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Restoration of the genus *Pseudocorynactis* Den Hartog, 1980 and enmended diagnosis of the genera *Corynactis* Allman,1846, *Pseudocorynactis* and *Paracorynactis* Ocaña, Den Hartog, Brito & Bos, 2010

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ABSTRACT

The genus *Pseudocorynactis* den Hartog, 1980 was synonymized in 2011 (see FAUTIN, 2011: 39) because its taxonomic weakness and merged into *Corynactis* Allman, 1846. In the same paper Fautin merge automatically *Pseudocorynactis caboverdensis* and *Pseudocorynactis globulifera* into *Corynactis* without appropriate discussion otherwise the paper printed one year ago (see OCAÑA *et al*., 2010) would had been referenced in Fautin's paper and indeed the new genus *Paracorynactis* Ocaña, den Hartog, Brito and Bos, 2010 would had not been overlooked by the North American author. Along this paper we reestablished the genus *Pseudocorynactis* and confirming the taxonomic status of *Paracorynactis* as separated genera from *Corynactis*. In addition, there are also enmended diagnosis of the genera *Pseudocorynactis*, *Paracorynactis* and *Corynactis* in order to prevent future erroneus taxonomic interpretations.

Keywords: *Pseudocorynactis*, genus reestablishment, tentacles structure and function, cnidom and anatomical differences.

RESUMEN

El género *Pseudocorynactis* den Hartog, 1980 fue sinonimizado con el género *Corynactis* Allman, 1846 debido a su inconsistencia taxonómica (ver FAUTIN, 2011: 39). En el mismo artículo Fautin sinonimizó e incluyó automáticamente a las especies *Pseudocorynactis caboverdensis* y *Pseudocorynactis globulifera* dentro del género *Corynactis* sin una

apropiada discusion ya que sino el artículo impreso un año antes (ver OCAÑA *et al*., 2010) hubiera sido citado en el trabajo de Fautin y el nuevo género *Paracorynactis* Ocaña, den Hartog, Brito and Bos, 2010 no hubiera sido ignorado por la autora norteamericana. A lo largo de este artículo restablecemos el género *Pseudocorynactis* y lo separamos definitivamente de *Corynactis*. Además, se incluyen las diagnosis enmendadas de los géneros *Pseudocorynactis*, *Paracorynactis* y *Corynactis* para prevenir futuras erróneas interpretaciones.

Palabras clave: *Pseudocorynactis*, género reestablecido, estructura y función tentáculos, cnidoma y diferencias anatómicas.

1. INTRODUCTION

The genus *Pseudocorynactis* was described by den Hartog in 1980 to accommodate a group of Corallimorpharians species from the Caribbean that have extremely well developed acrospheres. Later, the new genus *Paracorynactis* Ocaña, den Hartog, Brito and Bos, 2010 with prominent acrospheres was erected to merge a new species of solitary Corallimorphidae widely spread along the Indopacific region (see OCAÑA *et al*., 2010).

The genus *Corynactis* is well known along the temperate and even cold waters from the Mediterranean, Atlantic ocean, California coast, South Australia, New Zealand, South Africa and Chile.

FAUTIN (2011) published in Zootaxa, invalidated the genera *Pseudocorynactis* and merged into *Corynactis* arguing a taxonomic weakness. Sadly, Fautin ignored our paper (see OCAÑA *et al*., 2010) and nothing was mentioned (see FAUTIN, 2011) about the new genus *Paracorynactis* or the two new species of *Pseudocorynactis* described one year before (see OCAÑA *et al*., 2010). Moreover, it is also plausible to think that reviewers perhaps did not have enough experience to focus the polemic and categorical arguments used by Fautin or even to check previous papers studying similar subjects. The first author in this paper has enough experience working on Actiniaria and Corallimorpharia from New Zealand waters (see CAIRNS *et al*., 2009) but, obviously, he was not one of the reviewers in charge of the mentioned Fautin's paper. Since 2011 nothing has been published to void the new genus *Paracorynactis*, a very eloquent silence along several years because *Paracorynactis hoplites* is now days a well-known species with a particular predatory behaviour and ecology (BOS *et al*., 2011; WICKEL *et al*., 2016). Some other wrong interpretations and concepts have been noticed in Fautin's paper (2011): A) A not very accurate affirmation about den Hartog work as "only dealt with shallow waters corallimorpharians", as the deep water genera *Corallimorphus*, *Sideractis* and *Nectactis* were searched by him (see den HARTOG *et al*., 1993). B) The diagnosis of the genus *Corynactis* provided by FAUTIN (2011: 40) includes concepts like "mesoglea thin" or "weak sphincter" that cannot be applied to *Corynactis* genus and even less to *Pseudocorynactis* (wrongly merged by Fautin into the genus *Corynactis*).

Finally and although anyone can be wrong during the research process we maintain that *Pseudocorynactis* and *Paracorynactis* are genera difficult to merge into *Corynactis*. However, to prevent future erroneous interpretations, we emend the diagnosis of these genera, pointing out the main characteristics and morphological differences. Therefore *Pseudocorynactis* is re-established and also separated from *Corynactis*.

2. RESULTS AND REMARKS

In 2010 was published a paper with two new species and a new genus of Corallimorpharia from the Indopacific (see OCAÑA *et al*., 2010). Latter Fautin remarks the number of tentacles as a low importance character to distinguish *Pseudocorynactis* from *Corynactis* (2011: 39) and so the author did not discuss nor analyses the importance of the tentacle development, which was already emphasized in OCAÑA *et al*. (2010). The anatomical structure of the tentacles and their differences, was neither discussed or studied, although it was previously observed by den HARTOG (1980) and den HARTOG *et al*. (1992), and both papers are mentioned by FAUTIN (2011). Unfortunately, the clear differences existing among types and distribution of the cnidae (differences among genus and species) were treated as homogeneous characters in the Fautin's paper (2011: 39). The key characters to understand the genera differences are the tentacles structure, function and the cnidom types and distribution. Fautin's affirmation: "moreover, the types and distribution of nematocysts are identical in the two genera" *Corynactis* and *Pseudocorynactis* is not true. *Pseudocorynactis* and *Paracorynactis* have special spirocysts (>100 < 300 mm) and large homotrichs in the acrosphere (see OCAÑA *et al*., 2010); *Corynactis* presents normal size spirocysts as expected in most hexacorallians and has not any trace about homotrichs into the tentacles (see den HARTOG, 1980; den HARTOG *et al*., 1993; OCAÑA, 2003). In addition, *Paracorynactis* and *Pseudocorynactis* have long elliptical Peniciili E (p-mastigophore E) in the acrospheres, meanwhile there are oval Penicilli E in *Corynactis* (see den HARTOG, 1980; den HARTOG *et al*., 1993; OCAÑA, 2003). Nematocysts differences among the three genera (*Corynactis*, *Pseudocorynactis* and *Paracorynactis*) are supported by distinct acrosphere structure: thicker (>200mm) ectoderm with two spirocyst categories in *Paracorynactis* and *Pseudocorynactis* (see den HARTOG *et al*., 1993: 34, Fig. 37) and a thin ectoderm (<125mm) with a single spirocyst type found in *Corynactis* (see den HARTOG *et al*., 1993: 10f, figs. 10 and 11; OCAÑA, 2003). The extensible capacity of the tentacles stalk and the column is also a significant feature, which is linked with the anatomy of the stalk and the natural life of the species, in order to make differences between the genera discussed. *Pseudocorynactis* is a night and passive predator and so, it extends enormously the tentacles, much more than the column, waiting for a prey to be taken accidentally. The strong ectodermal musculature in the tentacles stalk of *Pseudocorynactis caribbeorum* (see den HARTOG *et al*., 1993: fig., 36) and the absence of nematocysts in the stalk in the former species and all the *Pseudocorynactis* species analyzed (see OCAÑA *et al*., 2010) are also consistent differences with the genus *Corynactis*: a diurnal gregarious genus and a passive predator on small invertebrates that can form pseudocolonies (see OCAÑA, 2003) with normal ectodermal musculature and without high extensible capacity in the tentacles. As a consequence of this, *Corynactis* has not strongly differentiated tissues in the tentacles, and the nematocysts are abundant in the stalk. *Paracorynactis* is an active diurnal predator with moderate extendible tentacles but with a high capacity to elongate the body wall in order to catch the prey. Echinoderms are the main pray of *Paracorynactis* and the moderate extendible tentacles can approach to the prey thanks to the highly extendible column (BOS *et al*., 2011; WICKEL *et al*., 2016). *P. hoplites* specimens are highly efficient predators usually found in crevices (BOS *et al*., 2011). Other features regarding the anatomy, to separate the genera in discussion, are related to the mus-

culature (A) and the pharynx (B): A) There is enlarged endodermic sphincter in the three genera but a strong branched pennon in its first part only has been observed in *Corynactis* species (see Figs. 1,3,5). In addition, there are conspicuous retractor muscles and no trace of parietobasilar muscles in *Corynactis* (see Fig. 5), meanwhile *Pseudocorynactis* have weak inconspicuous retractors, only visible with the analysis of histological sections (den HARTOG *et al*., 1993) and present well developed often rounded parietal ridges (see den HARTOG, 1980; OCAÑA *et al*, 2010 and Figs. 1 and 3). *Paracorynactis* retractors are only conspicuous in some free mesenteries but show well developed enlarged parietal ridges (see OCAÑA *et al*., 2010; Fig. 1). B) Pharynx with numerous folds showing distinct narrow, projecting mesogloeal lamellae equalling the mesenteries in number and situated in direct line with them is an exclusive character of *Pseudocorynactis* and *Paracorynactis* (see den HARTOG, 1980 and Figs.1 and 3). *Corynactis* show pharynx with well developed longitudinal endodermal ridges supported by slightly thickened mesogloea and number of these ridges considerably less than number of mesenteries connected with the stomodaeal wall (with the pharynx itself) (see den HARTOG *et al*., 1993; OCAÑA, 2003 and Fig. 5).

As we pointed out in a previous paper (see OCAÑA *et al*., 2010) the species *Pseudocorynactis caboverdensis* den Hartog, Ocaña & Brito, 1993 should be placed into the genus *Corynactis*. This genus placement is more appropriate because there are oval penicilli E in the acrospheres, nematocysts in the stalk and absence of large homotrichs in the acrospheres of *P. caboverdensis*. Although we overlooked the presence of large spirocysts in *P. caboverdensis* (a typical character only known in *Pseudocorynactis* and *Paracorynactis* (see OCAÑA *et al*., 2010) this was described in other of our previous paper (see den HARTOG *et al*., 1993: 39). All the features previously mentioned are merged in *Corynactis caboverdensis* and certainly three characteristics are typical of the genus *Corynactis* and only one (the large spirocysts) has been exclusively recorded in the genera with prominent acrospheres (*Pseudocorynactis* and *Paracorynactis*). The combination of characteristics may suggest to erect a new genus, but the scarce material searched (only one small specimen) advise us to include the species provisionally into the genus *Corynactis,* waiting for more material of *C. caboverdensis* to be studied before we take a definitive conclusion.

2.1.*Emended diagnosis of the genera:*

Paracorynactis (see OCAÑA *et al*., 2010)

Emended diagnosis of the genus: Solitary form which may reach a relatively large size (diameter of the oral disc 10 to 15 cm); clones have never been observed. Body wall highly extendible; 3 to 5 radial rows of tentacles concentrate at the disc periphery, this character is much more conspicuous in expanded conditions. Acrospheres very prominent (ectoderm length > 200 mm), the most developed tentacles are concentrated in the disc periphery and at the margin. Tentacle stalks with medium to moderate extending capacity (half of the column as a maximum); nematocysts of several categories present in the stalk; strong ectodermic musculature but no brush like mesogloeal processes. Pharynx with numerous folds (distinct narrow, projecting mesogloeal lamellae) equalling the mesenteries in number and situated in direct line with them; siphonoglyph not observed but low diferenciated siphonoglyph may be present. Enlarged endodermic sphincter concentrated in the upper part of the column. All mesenteries are perfect and provided with restricted enlarged

parietal ridges, weak retractors only conspicuous in free mesenteries. Cnidom: there are large elliptical penicilli E (length > 200 mm), large homotrichs and big special spirocysts (length >100 μm) in the acrospheres, showing the high development of the acrospheres; nematocysts present in the stalk.

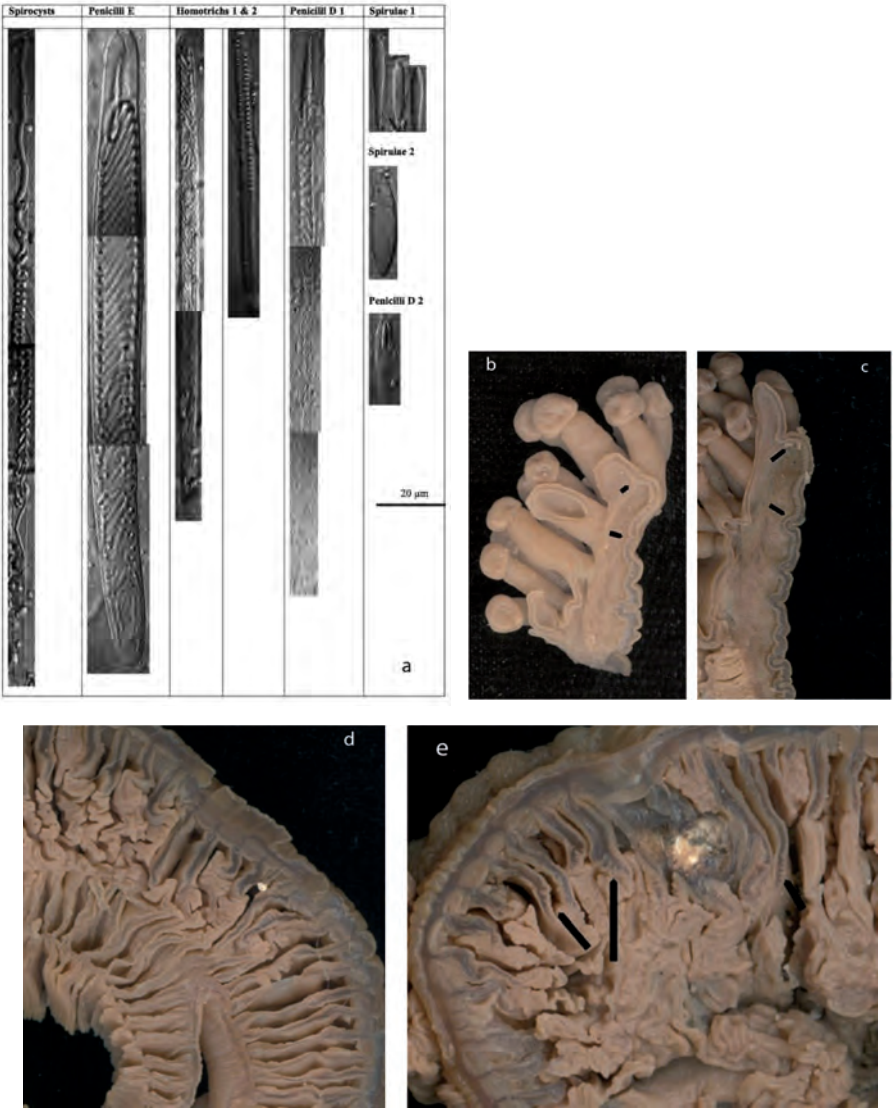

Fig. 1.- Main *Paracorynactis* features and characteristics. a) pictural survey of the cnidom; b) tentacles showing acrospheres and thick ectoderm along the stalks and sphincter situation; c) detail; d) parietobasilar ridges and pharynx furrous and mesenteries in line with them; e) parietobasilar ridges and retractor near the filaments. All the images were taken from OCAÑA *et al*. (2010); measurements of the samples should be consulted in OCAÑA *et al*. (2010).

Pseudocorynactis (see den HARTOG, 1980; den HARTOG *et al*., 1993; OCAÑA *et al*., 2010)

Emended diagnosis of the genus: Fairly large, solitary forms although small clones can be possible. Body variable in shape, when fully expanded often wide trumpet-shaped, mammiform when retracted. Base up to 4 cm in diameter. The oral disc and the tentacles can easily be withdrawn into the column. Tentacles well developed, ectacmaceous, motile

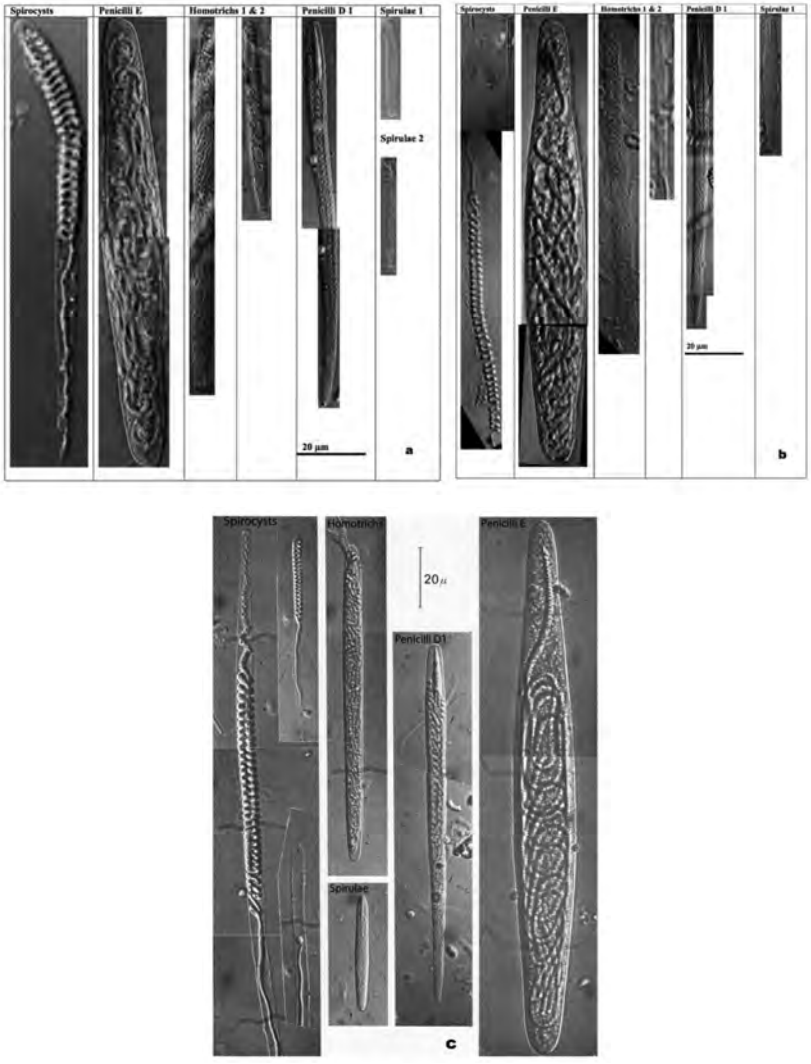

Fig. 2.- *Pseudocorynactis* nematocysts from tentacles. a) pictural survey of the *Pseudocorynactis globulifera* cnidom; b) pictural survey of the *Pseudocorynactis tuberculata* cnidom; c) pictural survey of the *Pseudocorynactis caribbeorum* cnidom. Images were taken from OCAÑA *et al*. (2010) (a & b) and den HARTOG (1980).

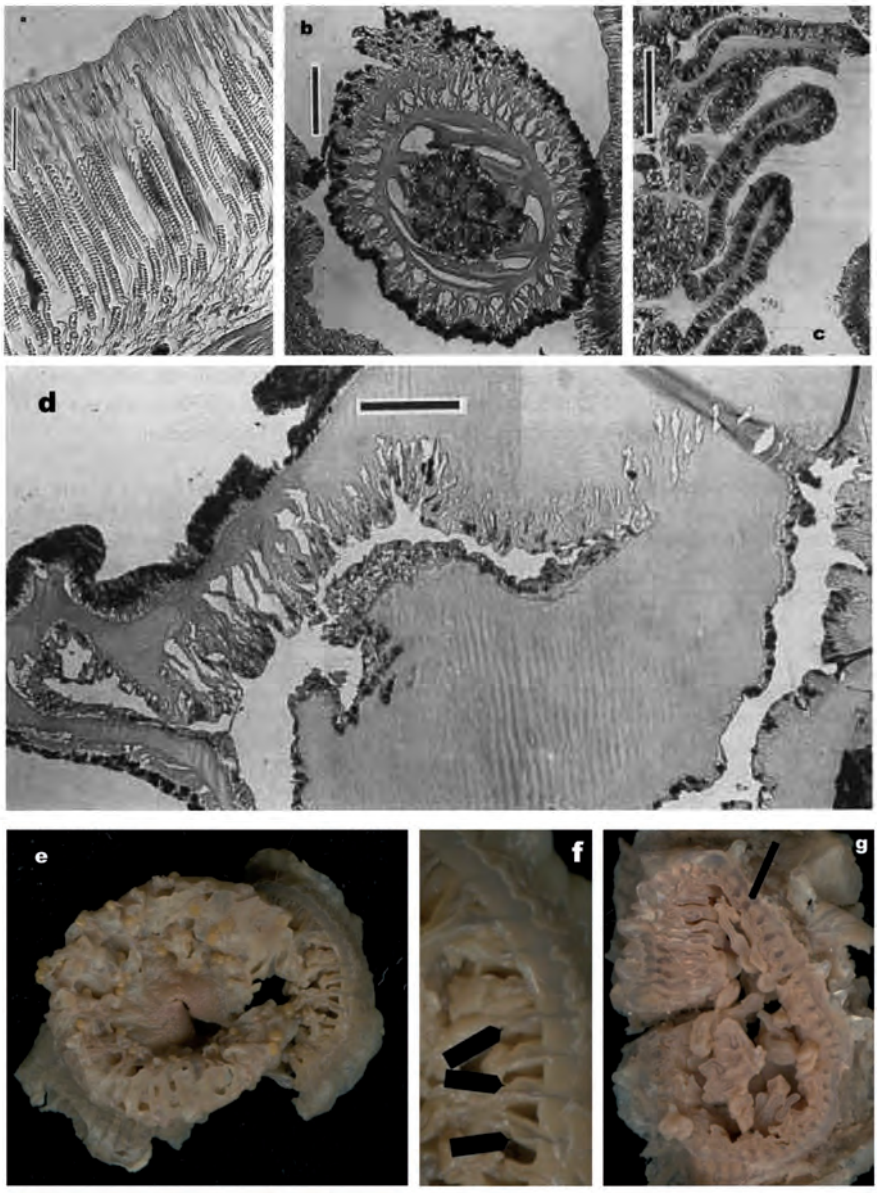

Fig. 3.- Main *Pseudocorynactis* features and characteristics. a) histological section of the *Pseudocorynactis caribbeorum* acrosphere (scale bar: 40mm); b) histological section of the *P. caribbeorum* stalk (scale bar: 250mm); c) histological section of the pharynx furrows in *P. caribbeorum* (scale bar: 250mm); d) histological section of the sphincter in *P. caribbeorum* (scale bar: 250mm); e) *Pseudocorynactis globulifera* with the typical tentacle stalk of the genus; f) parietobasilar ridges in *P. globulifera* mesenteries; g) parietobasilar ridges in *Pseudocorynactis tuberculata* mesenteries. Images were taken from den HARTOG *et al*. (1993) (a-d) and OCAÑA *et al*. (2010) (e-g); concerning to images e-g, measurements of the samples should be consulted in OCAÑA *et al*. (2010).

and retractile; acrospheres extremely well developed (very prominent); stalk highly extendible (more than the column length). From the histological and microanatomical point of view, the stalk presents strong developed ectodermal longitudinal musculature supported by conspicuous, brushlike mesogloeal processes. Two faintly indicated, though not histologically differentiated siphonoglyphs; Pharynx with distinct narrow projecting mesogloeal lamellae and numerous folds equalling the mesenteries in number and situated in direct line with them. Enlarged endodermic sphincter concentrated in the upper part of the column. All mesenteries perfect and fertile, provided with very distinct short, often rounded, mesogloeal parietal ridges; weak retractors only visible under histological sections. Cnidom: there are large elliptical penicilli E (length < 200 mm), large homotrichs and big special spirocysts (length >100 μm) in the acrospheres, showing the high development of the acrospheres; nematocysts absent from the stalk.

Corynactis (see ALLMAN, 1846; den HARTOG, 1980; den HARTOG *et al*., 2003; OCAÑA, 2003)

Emended diagnosis of the genus: small gregarious forms. Body variable in shape, when fully expanded often wide trumpet-shaped, mammiform when retracted. Base rarely exceeding 1 cm in diameter. The oral disc and the tentacles can easily be withdrawn into the column (see den Hartog, 1980 figs. 1-4; see den Hartog et al., 1993: figs. 16-25; Ocaña,

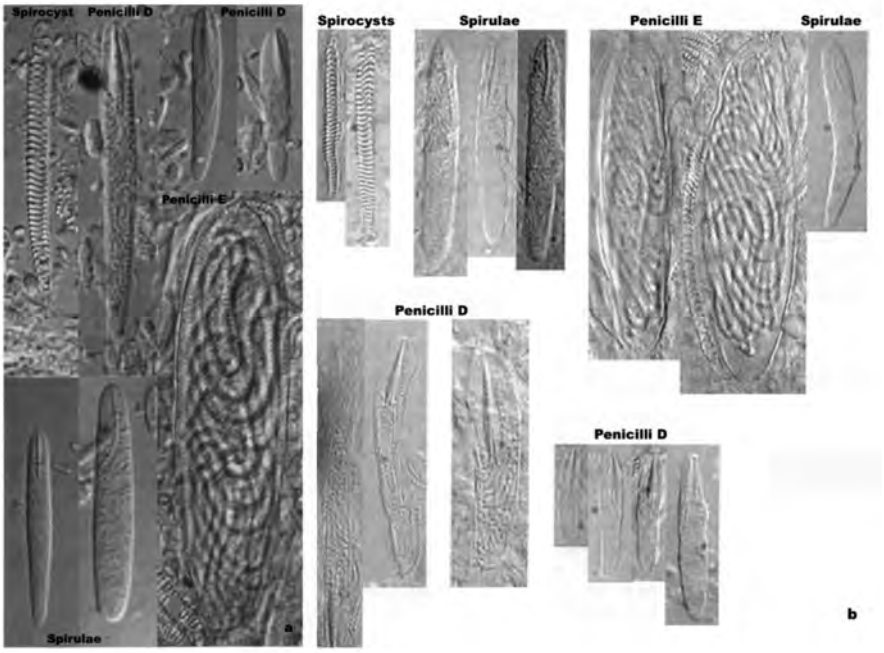

Fig. 4.- *Corynactis* nematocysts. a) cnidom from tentacles of *Corynactis viridis*; b) cnidom from tentacles of *Corynactis denhartogi*. Image "a" were taken from den Hartog *et al*. (1993) and "b" from OCAÑA (2003). Measurements of all the images should be consulted in those papers mentioned above.

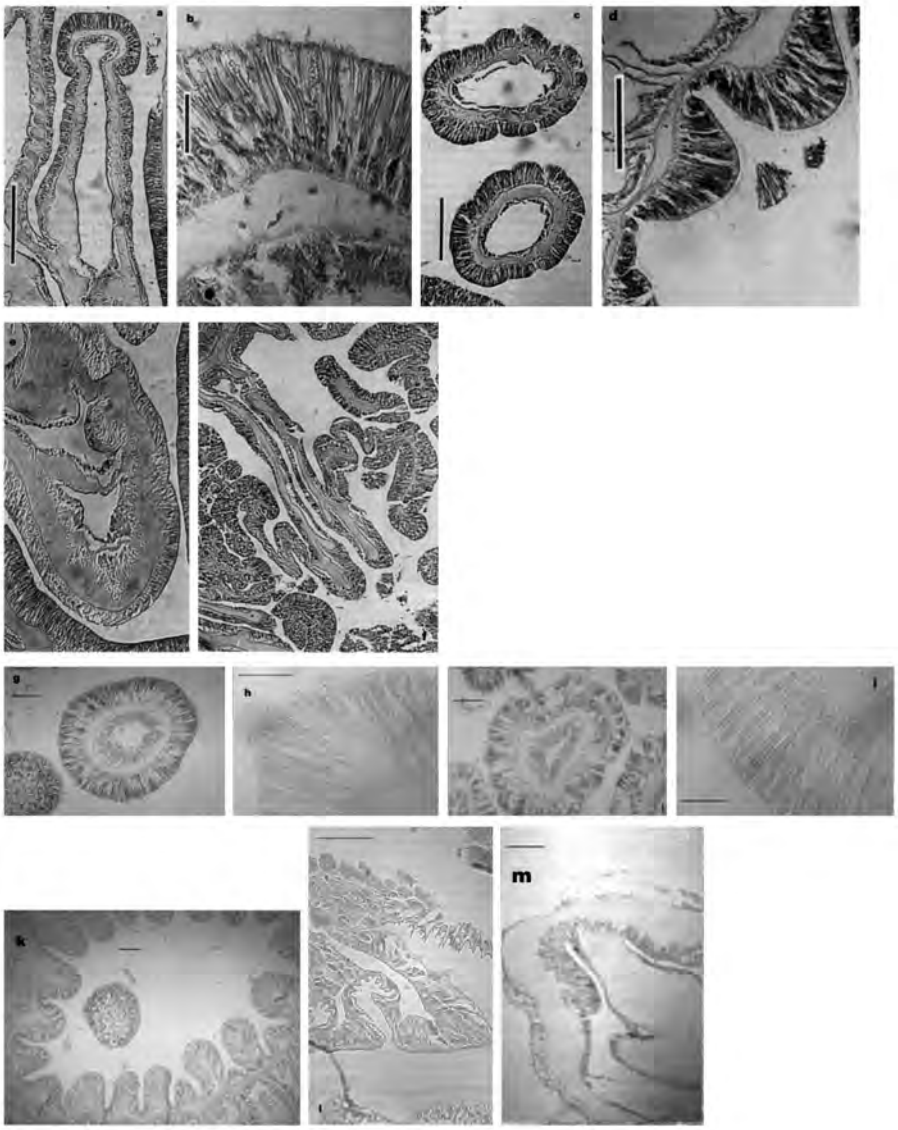

Fig. 5.- Main *Corynactis* features and characteristics. a) general histological section from acrosphere and stalk of *Corynactis viridis*; b) acrosphere cross section of *C. viridis*; c) stalk cross section of *C. viridis*; d) histological section from pharynx furrows of *C. viridis*; e) endodermic sphincter with the typical pennon of *C. viridis*; f) retractor musculature from *C. viridis* (images "a, c, e, f", scale bars 250mm; "b", scale bar 25mm; "d" scale bar 100mm); g) acrosphere cross section of *Corynactis denhartogi*; h) close up; i) stalk cross section of *C. denhartogi*; j) close up; k) pharynx furrows of *C. denhartogi*; l) *C. denhartogi* retractors; m) endodermic sphincter with the typical pennon of *C. denhartogi* (images "g, k", scale bars 100mm; "h" scale bar 50mm; "i" scale bar 75mm; "j" scale bar 25mm; "l, m", scale bars 150mm). Images a-f were taken from den HARTOG *et al*. (1993), images g-m were taken from OCAÑA (2003).

2003: fig. 2). Tentacles, ectamaceous, motile and retractile but with moderate extension capability, acrospheres well developed but not very prominent and no so much thicker (ectoderm lenght < 125 mm) and differenciated from the stalk (den Hartog et al., 1993: 11, figs. 12, 13; Ocaña, 2003: 261). Tentacular musculature is weak but firmly adhered to the mesogloea. Pharynx with well-developed longitudinal endodermal ridges supported by a slightly thickened mesogloea, number of these ridges considerably less than number of mesenteries connected with the stomodaeal wall. Low developed siphonoglyph may be present. Well-developed enlarged endodermic sphincter with a strong branched pennon in its first part. There are perfect and imperfect mesenteries, no mesogloeal ridges or parietobasilar muscle; conspicuous restricted retractor muscle forming mesogloeal pennons and different morphologies. Cnidom: there are large oval penicilli E (length < 100 mm), typical spirocysts (length <100 μm) in the acrospheres; nematocysts present from the stalk.

3. ACKNOWLEDGEMENTS

Ron Ates encouraged me to re-establish the genus *Pseudocorynactis*, I thank him his perseverance and I hope he can excuse my lateness to produce an appropriate answer. After all, I was waiting for a Fautin's rectification, regarding the paper printed in 2011, but it never came.

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