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Some bathyal cheilostome Bryozoa (Bryozoa, Cheilostomata) from the Canary Islands (Spain, Eastern Atlantic), with descriptions of three new species, a new genus, and a new family

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Abstract

Five bathyal species of cheilostome Bryozoa have been found on a submarine volcano off the Canary Islands, on dead skeletons of the madreporarian *Madrepora oculata* Linnaeus. Three of them are new to science. For one species, the introduction of a new genus and family is necessary. In addition, the generic assignment of *Cribrilina alcicornis* Jullien is revised, including this species in *Distansescharella* d'Orbigny. *Tessaradoma boreale* (Busk) is cited for the first time from the Canary Islands.

Resumen

Se han encontrado cinco especies de briozoos queilostomados en un volcán submarino de las Islas Canarias, sobre restos de esqueletos del madreporario *Madrepora oculata* Linnaeus. Tres de ellas son nuevas para la ciencia, y para una se ha propuesto además un nuevo género y familia. Se revisa también la asignación genérica de *Cribrilina alcicornis* Jullien, que se incluye en el género *Distansescharella* d'Orbigny. *Tessaradoma boreale* (Busk) se cita por primera vez para las Islas Canarias.

Keywords: Bathyal, Bryozoa, Canary Islands, Cheilostomata, new taxa, West Africa

Introduction

The deep-water bryozoan fauna of the Canary Islands has been poorly sampled. The expeditions that collected bryozoa around the Islands or in the neighbouring areas sampled mostly in shallow water. The “Vanneau” (Canu and Bassler 1925, 1928; d'Hondt 1978), the Atlantide Report (Cook 1968a), the Cineca Expedition (Harmelin 1977), or the collection by local researchers (Aristegui and Cruz 1986) usually sampled shallower than 1000 m, with few exceptions (Harmelin and Aristegui 1988). However, the Canary Islands, which are volcanic, are surrounded by waters deeper than 3000 m. In addition to the islands, several submarine mountains of the same volcanic origin exist in the area.

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The bathyal bryozoan fauna of the Canary Islands, including that of the Islands and that of the neighbouring seamounts, is almost completely unexplored. The Enmedio volcano is one of the highest submarine elevations in this area. It is situated between Tenerife and Gran Canaria, approximately at the same distance from both islands (the Spanish word “Enmedio” means “in the middle”). It is surrounded by depths of about 2200 m, but the volcano rises to 1686 m depth.

A geological expedition by the Spanish oceanographic ship *B.I.O. Hespérides* collected some pieces of skeletons of a dead scleractinian coral (*Madrepora oculata* L.), with some living colonies of five species of cheilostome Bryozoa. It is thus part of a community of bathyal Bryozoa on dead cnidarian skeletons, similar to that described by Zabala et al. (1993) for the northwestern Mediterranean. Three species are new to science. In addition, one of them cannot be accommodated in any described genus and family, and new taxa at both levels are proposed.

This biological material is a byproduct of an expedition that did not have biological purposes. Furthermore, the Bryozoa were initially overlooked. One member of the expedition was interested in the determination of the coral, and the specialist consulted noticed the bryozoan colonies and gave them to the author.

Material and methods

The material was collected during the expedition HE051 (September 1998) by the Spanish oceanographic ship *B.I.O. Hespérides* at the Enmedio volcano (UTM: 28R X=385500, Y=3107830). One trawl for geological purposes was conducted from the top of the mountain (1686 m depth) to the base (2200 m) (García Cacho et al. 2000). Several pieces of skeleton of the madreporarian coral *Madrepora oculata* L. were collected, but it is not possible to know at what specific depth, between the limits of the trawling, the biological material was collected.

No specialists in benthic fauna were present during the expedition, and the pieces were stored dry. Nevertheless, it may be observed that the coral was dead but at least part of the bryozoan colonies were alive when they were collected, because some membranous remains were still present.

The colonies were cleaned with diluted bleach, coated with gold and photographed at the Servicio de Microscopía Electrónica de la Universidad de Sevilla (SMEUS) with a scanning electron microscope JEOL XL20.

The type and figured material was separated from two pieces of *Madrepora* which were especially rich in colonies. These pieces are kept at the Museo Nacional de Ciencias Naturales (Madrid) (MNCN). In accordance with the policy of MNCN, all colonies of the same species, on each piece of coral, have the same catalogue number. Only the colonies separated as types have their own numbers. The pieces of *Madrepora* are referred below as “*Madrepora* 1” and “*Madrepora* 2”.

Taxonomy

Five species of cheilostome bryozoa were present on the surface of *M. oculata* skeletons. Three of them are new to science and need description. The generic status of *Cribrilina alcornis* Jullien, 1882 is revised, including it in *Distansescharella* d’Orbigny. The fifth species, *Tessaradoma boreale* (Busk), is well known in deep waters of the Atlantic Ocean

(Hayward and Ryland 1999) and does not need further comment, except for the fact that this is its first report for the Canary Islands.

Family CALLOPORIDAE Norman, 1903

Genus *Alderina* Norman, 1903

Alderina canariensis sp. nov.

(Figures 1–3; Table I)

Material

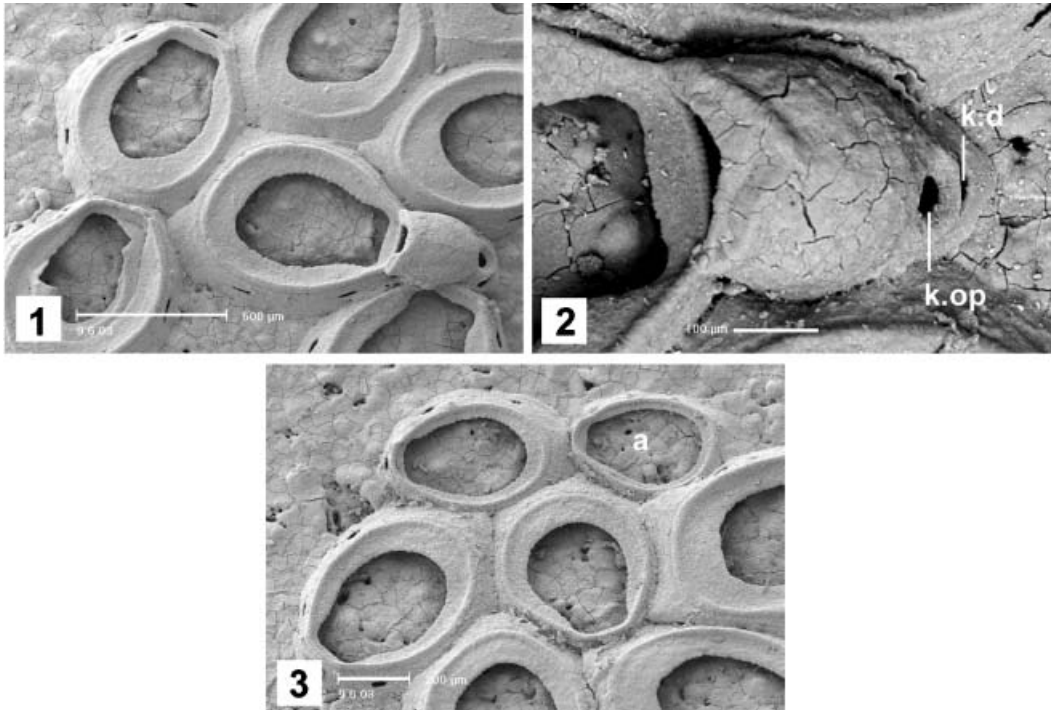
Many colonies on different pieces of *Madrepora oculata*.

Holotype: a complete colony with ancestrula and ovicells (MNCN 25.03/3722).

Other material. Numerous colonies on “*Madrepora* 1” (MNCN 25.03/3730) and “*Madrepora* 2” (MNCN 25.03/3736).

Description

Colony encrusting, unilaminar. Autozooids oval, with well-developed gymnocyst and cryptocyst. Spines absent except in the ancestrula and first zooids. Opesia extensive, occupying approximately two-thirds of the zooidal length. Ovicell hyperstomial, slightly



Figures 1–3. *Alderina canariensis* sp. n., holotype (MNCN 25.03/3722). (1) Autozooids and one ovicell, which has the ectooecium fully calcified. (2) Ovicell with frontal area of uncalcified ectooecium. The opesia (k.op.) and one dietella (k.d.) of the underlying kenozooid are also shown. (3) Ancestrula (a) and first zooids.

Table I. Dimensions (in mm) of *Alderina canariensis* sp. nov.

	N	Maximum	Minimum	Mean	SD
Zooid length	15	0.80	0.65	0.74	0.04
Zooid width	15	0.63	0.48	0.55	0.04
Opesia length	15	0.50	0.38	0.45	0.04
Opesia width	15	0.34	0.25	0.31	0.02
Ovicell width	10	0.30	0.25	0.27	0.02
Ancestrula length	3	0.48	0.43	0.44	
Ancestrula width	3	0.40	0.30	0.35	

longer than wide, not closed by the zooidal operculum. The ectooecium has usually a small triangular uncalcified area, but some ovicells have the ectooecium fully calcified. The ovicell is supported by a kenozooid which lies below and has a small gymnocyst and opesia and its own communication organs. Interzooidal communication by basal pore chambers, six per autozooid. Avicularia absent. The ancestrula is similar to an autozooid, but has thinner gymnocyst and cryptocyst and bears 10 marginal spines. The number of spines decreases progressively through early astogeny.

Discussion

The features of the new species, such as the gymnocyst and cryptocyst, the hyperstomial ovicell and the basal dietellae, are clearly calloporid. Among the calloporid genera, *Alderina* Norman, 1903 is the most appropriate to accommodate *A. canariensis* sp. nov., because its type species, *A. imbellis* (Hincks), has similar autozooids, lacks avicularia and its ovicell is not closed by the operculum. However, some differences exist between *A. canariensis* and *A. imbellis*, regarding mainly the marginal spines and the ovicell. In contrast with *A. canariensis*, *A. imbellis* is completely devoid of spines, even in the ancestrula (Hayward and Ryland 1998). The ovicell of *A. canariensis* sp. nov. has a small proximal area of uncalcified ectooecium, always clearly smaller than the same area of *A. imbellis*, and in some ovicells the ectooecium is fully calcified; these states coexist in the same colony. *Alderina canariensis* sp. nov. could also be near to *Crassimarginatella*, but the ovicell of this genus is closed by the operculum.

The most remarkable difference between *A. canariensis* sp. nov. and most calloporids (including *A. imbellis*) is the ovicell supported by a kenozooid, which has a small opesia (Figure 2). This is the situation termed B type by Bishop and Househam (1987). Although initially proposed for species of the genus *Puellina*, the classification of hyperstomial ovicells as types A, B and C depending on the degree of modification of the succeeding zooid may be used for many cheilostomes. The B type corresponds to the intermediate degree, in which the succeeding zooid is reduced to a kenozooid but still has a part of the frontal wall. It occurs in some cheilostome genera, such as *Puellina* and *Macropora* (Bishop and Househam 1987; López de la Cuadra and García Gómez 1997), where the three types are present depending on the species. Then, the B type ovicell of *A. canariensis* sp. nov. may be considered a specific character, which does not preclude the inclusion of this species in *Alderina*.

Within the Calloporoidea, the ovicell of type B also occurs in two austral uniserial species: *Daisyella libita* Gordon, 1989 and *Pyriporoides judyae* Branch and Hayward, 2005. Nevertheless, the ovicell of both species lack the small proximal area of uncalcified ectooecium which occurs in *Alderina*. Further, *Daisyella libita* has a median longitudinal

suture (Gordon 1989) and *Pyriporoides judiae* has a median longitudinal ridge (Branch and Hayward 2005), both structures lacking in any species of *Alderina*. An uniserial species, *Daisyella bathyalis* Rosso and Taylor, 2002, has been assigned to *Daisyella* in the northern Atlantic (Rosso and Taylor 2002). The ovicell of *D. bathyalis* has a proximal area of uncalcified ectooecium which occurs not only in *Alderina*, but also in some species of other calloporid genera like *Callopora*, *Amphiblestrum*, or *Copidozoum*, but it lacks any longitudinal structure, suture, or ridge, which are respectively present in *Daisyella* and *Pyriporoides*. Perhaps the generic assignment of *Daisyella bathyalis* could be reconsidered, but this is beyond the scope of the present work.

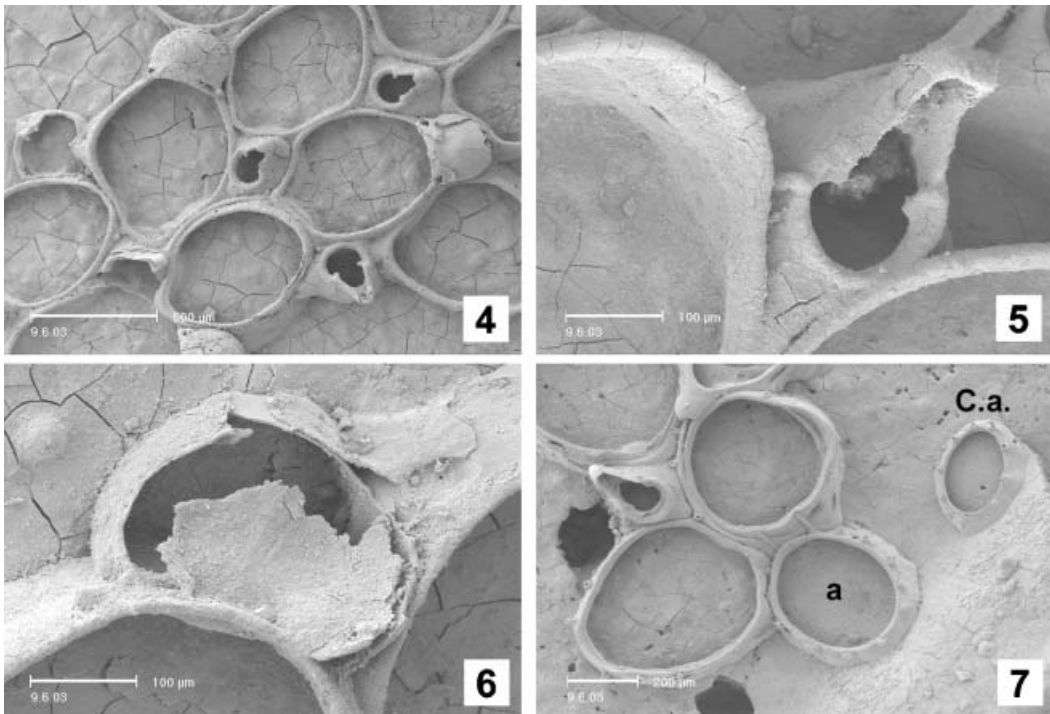
It is thus apparent that ovicells of B and C types, associated with a kenozooid, occur independently in different cheilostome genera, perhaps by reduction of the succeeding zooid.

Genus *Copidozoum* Harmer, 1926
***Copidozoum magnum* sp. nov.**
 (Figures 4–7; Table II)

Material

Many colonies on different pieces of *Madrepora oculata*.

Holotype: a complete colony with ovicells (MNCN 25.03/3723). Paratype: young colony with ancestrula (MNCN 25.03/3723).



Figures 4–7. *Copidozoum magnum* sp. n.: (4–6) holotype (MNCN 25.03/3723); (7) paratype (MNCN 25.03/3723). (4) Autozooids, ovicells, and avicularia. (5) Avicularium. (6) Broken ovicell, with the basal kenozooid below. (7) Ancestrula (a) and first zooids, the small ancestrula at right (C.a.) belongs to *Distansescharella alicornis*.

Table II. Dimensions (in mm) of *Copidozoum magnum* sp. nov.

	N	Maximum	Minimum	Mean	SD
Zooid length	15	0.83	0.63	0.70	0.05
Zooid width	15	0.63	0.50	0.55	0.04
Ovicell width	15	0.33	0.28	0.30	0.01
Avicularia length	15	0.31	0.23	0.26	0.03
Avicularia width	15	0.19	0.15	0.17	0.01
Ancestrula length	7	0.45	0.41	0.44	0.02
Ancestrula width	7	0.38	0.31	0.35	0.03

Other material. Numerous colonies on “Madrepora 1” (MNCN 25.03/3729) and “Madrepora 2” (MNCN 25.03/3735).

Description

Colony encrusting and unilaminar. Autozooids oval, with a narrow gymnocyst and very narrow cryptocyst. A large opesia occupies most of the frontal surface. Each autozooid bears a pair of caduceous oral spines, but there are no marginal spines except in the ancestrula and first zooids. Ovicell hemispherical, with semicircular orifice, fully calcified, with a narrow rim and two lateral ridges around the aperture. The ovicell is situated on a kenozooid, which may be seen at the colony margins, and in broken areas, as a small space below the ovicell, separated by pore chambers from both the maternal and the succeeding zooid. Intrazooidal budding by uniporous chambers. Avicularia interzooidal, triangular, with a hooked rostrum. Ancestrula tatiform, similar to autozooids in shape, but with 11 spines. The first postancestrular zooid has six spines in its distal half, and some of the subsequent zooids may have four.

Etymology

Magnum (=large) refers to the large size of the autozooids, compared with other species of the genus.

Discussion

The new species may be distinguished by its large zooids, thinly calcified and devoid of marginal spines, and by its ovicell lying on a kenozooid (Figure 6). In this species, the ovicell is of the type C of Bishop and Househam (1987), in which the supporting kenozooid is very reduced to an underlying space beneath the ovicell, without any trace of frontal wall, but with its own communication organs. The autozooids and avicularia are similar in shape to those of *Copidozoum exiguum* (Barroso 1920), but this species has small zooids with 8–10 marginal spines (Barroso 1920; Zabala and Maluquer 1988; Zabala et al. 1993; Hayward and Ryland 1998).

Two more species of *Copidozoum* exist in the Atlanto-Mediterranean region (*sensu* Ekman 1953): *C. planum* (Hincks) and *C. tenuirostre* (Hincks). Both have few or no spines, but they have avicularia with narrow rostrum and the ovicells are not supported by a kenozooid (Zabala and Maluquer 1988; Hayward and Ryland 1998). Only *C. exiguum* is found in deep waters, with a maximum known depth of 1097 m in the Bay of Biscay (Hayward and Ryland 1978). *Copidozoum planum* and *C. tenuirostre* are always found in

shallower depths than 200 m. Further, only *C. tenuirostre* is present on the Atlantic coast of Africa (Cook 1968a, 1968b, 1985; Aristegui and Cruz 1986) while *C. planum* and *C. exiguum* are only known from the Mediterranean or Atlantic European coasts.

Family CRIBRILINIDAE Hincks, 1879

Genus *Distansescharella* d'Orbigny, 1853

Distansescharella alcicornis (Jullien, 1882) comb. nov.

(Figures 7, 8; Table III)

Cribrilina alcicornis Jullien 1882; Harmelin 1978; Harmelin et al. 1989.

Material

Numerous colonies, with ovicells and ancestrulae, in both "Madrepora 1" (MNCN 25.03/3732) and "Madrepora 2" (MNCN 25.03/3737). Figured material, from "Madrepora 1": MNCN 25.03/3723.

Descriptions

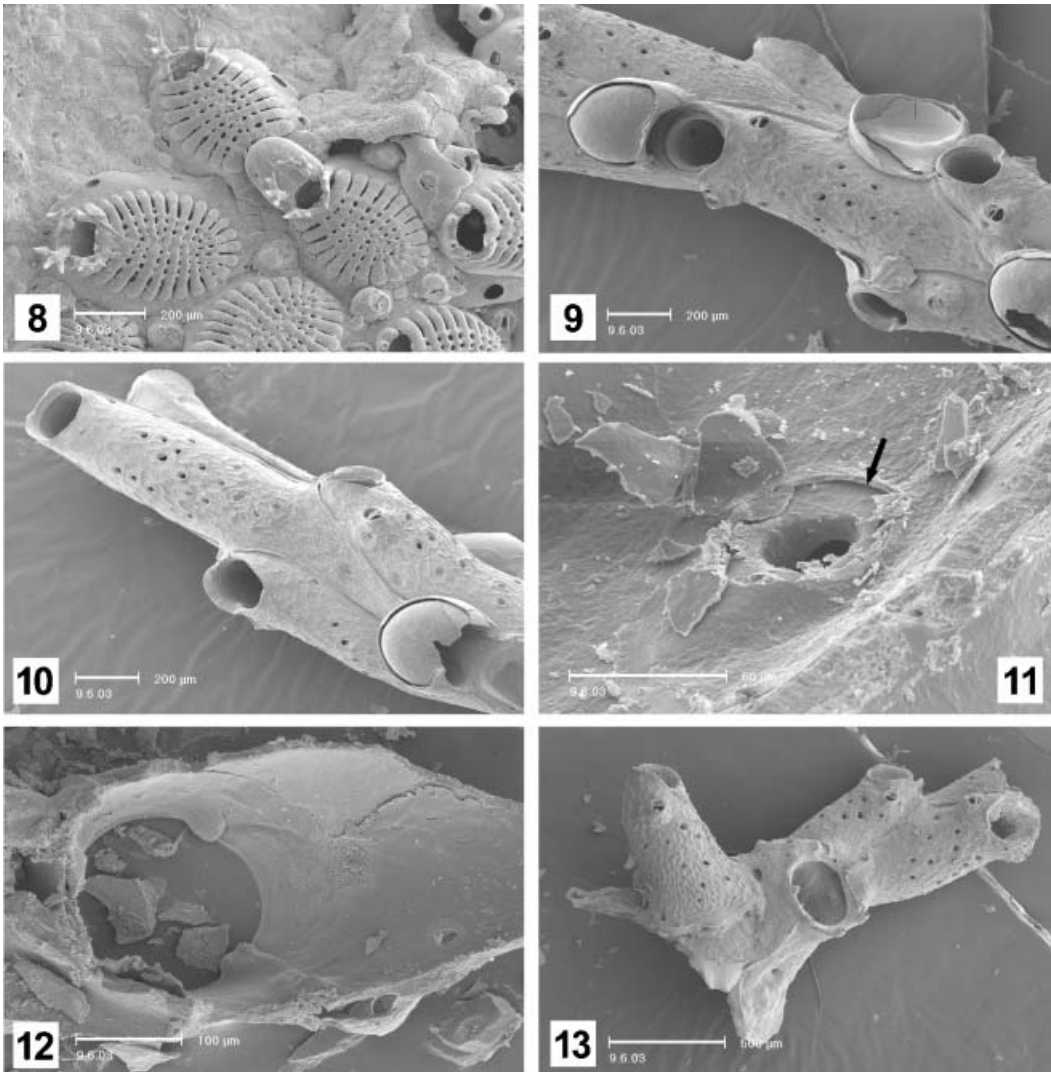
See Harmelin (1978) and Harmelin et al. (1989).

Remarks

Cribrilina alcicornis Jullien is a well-known species which does not need redescription. The numerous colonies present in the material from the Enmedio Volcan fit perfectly with previous descriptions (Harmelin 1978; Harmelin et al. 1989), although autozooids are slightly larger than in colonies from more northern waters. However, this report considerably enlarges the known geographical limits of the species, not previously cited southwards from the Straits of Gibraltar (Harmelin 1978; Harmelin et al. 1989). Otherwise, the depth of collection is within the previously known range of this bathyal species.

Assigning *Cribrilina alcicornis* to the genus *Distansescharella* d'Orbigny follows the opinion of Harmelin et al. (1989), who suggested that *Distansescharella seguenzai* Cipolla and *Cribrilina alcicornis* could be congeneric, although they did not formally propose the new binomen. After the clarification of *Cribrilina* Jullien by Bishop (1986, 1994), *Cribrilina alcicornis* cannot be retained in this genus, whose avicularia, when they exist, are adventitious and located at the sides of the orifice.

Harmelin et al. (1989) based their suggestion of a generic affinity between *Distansescharella seguenzai* and *Cribrilina alcicornis* on the similarity of the frontal shield, ovicell, number of spines, and the shape of the avicularia and the ancestrula. In both cases, the avicularia are vicarious. The zooids of *D. seguenzai* are linked by short tubules, and an alternation of kenozooids and avicularia separate the autozooids. *Distansescharella alcicornis* only occasionally has kenozooids, occupying spaces which leave no room for an autozooid. In addition, the zooids of *D. alcicornis* are united by dietellae in their walls, not by tubules. With these features, *D. alcicornis* is even more similar than *D. seguenzai* to the type species *Distansescharella familiaris* (von Hagenow), which lacks kenozooids (except for filling occasional small spaces) and is not disjunct. *Distansescharella familiaris* was redescribed, and a neotype was chosen, by Voigt (1959), and was also discussed and figured by Harmelin et al. (1989). Both *D. seguenzai* and *D. alcicornis* lack the large spatulate avicularia of *D. familiaris*, but as Harmelin et al. (1989) proposed, this may be a specific character of the type species.



Figures 8–13. (8) *Distansescharella alcicornis* (MNCN 25.03/3723). (9–13) *Acorania enmediensis* gen. et sp. nov.: (9–12) holotype (MNCN 25.03/3726); (13) paratype 1 (MNCN 25.03/3727). (9) Autozooid with ovicell and avicularia, the broken ovicell at right shows the unfused endooecium and ectooecium. (10) Growing tip of a branch. (11) Uniporous chamber, distal side, with pore and limit of the chamber (arrow). (12) Inner side of the frontal wall, with condyles. (13) Ancestrula and first zooids.

Table III. Dimensions (in mm) of *Distansescharella alcicornis*.

	N	Maximum	Minimum	Mean	SD
Zooid length	15	0.58	0.48	0.54	0.03
Zooid width	15	0.43	0.35	0.38	0.03
Orifice width	15	0.18	0.13	0.15	0.01
Ovicell width	15	0.23	0.18	0.20	0.02
Avicularia length	15	0.11	0.08	0.10	0.01
Ancestrula length	4	0.33	0.28	0.31	
Ancestrula width	4	0.28	0.20	0.24	

Family ACORANIIDAE fam. nov.*Diagnosis*

Autozooids with cryptocystidean frontal wall. Orifice with well-defined anter and poster, and condyles. Ovicell hyperstomial, not closed by the operculum, prominent, with an imperforate calcified entoecium, and a mostly membranous ectoecium. Interzooidal communication by uniporous septula. Avicularia may be present.

Genus *Acorania* gen. nov.*Diagnosis*

Colony erect. Autozooids elongate, with cryptocystidean wall, perforated by pseudopores except for an area proximal to the orifice. Orifice with well-defined anter and poster, and condyles. Peristome present. Ovicell hyperstomial, not closed by the operculum, prominent, with an imperforate calcified entoecium, and a mostly membranous ectoecium. Only a basal rim of ectoecium is calcified. Interzooidal communication through uniporous mural septula. Avicularia adventitious, on the margins of the frontal wall of autozooids, usually proximolateral to the orifice, paired or single, directed outwards.

Etymology

Acorania [a-ko-rá-nja] (feminine) derives from Acorán [a-ko-rán], one of the names (the easiest to pronounce and write) of the supreme god of the Guanches, the original people of the Canary Islands.

Acorania enmediensis sp. nov.

(Figures 9–13; Table IV)

Material

A few colonies, most in “Madrepora 2”. Only the holotype is well developed and preserved, but the ancestrula is overgrown and is not branched. Two paratypes have been chosen to complete the description.

Holotype: complete colony 2 cm high, not branched, with ovicells. The distal half used for SEM pictures (Figures 9, 10, 12, 13) (MNCN 25.03/3726). Paratypes: paratype 1, very

Table IV. Dimensions (in mm) of *Acorania enmediensis* gen. et sp. nov.

	<i>N</i>	Maximum	Minimum	Mean	SD
Zooid length	15	1.50	1.13	1.36	0.12
Zooid width	15	0.48	0.30	0.39	0.05
Orifice length	15	0.20	0.18	0.20	0.01
Ovicell width	10	0.38	0.33	0.35	0.02
Avicularia length	15	0.10	0.06	0.08	0.01
Ancestrula length	1	0.63			
Ancestrula width	1	0.45			

young colony, with ancestrula and three autozooids in two branches, used for SEM (Figure 11) (MNCN 25.03/3727); paratype 2, old colony, broken and branched (MNCN 25.03/3728).

Other material. One young colony on “Madrepora 1” (MNCN 25.03/3731) and a few ancestrulae on “Madrepora 2” (MNCN 25.03/3734).

Description

Colony erect, branching, delicate (branches 1 mm wide), with four rows of alternate autozooids whose frontal planes are angled at 45° to each other. Consequently, the branch has a frontal face in which the four rows are visible and an abfrontal face devoid of apertures. The autozooids are elongate, with the frontal wall perforated by pseudopores except in a small area proximal to the orifice. The orifice is almost circular, slightly wider than long, with two proximolateral condyles and a wide poster. A very low peristome, seen by SEM, is developed on both sides of the anter, but it is interrupted distally and does not surround the poster. The ovicell is hyperstomial, not closed by the operculum, prominent and smooth, with the ectooecium fully membranous except for a basal rim, and a fully calcified imperforate endooecium. Each autozooid bears usually two (less frequently only one) small elliptical avicularia, proximolateral to the orifice, with a complete bar between the opesia and the rostrum. Supplementary avicularia, directed outwards, may exist on the margins of the frontal wall of old zooids. Ancestrula erect, tatiform, with 10 marginal spines. Both transversal and lateral walls between zooids are double. Interzooidal communication by mural chambers, each one with a uniporous septulum.

Etymology

The specific name *enmediensis* refers to the Enmedio volcano.

Discussion

Acoraniidae fam. nov. is introduced to accommodate *Acorania* gen. nov., whose combination of characters is unique and does not fit any described family of cheilostomes. Many genera within the Lepraliomorpha have perforated frontal walls and orifices without a lyrula. Most of them are included in the superfamilies Schizoporelloidea Jullien and Smittinoidea Levinsen. But they do not have an ovicell with the features of *Acorania* gen. nov.: frontally uncalcified ectooecium, calcified imperforate endooecium and not closed by the operculum. The only exception is the Pacific genus *Torquatella* Tilbrook, Hayward and Gordon, provisionally included by the authors in the family Teuchoporidae Neviani (Tilbrook et al. 2001).

Acorania gen. nov. must not be included in the Teuchoporidae because it differs from the last diagnoses of this family (Gordon 1984; Hayward and Ryland 1999) in the presence of uniporous mural chambers for interzooidal communication and the imperforate ovicell, while Teuchoporidae has basal pore chambers or multiporous septula and perforate ovicell. *Torquatella* is the only Teuchoporidae genus with an imperforate ovicell, but it must be remembered that the inclusion of *Torquatella* in this family was only provisional (Tilbrook et al. 2001), and that *Torquatella*, as other teuchoporids, has multiporous septula.

In addition, the Teuchoporidae are represented in the Atlantic by *Phylactella* Hincks, which is very different from *Acorania* gen. nov.: *Phylactella* lacks avicularia and has a lyrula,

perforated ovicell, and basal multiporous chambers (Hayward and Ryland 1999). A close relationship between *Phylactella* and *Acorania* gen. nov. seems unlikely.

Other genera have similar ovicells, like the austral taxa *Isoschizoporella* (Eminoeciidae) and *Hippadenella* (Smittinidae), but they have imperforate frontal walls and multiporous septula (Hayward 1995). Further, the ovicells of the Eminoeciidae are associated with polymorphs (Hayward 1995), which does not occur in *Acorania* gen. nov.

The Acoraniidae fam. nov. may be placed in the superfamily Schizoporelloidea Jullien because of its lepralioid frontal wall, orifice without a lyrula, and ovicell with membranous ectoecium and imperforate endoecium, shared with schizoporelloideans such as *Arthropoma*, *Kymella*, *Fenestulina*, and the Lacernidae Jullien as redefined by Parker and Gordon (1992), although, in contrast with the new family, the ovicell is closed by the operculum in all these taxa.

Nevertheless, any assignation to a superfamily within the Lepraliomorpha may be considered provisional in the current state of knowledge. The superfamilies of Lepraliomorpha, and especially the very diverse Schizoporelloidea, need revision and clarification of diagnostic characters. Gordon (1994) re-established the Smittinoidea Levinsen, in which the two layers of the ovicell are calcified (which precludes the inclusion of Acoraniidae fam. nov. in it), but since then, several works differ in the assignation of some families to either Schizoporelloidea, Smittinoidea or others. An example may be the above-mentioned Teuchoporidae, included in the Schizoporelloidea by Hayward and Ryland (1999) and Bock (2006), but in the Smittinoidea by Tilbrook et al. (2001).

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