which males lack first gonopods. The other four are *O. haigae* de Saint Laurent, 1972 (Eastern Pacific); *O. orientalis* de Saint Laurent, 1972 (Indo-Pacific); *O. tuamotu* Lemaitre, 1994 (known only from the Tuamotu Archipelago); and *O. cidaris* Lemaitre, 1996 (known only from Australia). The males of these

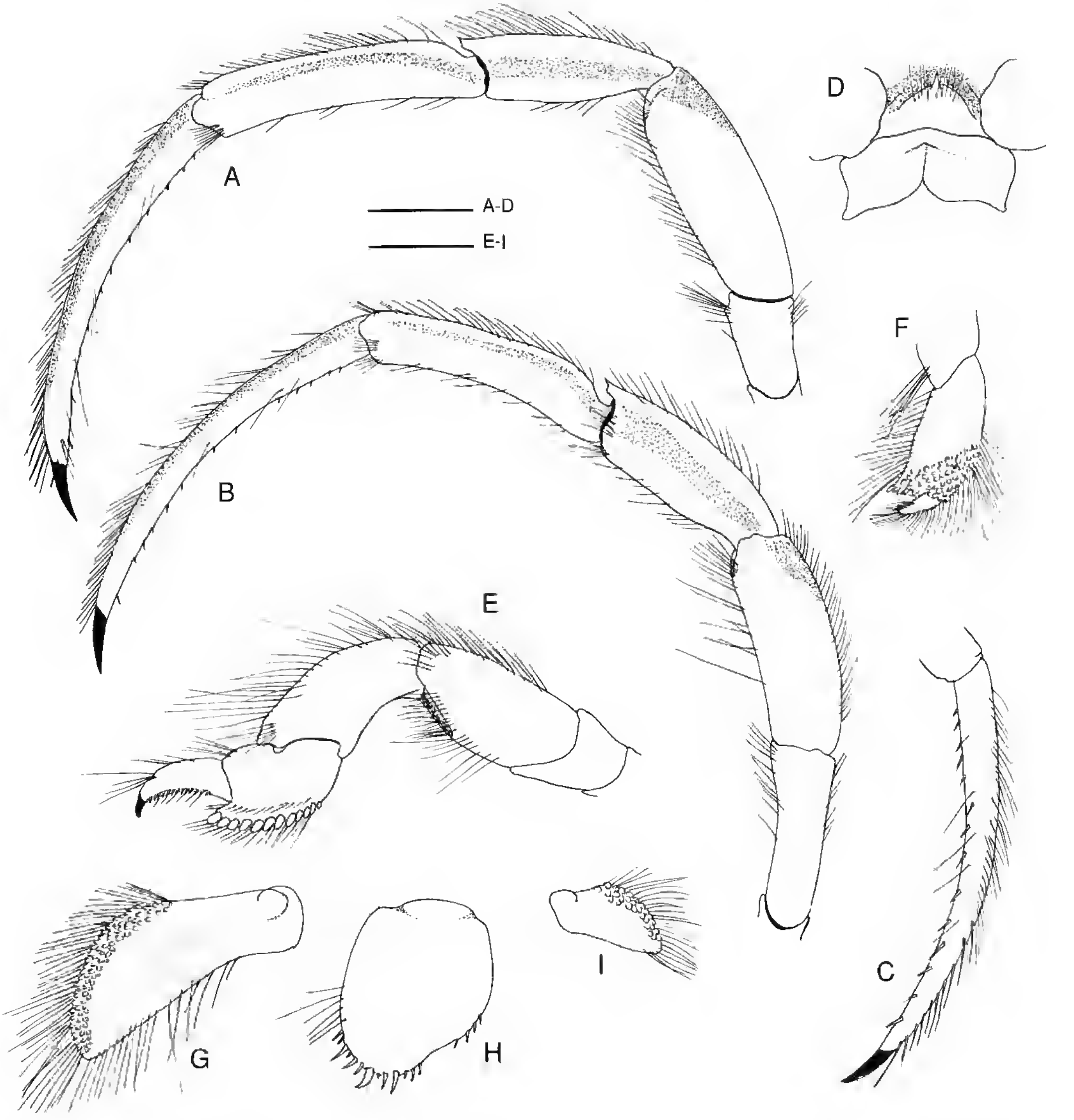

FIG. 3 — *Oncopagurus oimos* n.sp., *Marara*, stn 499, Moruroa atoll: holotype ♂ (2.8 mm) (MNHN-Pg 5505). **A**, left second pereopod (lateral view); **B**, left third pereopod (lateral view); **C**, dactyl of same (mesial view); **D**, sternite of third pereopods (ventral view); **E**, left fourth pereopod (lateral view); **F**, propodus and dactyl of left fifth pereopod (lateral view); **G**, exopod of left uropod (dorsal view); **H**, telson (dorsal view); **I**, exopod of right uropod (dorsal view). Stippled areas on second (**A**) and third (**B**) pereopods indicate reddish colour pattern. Scale bars: A-D, 1 mm; E-I, 0.5 mm.

four species have paired asymmetrical second gonopods; however, Lemaitre (1996, 1997) has documented intra-specific variation in males of *O. orientalis* and *O. cidaris*, where the second right gonopod is occasionally lacking. The three known males of *O. oimos* n.sp. have only reduced, simple unpaired left second pleopods. The segmentation of the male second pleopods in these five species differs. The second pleopods are unsegmented in *O. oimos* n.sp., *O. haigae* and *O. orientalis*; they are two-segmented in *O. tuamotu*; and one- or two-segmented in *O. cidaris*. Of all known species of *Oncopagurus*, *O. oimos* n.sp. is the only one in which females have only unpaired left second pleopods; females of all other species have vestigial right second pleopods as well.

The distinctive colour pattern of *O. oimos* n.sp., can be used to distinguish it from *O. tuamotu*, the only other congeneric species known from French Polynesia. The new species has broad stripes on the left cheliped and ambulatory legs (Figs 1G, 3A, B), whereas *O. tuamotu* has red bands on the cheliped and walking legs (see Lemaitre 1994: 411, fig. 28I). In addition to the previously mentioned differences in pleopod conditions, other characters can also be used to distinguish *O. oimos* n.sp. from *O. tuamotu*. The mesial face of the right palm is rounded in the new species, with a weak irregular dorsomesial row of spines, whereas the mesial face is expanded distally, and there is a distinct dorsomesial and ventromesial rows of spines in *O. tuamotu*. The left chela is noticeably more slender, as long as the carpus, and the fingers are set nearly parallel to the longitudinal axis of the palm in the new species; the chela is shorter than the carpus, and the fingers are set obliquely (pointing ventrolaterally) to the longitudinal axis of the palm in *O. tuamotu*.

Acknowledgements

The collecting efforts of Joseph Poupin in French Polynesia have been invaluable in documenting the crustacean fauna from this area. His efforts are gratefully acknowledged. I thank also Alain Crosnier for fostering this and other studies based on the important material gathered during many recent French expeditions.

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Phyllotymolinidae, nouvelle famille de Brachyoures Podotremata (Crustacea, Decapoda)

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RÉSUMÉ

Une nouvelle famille de crabes, les Phyllotymolinidae, est décrite pour les genres *Phyllotymolinum* Tavares, 1993, le genre-type, *Genkaia* Miyake *et* Takeda, 1970 et *Lonchodactylus* Tavares *et* Lemaitre, 1996. Quatre espèces sont incluses dans la nouvelle famille : *Phyllotymolinum crosnieri* Tavares, 1993 (Nouvelle-Calédonie et Vanuatu, 280-301 m) ; *Genkaia gordonae* Miyake *et* Takeda, 1970 (Japon, Tsushima, nord-est de Kyushu, 68-100 m) ; *Genkaia keijii* Tavares, 1993 (Nouvelle-Calédonie, 135-150 m) et *Lonchodactylus messingi* Tavares *et* Lemaitre, 1996 (Bahamas, 262 m).

MOTS CLÉS.
Crustacea,
Decapoda,
Brachyura,
Podotremata,
nouvelle famille,
faune bathyale.

ABSTRACT

Phyllotymolinidae, new family of Brachyura Podotremata (Crustacea, Decapoda). A new crab family, Phyllotymolinidae, is described to accommodate the genera *Phyllotymolinum* Tavares, 1993, the type genus, *Genkaia* Miyake *et* Takeda, 1970 and *Lonchodactylus* Tavares *et* Lemaitre, 1996. Four species are included in the new family: *Phyllotymolinum crosnieri* Tavares, 1993 (New Caledonia and Vanuatu, 280-301 m); *Genkaia gordonae* Miyake *et* Takeda, 1970 (Japon, Tsushima, north-eastern Kyushu, 68-100 m); *Genkaia keijii* Tavares, 1993 (New Caledonia, 135-150 m); and *Lonchodactylus messingi* Tavares *et* Lemaitre, 1996 (Bahamas, 262 m).

KEY WORDS
Crustacea,
Decapoda,
Brachyura,
Podotremata,
new family,
bathyal fauna.

INTRODUCTION

Une nouvelle famille, celle des Phyllotymolinidae fam. nov., est établie ici pour recevoir les genres *Genkaia* Miyake *et* Takeda, 1970, *Phyllotymolinum* Tavares, 1993 et *Lonchodactylus* Tavares *et* Lemaitre, 1996. Des trois genres mentionnés, seul *Genkaia* n'a pas été originalement décrit dans les cyclodorippidés. Lors de sa description, Miyake & Takeda (1970 : 27) puis Takeda (1973 : 77) ont vu en *Genkaia* un proche parent des genres dromiens *Hypoconcha* Guérin-Méneville, 1854 et *Conchoedromia* Chopra, 1934, et l'ont provisoirement rattaché aux Dromiidae. C'est Tavares (1993a : 281) qui a montré qu'il n'existe pas de liens immédiats entre *Genkaia* et les Dromiacea et l'a transféré dans les Cyclodorippidae.

Chez tous les Cyclodorippidae la disposition de l'endostome et des appendices buccaux peut être qualifiée d'oxystome, avec la fermeture du plancher buccal par les seuls troisièmes maxillipèdes (Mxp3). On notera que le palpe articulé sur la face interne du mérus de Mxp3 améliore la coaptation entre celui-ci et l'endostome. En revanche, les modifications pour la respiration rencontrées chez les Phyllotymolinidae concernent surtout les antennes, dans leur totalité. L'endostome est brachygnathe : le bord latéral du cadre buccal et les Mxp3 s'étendent vers l'avant, mais en demeurant rectangulaires. Il n'y a aucune coaptation entre les Mxp3 et l'endostome. L'appareil respiratoire des Phyllotymolinidae ne peut donc pas être considéré comme une disposition oxystome. Les structures impliquées dans le système respiratoire des Cyclodorippidae et des Phyllotymolinidae ne sont pas homologues et ne peuvent pas dériver l'un de l'autre. Ce sont principalement les importantes novations uniques chez les Brachyoures, fournies par la chambre prostomiale chez *Phyllotymolinum*, *Genkaia* et *Lonchodactylus* qui imposent la création de la nouvelle famille des Phyllotymolinidae.

La terminologie utilisée pour désigner les différentes structures de la carapace est celle de Tavares (1991b). Les abréviations suivantes ont été employées pour certains appendices :

Mxp1, 2, 3	maxillipèdes 1, 2 et 3 ;
P2, P3, P4, P5	péréiopodes 2, 3, 4 et 5 ;
Pl1, Pl2	pléopodes 1 et 2 ;
MNHN	Muséum national d'Histoire naturelle, Paris ;
ZMA	Zoölogisch Museum, Amsterdam.

PHYLLOTYMOLINIDAE fam. nov.

Dromiidae – Miyake & Takeda 1970 : 26. – Takeda 1973a : 77 (*pro parte*) ; 1973b : 22 (*pro parte*) ; 1985: 97. – Sakai 1976 : 7 (*pro parte*).

Cyclodorippidae – Tavares 1993a : 280, 285 (*pro parte*). – Tavares & Lemaitre 1996 : 464. – Tavares 1997 : 262 (*pro parte*).

GENRE-TYPE. — *Phyllotymolinum* Tavares, 1993. Genre neutre. Espèce-type *Phyllotymolinum crosnieri* Tavares, 1993 par désignation originale et par monotypie.

GENRES INCLUS. — *Phyllotymolinum* Tavares, 1993 ; *Genkaia* Miyake *et* Takeda, 1970 ; *Lonchodactylus* Tavares *et* Lemaitre, 1996.

ESPÈCES INCLUSES. — *Phyllotymolinum crosnieri* Tavares, 1993 ; *Genkaia gordonae* Miyake *et* Takeda, 1970 ; *Genkaia keijii* Tavares, 1993 ; *Lonchodactylus messingi* Tavares *et* Lemaitre, 1996.

DISTRIBUTION. — Même si les connaissances actuelles sur les Phyllotymolinidae sont fort limitées, il semble que, à l'exemple des Cyclodorippidae (Tavares 1997), l'Atlantique américain et l'océan Indo-Ouest-Pacifique possèdent une faune phyllotymolinienne qui leur est propre. Des trois genres connus de Phyllotymolinidae, deux sont exclusivement indo-ouest-pacifiques : *Genkaia* (*G. gordonae*, Japon, Tsushima, nord-est de Kyushu, 68-100 m ; *G. keijii*, Nouvelle-Calédonie, 135-150 m) et *Phyllotymolinum* (*P. crosnieri*, Nouvelle-Calédonie et Vanuatu, 280-370 m). *Lonchodactylus* est entièrement américain (*L. messingi*, Bahamas, 262 m).

DESCRIPTION

Carapace bien calcifiée, assez plane, peu sculptée. Front subtriangulaire. Limites entre la face dorsale de la carapace et les flancs assez nettes. Largeur fronto-orbitaire supérieure à la moitié de la largeur maximale de la carapace.

Cavité orbitaire communiquant librement avec la cavité antennaire ; le lobe infra-orbitaire, médiocre, ne sépare nullement l'une de l'autre les cavités oculaire et antennaire. Bords supérieur et inférieur de l'orbite bien délimités. Dent exorbitaire proéminente. Pédoncules oculaires mobiles, courts, orientés transversalement par rapport à l'axe de la carapace. Antennes remarquablement robustes ; premier article antennaire mobile ; articles 2 + 3 en forme d'un grand auvent. Avancée de l'endostome très courte. Bords latéraux du cadre buccal assez allongés, atteignant le segment 2 + 3 de l'antenne.

Troisièmes maxillipèdes se coaptant parfaitement avec le bord latéral du cadre buccal. Exopodites des trois paires de maxillipèdes pourvus d'un flagelle normal. Exopodite de Mxp3 avec l'extrémité effilée, très long, atteignant l'extrémité distale du mérus ; palpe articulé à l'angle antéro-externe du mérus, ses articles 2 et 3 comprimés dorso-ventralement. Propode de l'endopodite de Mxp2 sans avancée.

Chélipèdes égaux. P2 et P3 similaires, peu sétifères, faiblement ornés ; dactyle comprimé latéralement. P4 et P5 également similaires, mais ischion de P5 deux fois plus long que celui de P4 ; P4 et P5 réduits, sauf leur coxae, et subdorsaux ; dactyle préhensile, se fermant sur la face latérale du propode.

Cavité sterno-abdominale peu délimitée et excavée. Abdomen femelle formé de sept segments, tous assez élargis. Premier segment abdominal couvrant tout l'espace entre les coxae des P5. Chez les femelles de *Genkaia* et *Lonchodactylus*, pléopodes 1 (Pl1) de la femelle vestigiaux, uniramés, insérés sur la face ventrale du premier seg-

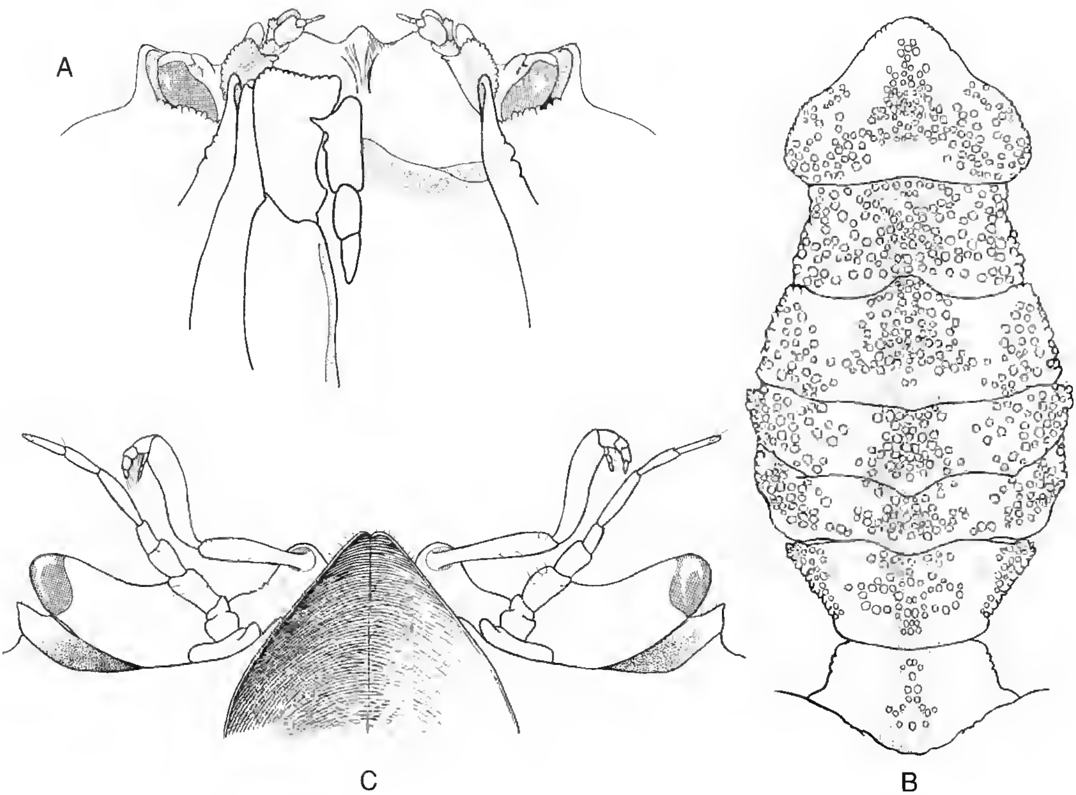


FIG. 1. — **A**, **B**, *Phyllotymolinum crosnieri* Tavares, 1993, ♂ holotype, 5,7 × 6,9 mm (MNHN-B 24617) ; **A**, vue ventrale de la région antérieure du cadre buccal ; **B**, face externe des segments abdominaux 1 à 6, et du telson ; **C**, *Ketamia depressa* (Ihle, 1916) (Cyclodorippidae), ♀ paralectotype, 4 × 4,3 mm (ZMA-De 102973), *id.* à A.

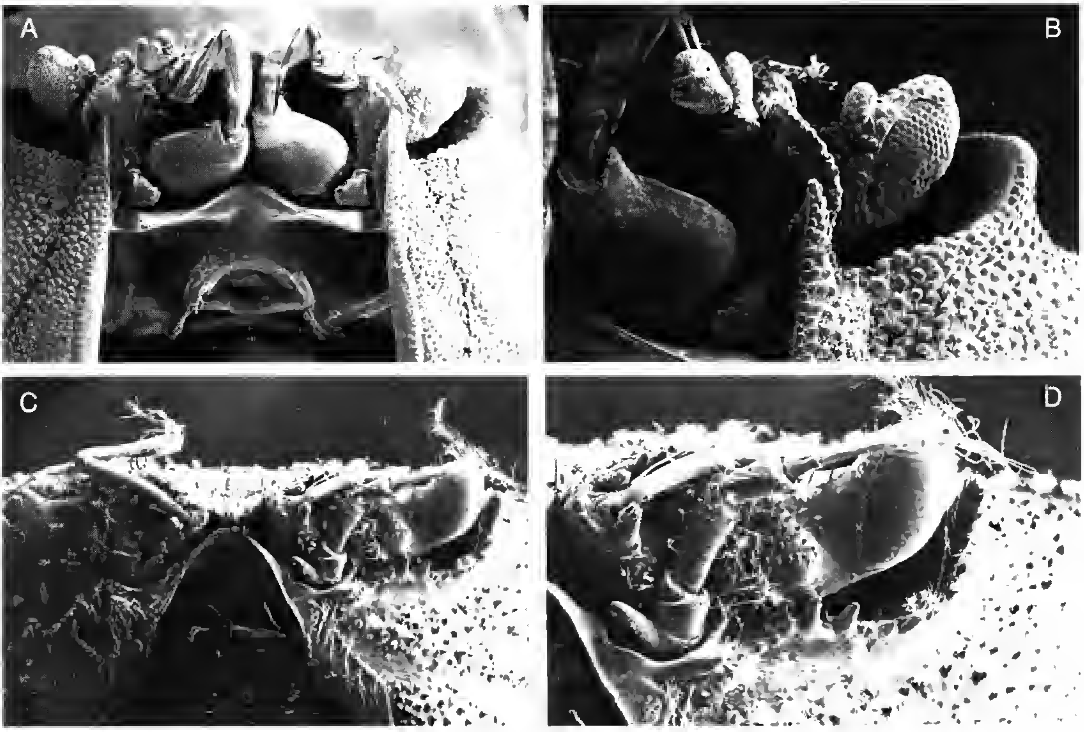


FIG. 2. — **A**, **B**, *Phyllotymolinum crosnieri* Tavares, 1993, ♀, 4 × 4,5 mm (MNHN-B 24618) ; **A**, vue d'ensemble de la région frontale de la carapace ; **B**, détail de la région antennaire ; à noter les bords du cadre buccal allongés jusqu'à toucher le deuxième article antennaire, très développé et en forme d'auvent ; **C**, **D**, *Xeinostoma eucheir* Stebbing, 1920 (Cyclodorippidae), ♀, 5 × 5,5 mm (MNHN-B 24717) ; **C**, vue frontale de la carapace ; **D**, détail des régions antennaire et oculaire. À noter les différences entre l'endostome de *P. crosnieri* et celui de *X. eucheir*.

ment abdominal. Pl1 absents chez la femelle de *Phyllotymolinum*. Pléopodes 2 à 5 biramés, Pl5 plus court que les pléopodes 2 à 4, non ovifère. Uropode absent chez la femelle et chez le mâle. Abdomen mâle de sept segments (jusqu'à présent le mâle de *Lonchodactylus messingi* n'est pas connu).

NOVATIONS ET AFFINITÉS DES PHYLLOTYMOLINIDAE

Il n'est pas question de mener dans cette note une analyse approfondie des affinités entre les Phyllotymolinidae fam. nov. et les autres Podotremata. Une analyse cladistique des familles de Podotremata est en cours de préparation (Guinot & Tavares). Toutefois, de la confrontation des connaissances accumulées au cours des études sur les Cyclodorippidae (Tavares 1991a, b, 1992a, b, c, 1993a, b, 1994, 1996, 1997 ; Tavares & Lemaitre 1996), dont les Phyllotymolinidae sont assez proches, nous avons dégagé certaines idées que nous avons jugé utile d'exposer dès à présent.

Chambre prostomiale

Les Phyllotymolinidae ne sont pas les seuls Podotremata à posséder une chambre prostomiale. Une telle chambre existe, par exemple, chez tous les Cyclodorippidae. Cependant, il faut bien faire la distinction entre les structures et appendices qui sont impliqués dans la formation de la chambre prostomiale, d'une part chez les Cyclodorippidae et d'autre part chez les Phyllotymolinidae.

La chambre prostomiale des Cyclodorippidae est constituée par le plancher de l'endostome recouvert par les appendices suivants : mandibules, maxillules, maxilles et maxillipèdes. L'endostome

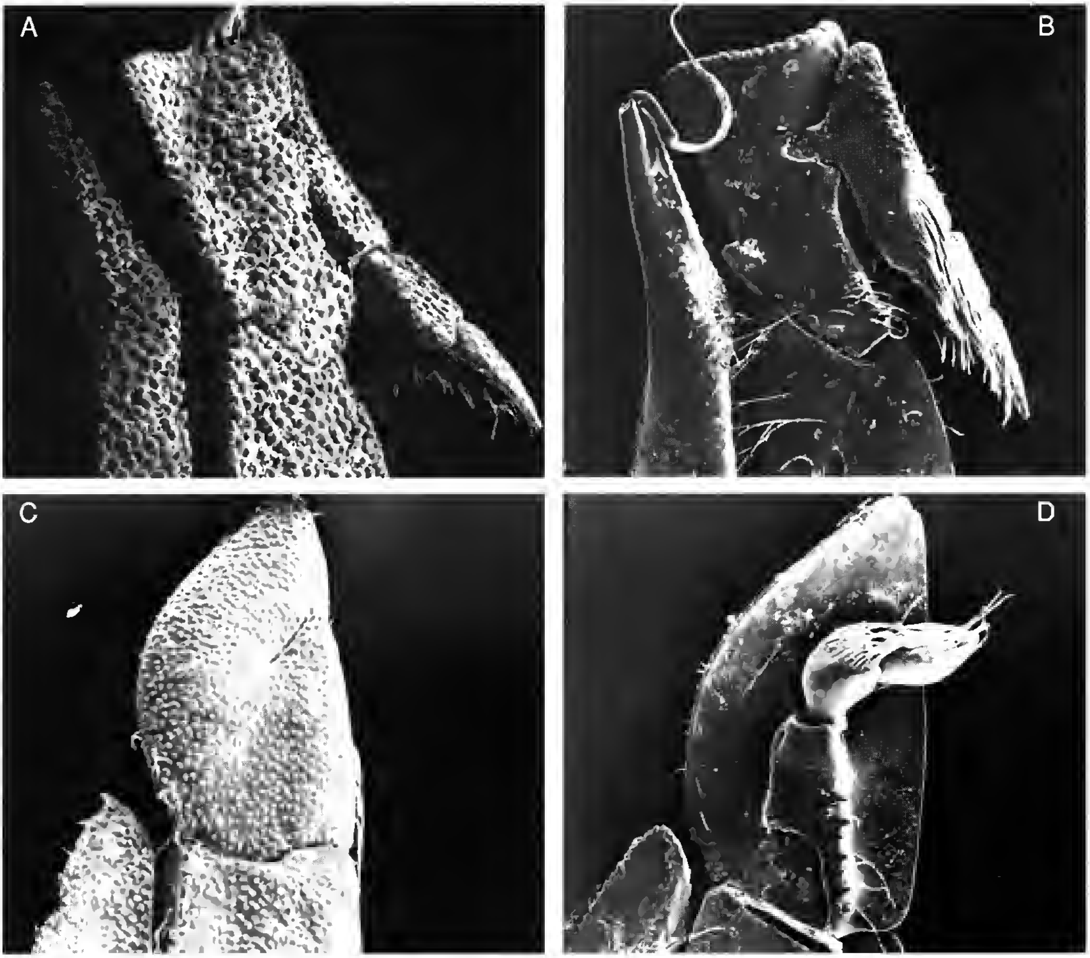
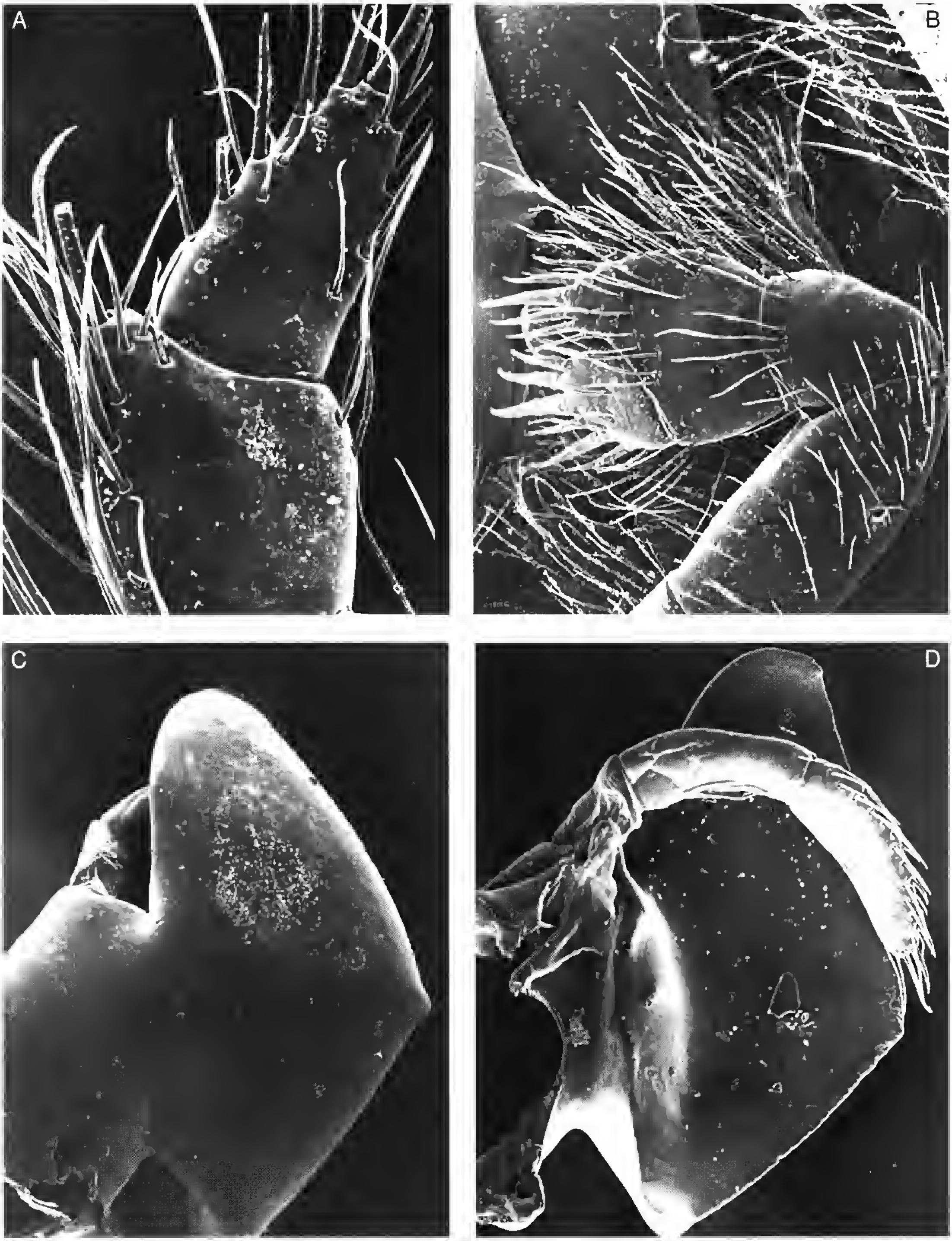


FIG. 3. — **A**, **B**, *Phyllotymolinum crosnieri* Tavares, 1993, ♀, 4 × 4,5 mm (MNHN-B 24618), vues dorsale (**A**) et ventrale (**B**) du Mxp3 ; à noter l'exopodite muni de flagelle et le palpe articulé sur le bord interne du mérus ; **C**, **D**, *Clythrocerus nitidus* (A. Milne Edwards, 1880) (Cyclodorippidae), ♂, 4 × 4,5 mm (MNHN-B 13489), vues dorsale (**C**) et ventrale (**D**) du Mxp3 ; à noter l'exopodite dépourvu de flagelle et le palpe articulé sur la face interne du mérus.

joue, dans tous les genres de la famille, un rôle primordial pour la formation de cette chambre prostomiale. Il est généralement très allongé et forme une gouttière, rétrécie vers l'avant et qui peut même dépasser de beaucoup le bord frontal de la carapace (Figs 1C, 2C). Comme relevé par Ortmann (1892 : 552) et par Ihle (1916b : 110, fig. 62), le Mxp3 épouse la forme de la gouttière endostomienne : il est extrêmement allongé et son mérus se termine par une extrémité distale avancée et effilée (Fig. 3C) ; le palpe est articulé non pas sur l'angle antéro-externe du mérus, mais à sa face interne, permettant une coaptation plus parfaite de chaque endopodite des Mxp3 (Fig. 3D). L'exopodite, lui aussi effilé distalement, est presque toujours dépourvu de flagelle (Fig. 3C, D), ce qui améliore la coaptation entre l'exopodite et les bords du cadre buccal. L'épipodite de Mxp3 est absent chez tous les Cyclodorippidae. Le Mxp2 conserve une forme plus habituelle (Fig. 4B) et agit, probablement, comme un filtre. Là aussi, l'exopodite est parfois dépourvu de flagelle. L'endopodite de Mxp1 est généralement plus allongé que l'exopodite et s'enroule vers son extrémité distale, comme l'a bien vu Ihle (1916b : 109, fig. 57) ; souvent


A
B
C
D

l'exopodite ne porte pas de flagelle. La maxille et la maxillule ne montrent pas de transformations, mais les mandibules sont modifiées en fonction du type de respiration oxystome : elles se coaptent entre elles, et leur forme très allongée (Fig. 4C, D) aide à guider le courant d'eau vers l'avant.

Chez les Phyllotymolinidae la chambre prostomiale est formée surtout du troisième maxillipède, du bord latéral du cadre buccal, de la mandibule et, cas unique chez les Brachyoures, de l'antenne. Les bords latéraux du cadre buccal s'allongent jusqu'à toucher les deuxième, troisième et quatrième articles antennaires (Figs 1A, 2A, B). Ceux-ci sont assez développés et en forme d'auvent (très caractéristique chez *Phyllotymolinum*, Fig. 2B), constituant avec les bords latéraux du cadre buccal une sorte de couloir, rétréci vers l'avant, remplaçant, du point de vue fonctionnel, la gouttière endostomienne décrite ci-dessus. On notera que les modifications du deuxième article antennaire (Fig. 5A, B) offertes par certains genres de Cyclodorippidae (*Deilocerus*, *Corycodus*, *Neocorycodus* et *Clythrocerus*) ne sont nullement de même nature que celles trouvées chez les Phyllotymolinidae et, d'ailleurs, elles n'ont aucune relation avec la formation d'une chambre prostomiale. Chez les Phyllotymolinidae, les Mxp3 sont d'un type ordinaire, si ce n'est qu'ils se coaptent parfaitement entre eux et avec les bords du cadre buccal, assurant ainsi la fermeture de la chambre prostomiale (Fig. 3A, B). Ici, l'endostome ne joue pas un rôle essentiel : il est court et n'est pas en forme de gouttière (Figs 1A, 2A). Chez *Genkaia*, la mandibule ne participe pas à la formation de la chambre prostomiale ; en revanche, chez *Phyllotymolinum*, la mandibule est tout aussi allongée que celle des Cyclodorippidae.

Fermeture du dactyle de P4 et de P5

Comme d'ordinaire chez les Brachyoures (voir aussi Guinot 1968), c'est toujours par deux

FIG. 4. — **A**, *Phyllotymolinum crosnieri* Tavares, 1993, ♀, 4 × 4,5 mm (MNHN-B 24618), détail de l'endopodite de Mxp2 ; à noter le propode sans avancée ; **B-D**, *Clythrocerus nitidus* (A. Milne Edwards, 1880) (Cyclodorippidae), ♂, 4 × 4,5 mm (MNHN-B 13489) ; **B**, détail de l'ensemble propode-dactyle ; à noter l'avancée du propode orné à peu près comme le dactyle ; **C**, **D**, mandibules gauche et droite, vues dorsale (C) et ventrale (D) ; à noter la forme très allongée.

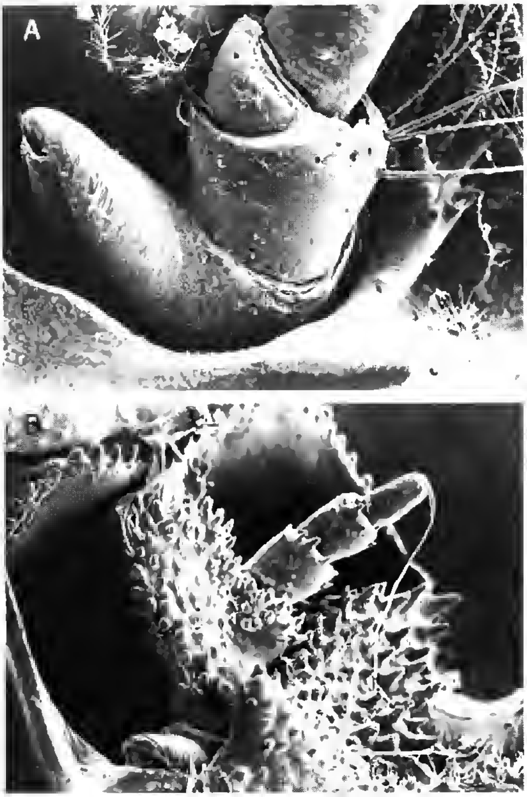


FIG. 5. — **A**, *Xeinostoma eucheir* Stebbing, 1920 (Cyclodorippidae), ♀, 5 × 5,5 mm (MNHN-B 24717), détail des quatre premiers articles antennaires ; **B**, *Clythrocerus nitidus* (A. Milne Edwards, 1880) (Cyclodorippidae), ♂, 4 × 4,5 mm (MNHN-B 13489), vue d'ensemble de l'antenne.

condyles que les articles des pattes thoraciques s'articulent entre eux (ou au corps, dans le cas de la coxa). Le plan d'articulation est alterné : la coxa s'articule au corps par un condyle ventral et par un condyle dorsal ; le basis s'articule à la coxa par deux condyles latéraux ; l'articulation entre l'ischion et le basis se fait à nouveau par un condyle ventral et par un condyle dorsal, et entre l'ischion et le mérus par deux condyles latéraux, et ainsi de suite. L'articulation à condyles latéraux entre deux articles permet une mobilité nettement plus importante que celle où la jointure des articles est dorso-ventrale. Chez les Phyllotymolinidae, P4 et P5 offrent, malgré leurs fortes modifications, un plan d'articulation qui reste rigoureusement le même. Cependant, c'est sur la face latérale du propode que les dactyles de P4 et

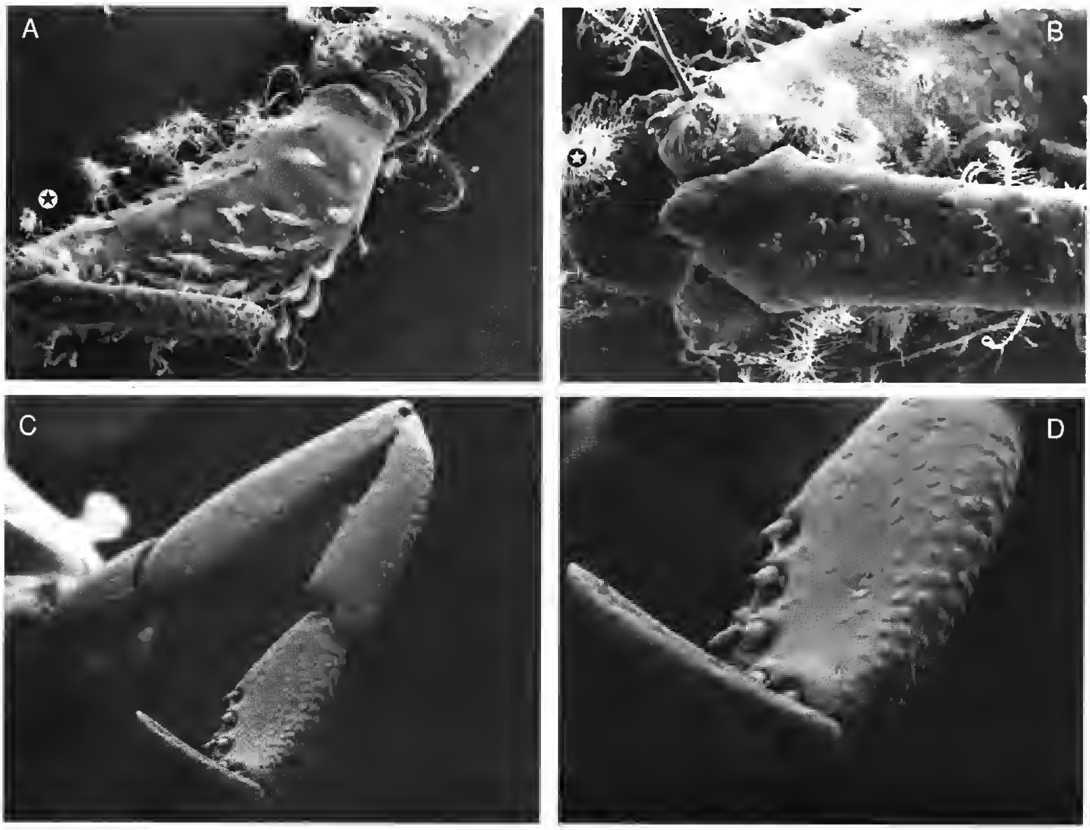


FIG. 6. — **A**, **B**, *Xeinostoma eucheir* Stebbing, 1920 (Cyclodorippidae), ♀, 5 × 5,5 mm (MNHN-B 24717) ; **C**, **D**, *Phyllotymolinum crosnieri* Tavares, 1993, ♀, 4 × 4,5 mm (MNHN-B 24618) : péréiopode 5 ; à noter le propode articulé sur le carpe par deux condyles dorso-ventraux et la torsion du propode et, en conséquence, le dactyle articulé sur le propode par deux condyles également en position dorso-ventrale.

de P5 se ferment. Le propode est parfois muni d'un petit tubercule ou de fortes soies, ce qui augmente la capacité préhensile de l'ensemble propode-dactyle (Fig. 6D). Rappelons que l'articulation entre le propode et le dactyle est assurée par deux condyles latéraux, ce qui assure beaucoup de souplesse mais impose, normalement, une fermeture du dactyle sur la face ventrale du propode et non pas sur sa face latérale. Néanmoins, chez tous les Phyllotymolinidae (ainsi que chez certains Podotremata), la moitié distale du propode de P4 et de P5 est tordue : les deux condyles latéraux assument de ce fait une position presque dorso-ventrale (Fig. 6A-D), ce qui permet au dactyle de se fermer sur la face latérale du propode, tout en gardant une très forte mobilité. C'est ainsi que le crabe acquiert la possibilité de tenir un objet au-dessus de la carapace.

Appareil de maintien de l'abdomen

Efficace, l'appareil de maintien de l'abdomen des Phyllotymolinidae est bien différent des systèmes décrits par Guinot (1979) pour la plupart des familles de Podotremata où la rétention de l'abdomen est souvent assurée par la coxa des divers appendices. Le fait que chez les Phyllotymolinidae le système de maintien (système à butoir) de l'abdomen fait appel à des éléments anatomiques différents (novation sur le sternite 6) de ceux des Cyclodorippidae (système à glissière, Figs 7A-C, 8), conduit à considérer l'appareil de rétention des Phyllotymolinidae

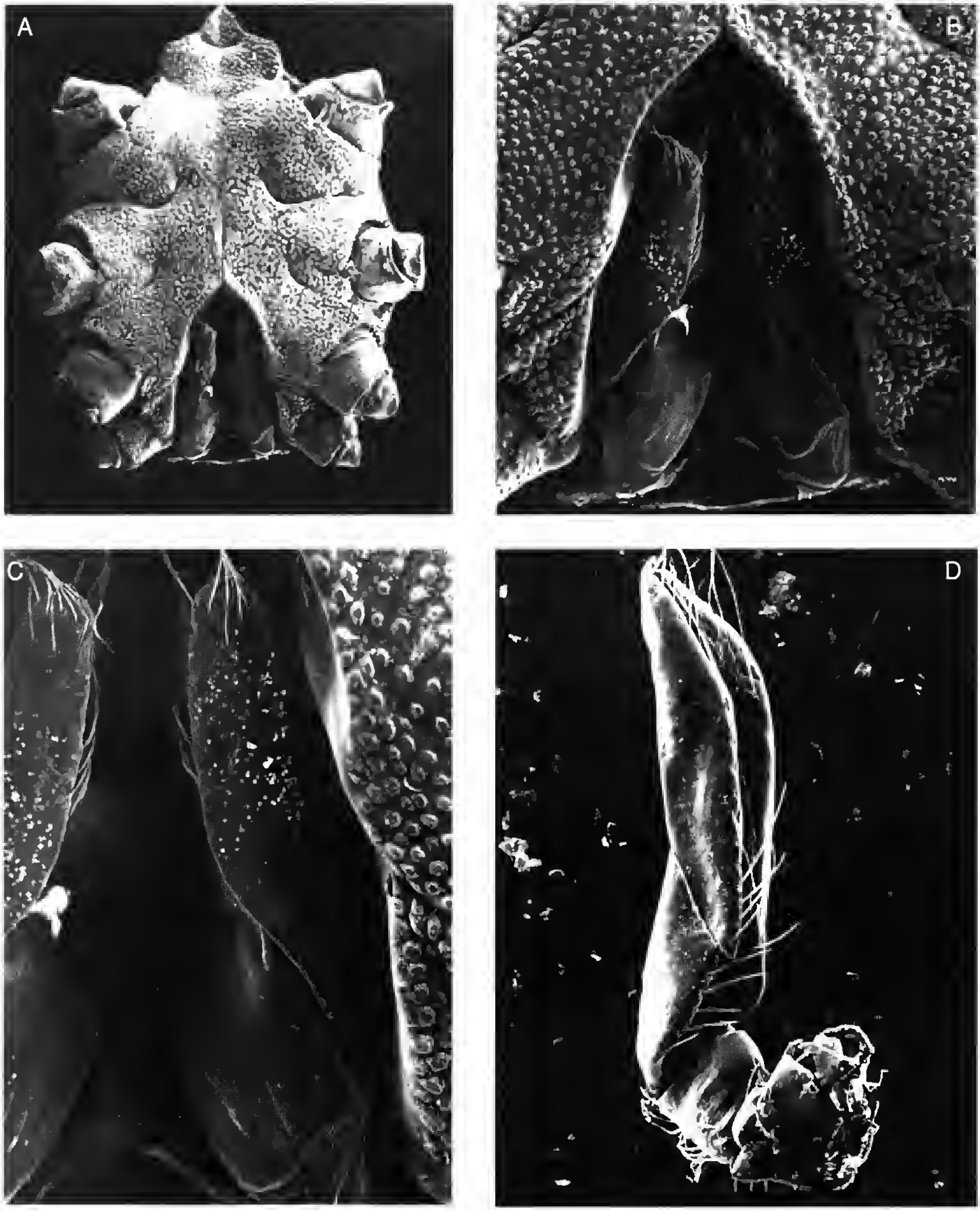


FIG. 7. — **A**-**D**, *Clythrocerus nitidus* (A. Milne Edwards, 1880) (Cyclodorippidae), ♂, 4 × 4,5 mm (MNHN-B 13489) ; **A**, vue d'ensemble du sternum thoracique ; **B**, détail de la cavité sterno-abdominale ; **C**, détail de l'un des bords latéraux de la cavité sterno-abdominale ; **D**, vue d'ensemble du Pl1. À noter, en A et B, que le sternum, assez large, n'est pas entièrement recouvert par l'abdomen quand celui-ci est replié sous le céphalothorax.

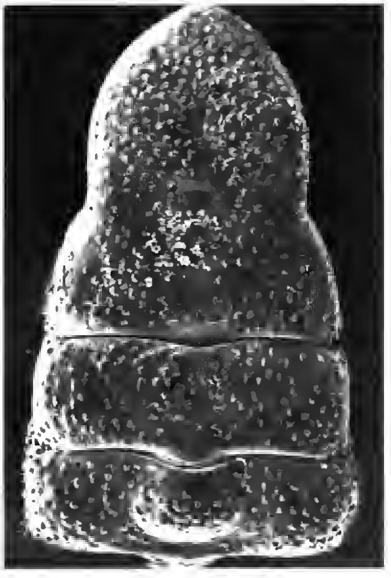


FIG. 8. — *Clythrocerus nitidus* (A. Milne Edwards, 1880) (Cyclodorippidae), ♂, 4 × 4,5 mm (MNHN-B 13489), les trois derniers segments abdomianux. À noter que la cavité sterno-abdominale fait saillie au niveau des P3 (Fig. 7B, C) et retient l'abdomen en l'empêchant de se soulever. De plus, le moulage entre le dernier segment abdominal et cette partie du sternite 6 rend ce système plus efficace.

comme non homologue de celui des autres Podotremata. Chez *Phyllotymolinum* le telson est très élargi à la base, il dépasse largement de chaque côté le bord antérieur du segment 6 (Fig. 1B). Le sternite 6 possède de chaque côté, au niveau de la coxa de P3, deux saillies en forme d'éperon obliques, bordées par une gorge. Lors du mouvement vers l'avant de l'abdomen, l'éperon sert de butée à l'expansion postéro-latérale du telson qui va pouvoir s'engager dans la gorge. Une ébauche de moulage entre l'abdomen et le sternum rend ce mécanisme plus parfait. Seul, un mouvement vers l'avant, suivi d'un soulèvement de l'abdomen, permet à celui-ci de se désengager. Chez *Genkaia*, le système de rétention est similaire, sauf que chaque éperon sur le sternite 6 est remplacé par une sorte de crête ornée de granules. Le mâle de *L. messingi* étant inconnu à l'heure actuelle, nous ne disposons d'aucun renseignement sur l'appareil de maintien de l'abdomen chez le genre *Lonchodactylus*.

Chambre incubatrice

Les Phyllotymolinidae femelles possèdent des segments abdominaux assez calcifiés, très bombés, avec des bords incurvés vers le bas. Ainsi la ponte est entièrement enserrée dans la sorte de boîte ainsi formée. Chez *Phyllotymolinum*, les exopodites des pléopodes, assez larges, assurent la fermeture latérale de la boîte (Fig. 9D). On observe une tendance vers la réduction du nombre de pléopodes (chez *Phyllotymolinum*, pas de Pl1) et de leur taille. Les Phyllotymolinidae sont les seuls Podotremata à avoir, chez la femelle, un Pl5 très réduit et non ovifère.

CYCLODORIPPOIDEA

Il n'est pas envisageable de considérer les Phyllotymolinidae comme une sous-famille de Cyclodorippidae. Outre les différences étudiées ci- dessus, il existe bien d'autres traits distinctifs concernant notament la formation de la cavité sterno-abdominale, le nombre de segments abdominaux, les pléopodes chez la femelle. Nous ne décelons aucune synapomorphie qui permetrait de réunir les Phyllotymolinidae et les Cyclodorippidae. D'ailleurs, dans l'état de nos connaissances actuelles, la notion de Cyclodorippoidea (Cymonomidae + Cyclodorippidae + Phyllotymolinidae) est à vérifier.

CLÉ POUR LES GENRES ET ESPÈCES DE PHYLLOTYMOLINIDAE FAM. NOV.

1. Ouvertures de la spermathèque presque contiguës et non indiquées par une bosse bien distincte .... *Lonchodactylus messingi*

2. Ouvertures de la spermathèque très écartées, indiquées par une bosse bien distincte.. 3

3. Pl1 absents chez la femelle. Exopodite de Pl2-5 foliacé. Sternites thoraciques 6-7 contigus .... *Phyllotymolinum crosnieri*

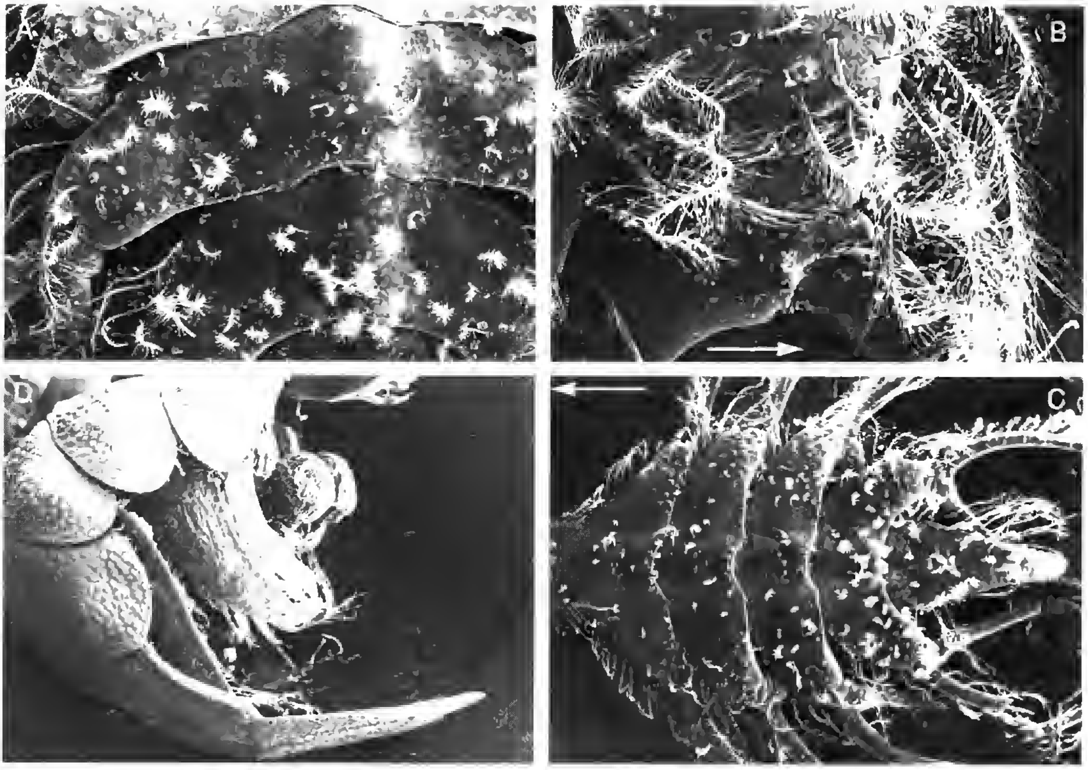


FIG. 9. — **A-C**, *Xeinostoma eucheir* Stebbing, 1920 (Cyclodorippidae). ♀, 5 × 5,5 mm (MNHN-B 24717) ; **D**, *Phyllotymolinum crosnieri* Tavares, 1993, ♀, 4 × 4,5 mm (MNHN-B 24618) : abdomen chez la femelle. B, C, la flèche indique le haut de la figure ; les pléopodes s'articulent à l'extrémité des segments abdominaux et non pas sur leur face ventrale ; D, les exopodites des pléopodes, assez larges, assurent la fermeture latérale de l'abdomen et la ponte est entièrement enserrée dans la sorte de boîte ainsi formée.

4. Pl1 présents, uniramés et vestigiaux. Exopodite de Pl2-5 comme d'ordinaire. Sternite 7 chevauchant une partie du sternite 6 .... *Genkaia* (5)

5. Distance entre la saillie latéro-branchiale de la carapace et de la dent exorbitaire correspondante aussi grande que la moitié de la largeur fronto-orbitaire de la carapace. Régions métabranchiales presque lisses. Doigts des chélipèdes allongés (doigt fixe orné de deux carènes longitudinales assez nettes sur chacune des faces interne et externe ; doigt mobile avec une seule carène). Bord préhensile du doigt fixe armé de dents menues. Face ventrale du propode du chélipède avec une avancée bien développée et en forme d'aile ; face ventrale du mérus munie d'une bosse assez grosse .... *G. keijii*

— Distance entre la saillie latéro-branchiale de la carapace et de la dent exorbitaire correspondante nettement moins grande que la moitié de la largeur fronto-orbitaire de la carapace. Régions métabranchiales abondamment garnies de granules aplatis. Doigts des chélipèdes plutôt courts (paire de carènes sur le doigt fixe et carène impaire du doigt mobile très peu nettes). Bord préhensile du doigt fixe armé de dents triangulaires fortes et assez développées. L'avancée aliforme de la face ventrale

FIG. 10. — *Phyllotymolinum crosnieri* Tavares, 1993, ♂, 4,2 × 4,2 mm (MNHN), vue dorsale. Échelle : 2 mm.

du propode des chélipèdes moyennement développée ; pas de bosse (ni d'autre protubérance accentuée, seulement des granules) sur la face ventrale du mérus ....*G. gordonae*

LISTE DES ESPÈCES DE PHYLLOTYMOLINIDAE ET DE CYCLODORIPPIDAE ILLUSTRÉES DANS CETTE NOTE

Clythrocerus nitidus (A. Milne Edwards, 1880) (Cyclodorippidae), *Bache*, W. Stimpson coll., *Sandy Key*, 135 m : ♂, 4 × 4,5 mm (MNHN-B 13489).

Ketamia depressa (Ihle, 1916) (Cyclodorippidae), Indonésie, *Siboga*, stn 260, îles Kei, 5°36,5'S - 132°55,2'E, 90 m : ♀ paralectotype, 4 × 4,3 mm (ZMA-De 102973).

Phyllotymolinum crosnieri Tavares, 1993 Nouvelle-Calédonie, SMIB 6, stn DW 117, 18°59,40'S - 163°25,40'E, 280 m : ♂ holotype, 5,7 × 6,9 mm (MNHN-B 24617).

Phyllotymolinum crosnieri Tavares, 1993 Nouvelle-Calédonie, SMIB 6, stn DW 117, 18°59,40'S - 163°25,40'E, 290 m : ♀, 4 × 4,5 mm (MNHN-B 24618).

Phyllotymolinum crosnieri Tavares, 1993 Nouvelle-Calédonie, *Lagon*, stn 500, 19°04'S - 163°30'E, 4.III.1985, 225 m : ♂, 4,2 × 4,2 mm (MNHN).

Xeinostoma eucheir Stebbing, 1920 (Cyclodorippidae), *Vauban*, 12°38,5'S - 48°16,5'E, 240 m : ♀, 5 × 5,5 mm (MNHN-B 24717).

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Collemboles interstitiels de sables continentaux et fluviatiles du Venezuela

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Thibaud J.-M. & Diaz A. 1998. — Collemboles interstitiels de sables continentaux et fluviatiles du Venezuela. *Zoosystema* 20 (1) : 123-127.

MOTS CLÉS
Collembola,
taxinomie,
nouvelle espèce,
sables continental et fluviatile,
Venezuela.

RÉSUMÉ
Dans ce travail nous citons huit espèces de Collemboles interstitiels des sables continentaux et fluviatiles du Venezuela, dont une espèce nouvelle pour la science : *Xenyllogastrura venezueliensis* n.sp. (Hypogastruridae).

KEY WORDS
Collembola,
taxinomy,
new species,
continental and fluvial sands,
Venezuela.

ABSTRACT
Interstitial Collembola of continental and fluvial sands from Venezuela. In this work we list eight interstitial species of Collembola from continental and fluvial sands in Venezuela, one of these species being new for science : *Xenyllogastrura venezueliensis* n.sp. (Hypogastruridae).

INTRODUCTION

Les Collemboles ont été récoltés, par le premier auteur, lors d'une mission effectuée au Venezuela en décembre 1996. Ils ont été extraits, par la méthode du lavage, du sable de dunes continentales proches de la ville de Coro dans l'État du Falcon, du sable fluviatile du Río Chama près d'El Vigia et du sable d'un torrent glaciaire du Páramo de Mucubají dans l'État de Mérida.
Huit espèces ont été identifiées, dont trois nouvelles pour le Venezuela, et une nouvelle pour la science : *Xenyllogastrura venezueliensis* n.sp. L'holotype et des paratypes sont déposés au Laboratoire d'Entomologie du Muséum national d'Histoire naturelle à Paris (MNHN), d'autres paratypes sont déposés au Département de Biologie de l'université des Andes à Mérida.

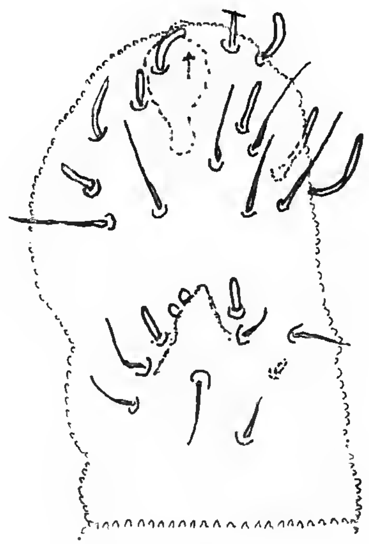

FIG. 1. — *Xenyllogastrura venezueliensis* n.sp., articles antennaires III et IV.

Famille HYPOGASTRURIDAE Börner, 1913

Xenyllogastrura venezueliensis n.sp.
(Figs 1-3)

MATÉRIEL-TYPE. — Holotype ♀ et 9 paratypes ♂ et ♀ (MNHN) et 4 paratypes ♂ et ♀ (Mérida, Universidad de los Andes).

LOCALITÉ-TYPE. — Venezuela, sable dunaire continental à Coro (État du Falcon), 6.XII.1996, J.-M. Thibaud réc.

DESCRIPTION
Longueur de l'holotype femelle : 400 µm ; des paratypes : 380-400 µm. Couleur blanche ; seules les cornéules résiduelles sont légèrement pigmentées en gris. Grains tégumentaires moyens (1 µm). Soies du même type, soies sensorielles un peu plus épaisses.
Antennes petites (57 µm), 0,8 fois plus courtes que la diagonale céphalique. Rapports articles antennaires I : II : III : IV = 1 : 1,2 : 1,36 : 1,6. Articles antennaire I et II avec, respectivement, sept et douze soies. Articles antennaires III et IV sans séparation nette. Organe sensoriel de l'article antennaire III classique du genre, avec deux microsensilles globuleuses, cachées partiellement par un repli tégumentaire et encadrées par deux sensilles de garde plus longues et cylindriques, ne dépassant pas la limite supérieure de ce repli tégumentaire, et par trois soies de garde ; présence d'une quinzaine d'autres soies et de la microsensille ventro-externe. Article antennaire IV avec sept ou huit sensilles cylindriques ; présence de la microsensille, ici assez longue, de l'organite subapical et d'une grosse vésicule apicale (Fig. 1).
Organe postantennaire avec 4 + 4 tubercules périphériques ; 33,3 % des individus présentent une asymétrie avec 4 + 3 tubercules. Le diamètre de cet organe postantennaire est égal à deux ou trois fois celui d'une cornéule (Fig. 2). 4 + 4 cornéules résiduelles d'un diamètre réduit (2 à 3 µm). Les pièces buccales sont classiques du genre.
Tibiotarses I, II et III avec, respectivement, dix-sept, dix-sept et seize soies, sans ergot capité ; fémurs avec chacun dix soies et trochanters avec chacun cinq soies. Griffes trapues, sans dent, avec un empodium assez court.
Tube ventral avec 6 + 6 soies. Rétinacle avec 2 + 2 dents. Furca courte (28 µm). Rapport manubrium : mucro-dens = 1,3 : 1. Dens avec deux soies dorsales. Présence de deux épines anales très petites (2 à 3 µm).
Chétotaxie dorsale (Fig. 2). Signalons, sur les

thorax II et III, la présence des m2, la position en p3 des soies sensorielles, l'absence des microsensilles latérales et, sur l'abdomen V, la présence des soies m2.
Chétotaxie ventrale des abdomens II à IV (Fig. 3). Signalons, sur la tête, la présence de 2 + 2 soies le long de la ligne ventrale, sur le thorax l'absence de soie, sur l'abdomen IV la présence, à la base du manubrium, d'une paire de macrochètes à large embase, caractéristiques du genre.
Ces chétotaxies présentent parfois certaines variabilités. Par exemple, sur le sternite abdominal IV, la rangée postérieure porte 1 + 1 ou 3 + 3 soies.

Discussion
Cette nouvelle espèce est très proche de *Xenyllogastrura octoculata* (Steiner, 1955) d'Europe et de Méditerranée, espèce redécrite par Deharveng & Gers (1979), et proche de *X. arenaria* Fjellberg, 1991 des îles Canaries.
Elle se différencie de la première par la longueur des deux sensilles de garde sur l'article antennaire III, ainsi que par celle de la microsensille sur l'article antennaire IV et par quelques détails de sa chétotaxie.
Elle se sépare de la seconde par la chétotaxie des tibiotarses, par la variabilité oculaire, par la longueur de l'empodium, par la taille du mucrodens, par la longueur des deux sensilles de garde sur l'article antennaire III, et par quelques détails de sa chétotaxie.
Ajoutons enfin que cette citation est la première du genre *Xenyllogastrura*, genre méditerranéen-européen-macaronésien, dans la région néotropicale.

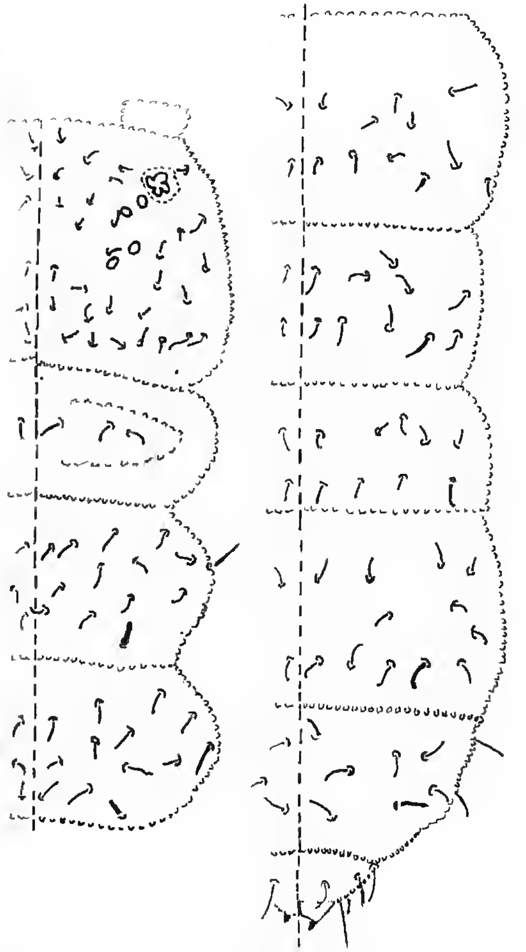

Fig. 2. — *Xenyllogastrura venezueliensis* n.sp., chétotaxie dorsale.

Famille Brachystomellidae Stach, 1949

Rapoporthella yolandae (Rapoport *et* Mano, 1969)

Matériel examiné. — 1 ♀, sable fluviatile du Río Chama à El Vigia, 2.XII.1996.

Remarque
Espèce édaphique-psammophile, néotropicale, décrite d'un sol de savane du Venezuela et retrouvée dans plusieurs îles des Petites Antilles.

Famille Onychiuridae Börner, 1913

Mesaphorura macrochaeta Rusek, 1976

Matériel examiné. — 6 ♀ et 14 ex. en alcool, sable d'un torrent glaciaire dans la vallée de Mucabají (Páramo de Mucubají, État de Mérida), 3.XII.1996.

Remarque
Espèce édaphique-psammophile, holarctique, retrouvée ici dans un milieu montagnard.

Protaphorura encarpata (Denis, 1931)

Matériel examiné. — 1 ♀, sable d'un torrent gla-

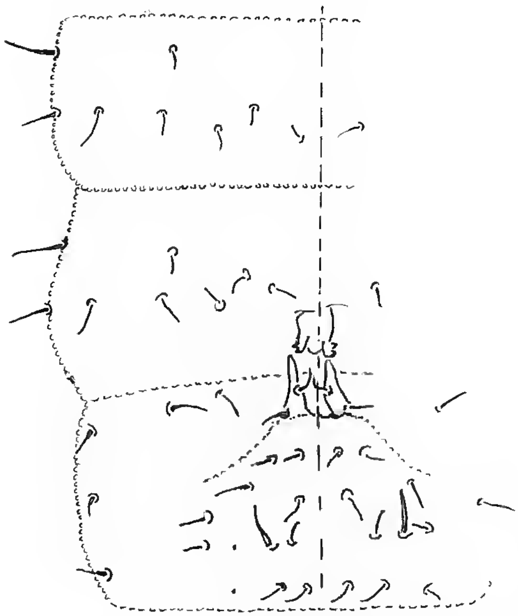

FIG. 3. — *Xenyllogastrura venezueliensis* n.sp., chétotaxie ventrale des abdomens II à IV.

ciaire dans la vallée de Mucabají (Páramo de Mucubají, État de Mérida), 3.XII.1996.

REMARQUE
Espèce édaphique, néotropicale, déjà signalée par Diaz & Najt (1995) du même páramo.

Famille ISOTOMIDAE Börner, 1913

Folsomides parvulus Stach, 1922

MATÉRIEL EXAMINÉ. — 1 ♀ et 1 juv., sable fluviatile du Río Chama à El Vigia, 2.XII.1996. 1 ♀, sable d'un torrent glaciaire dans la vallée de Mucabají (Páramo de Mucubají, État de Mérida), 3.XII.1996.

REMARQUE
Espèce édaphique-psammophile, cosmopolite, déjà signalée au Venezuela.

Folsomina onychiurina Denis, 1931

MATÉRIEL EXAMINÉ. — 8 ♀, sable fluviatile du Río Chama à El Vigia, 2.XII.1996.

REMARQUE
Espèce édaphique-psammophile, cosmopolite, déjà signalée au Venezuela.

Cryptopygus thermophilus (Axelson, 1900)

MATÉRIEL EXAMINÉ. — 1 ♀ et 1 ♂, sable fluviatile du Río Chama à El Vigia, 2.XII.1996.

REMARQUE
Espèce édaphique-psammophile, cosmopolite, déjà signalée au Venezuela.

Isotomiella* cf. *symetrimucronata
Najt *et* Thibaud, 1987

MATÉRIEL EXAMINÉ. — 1 ♀, sable d'un torrent glaciaire dans la vallée de Mucabají (Páramo de Mucubají, État de Mérida), 3.XII.1996.

REMARQUE
Espèce édaphique, pantropicale, décrite de l'Équateur, déjà retrouvée en Amazonie brésilienne, dans les îles Seychelles, dans l'atoll de Fangataufa (Polynésie) et dans trois îles des Galapagos (Thibaud, Najt & Jaquemart 1994). Cet unique exemplaire est, malheureusement, dépourvu de dens et de mucron.

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Röckel D., Korn W. & Kohn A. J. 1995. — *Manual of the living Conidae, volume 1: Indo-Pacific region.* Christa Hemmen, Wiesbaden, 517 p.

Schwaner T. D. 1985. — Population structure of black tiger snakes, *Notechis ater niger*, on offshore islands of South Australia: 35-46, *in* Grigg G., Shine R. & Ehmann H. (eds), *Biology of Australasian Frogs and Reptiles.* Surrey Beatty and Sons, Sydney.

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