Corynactis denhartogi (Anthozoa: Corallimorpharia) a new species of soft hexacoral from New Zealand waters

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Key words: *Corynactis denhartogi;* Corallimorpharia; New Zealand.
A new species of Corrallimorpharia from New Zealand, *Corynactis denhartogi* is described and depicted. The species is compared with other species of the genus, particularly with the intertidal *C. australis.*

Introduction

Because of the absence of characters that clearly differentiate species and the overall similarity in shape of specimens around the world the genus *Corynactis* is not well known. Some of the species originally described in the genus have been reassigned to different genera (see den Hartog et al., 1993: 22). According to den Hartog et al. (op. cit.) the status of the *Corynactis* species has to be solved through the complete study of the anatomy, the histology and the cnidom. According to Carlgren (1941: 2) the cnidom characters of size and tissue distribution provide useful information to distinguish the species of *Corynactis* and we use these characters in the present paper.

The presence of *Corynactis* in the southern hemisphere was considered by some authors (den Hartog et al., 1993: 27; Ocaña, 1997) to suggest a Gondwana origin for this genus. This idea is supported by the presence of at least two different species of *Corynactis* (Ocaña & den Hartog, in prep.) in the New Zealand region.

Material and Methods

All of the known material of this species comes from the south west coast of New Zealand and was collected by the New Zealand Oceanographic Institute using trawls. The samples were fixed with 8-10% formaldehyde and later stored in 70% alcohol in the collections of the former New Zealand Oceanographic Institute, now included in the National Institute of Water and Atmosphere research (NIWA). The material is deposited mainly in the New Zealand Oceanographic Institute collections (NZOI), one paratype and a number of polyps are also deposited in the Nationaal Natuurhistorisch Museum, Leiden (RMNH). The general morphology and anatomy were studied by means of a stereo dissecting microscope. The anatomical and histological details were studied using the Mallory triple stain for topographic staining (see Gabe, 1968). Histology (more than 100 sections taken from two specimens) and nematocysts (more than 300 capsules measured) were examined and studied with a light microscope. The classification and terminology of nematocysts used here essentially follows

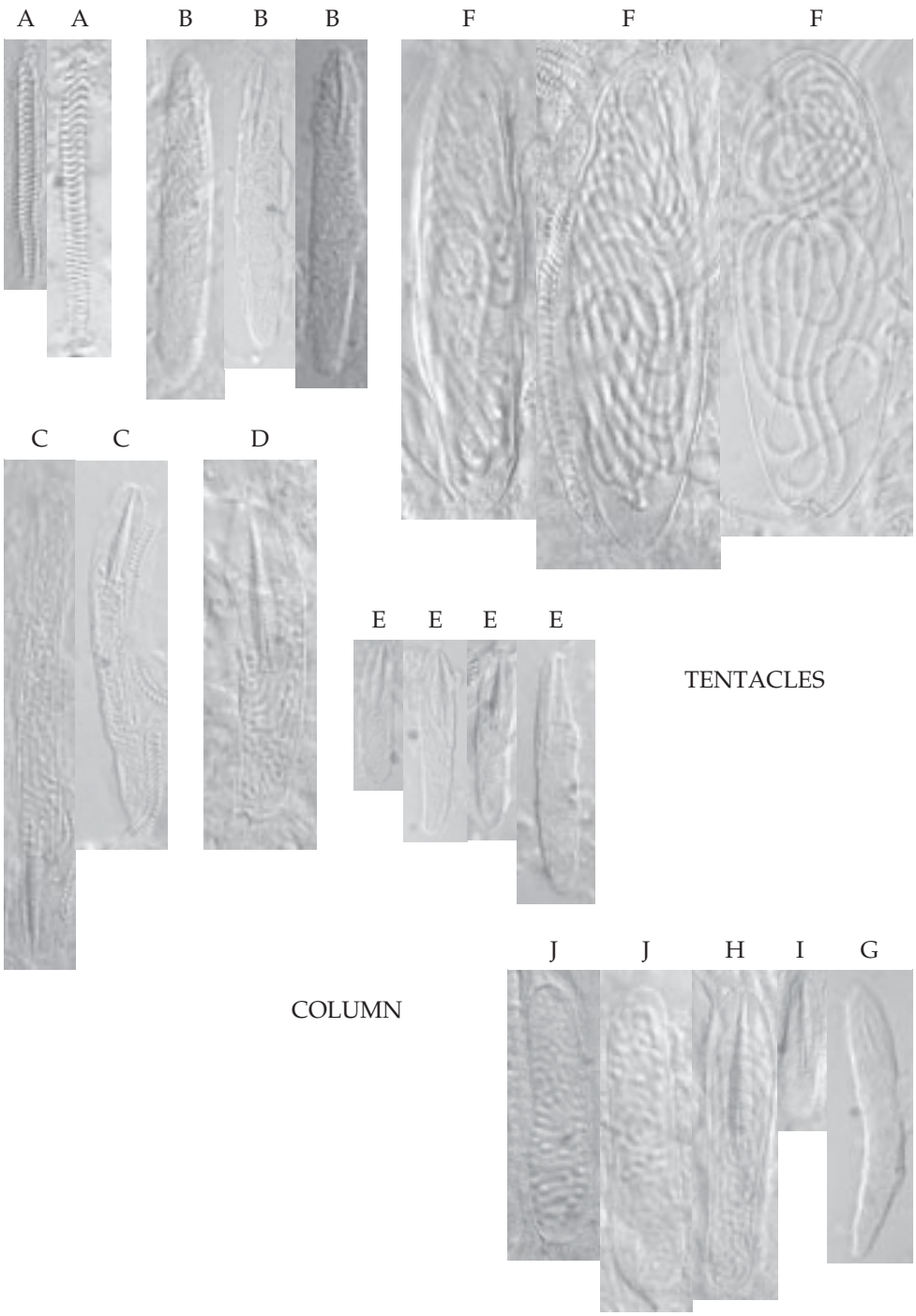

Fig. 1, Cnidom of *Corynactis denhartogi*. The letters refer to those in Table I. (see PHARYNX N for scale, its width is 26 μm).

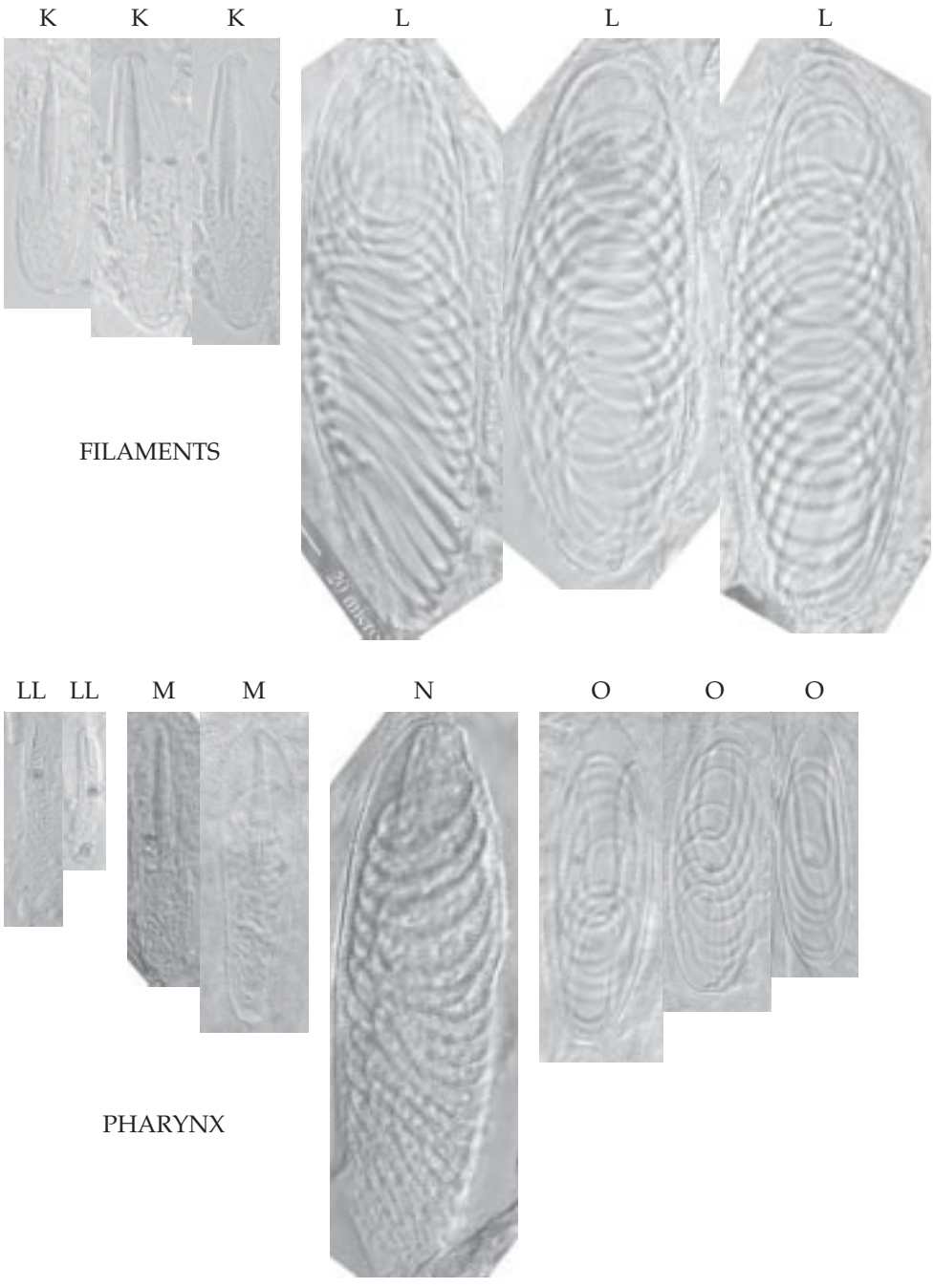

Fig. 1, Cnidom of *Corynactis denhartogi*. The letters refer to those in Table I. (see PHARYNX N for scale, its width is 26 μm).

that of Schmidt (1972), as adapted by den Hartog (1980: 7-9) and den Hartog et al. (1993). The surveys of the cnidom are summarized in tables in which the means and ranges of length and width of nematocysts are included.

Systematic part

Corallimorphidae R.Hertwig, 1882

Corynactis Allman, 1846

Corynactis denhartogi spec. nov.

Type Material.— Holotype, NZOI H-814, "New Zealand region, off Fiords coast, 5.vi.1961, NZOI Stn B480, 45º16.8'S 166º51.3'E, 116 meters, on black coral skeleton, several specimens of *Phellia aucklandica* (Carlgren, 1924) were also noticed in the same habitat. Paratypes: NZOI P-1293, 1 specimen from the middle of the main pseudo-colony, same data; NZOI P-1294, 1 specimen from the other smaller pseudo-colony, same data; NZOI P-1295, 1 specimen from the middle of the main pseudo-colony, same data; RMNH Coel. 32021, 1 specimen from the other smaller pseudo-colony, same data.
Other Material.— NZOI Stn B480 "New Zealand region, off Fiords coast, 5.vi.1961, 45º16.8'S 166º51.3'E, 116 meters, 49 polyps forming a pseudo-colony, polyps connected by basal expansions, they form a small cluster of 8 specimens in one of the end of the branch of the antipatharian skeleton and other composed by 41 polyps placed at the other end of the branch of the antipatharian skeleton. NZOI Stn B480 "New Zealand region, off Fiords coast, 5.vi.1961, 45º16.8'S 166º51.3'E, 116 meters, 22 polyps spread in the bottle but not encrusting on the antipatharian skeleton. AK 131939 Northland, North Cape, 7.5 miles east of cape, 20.ii.1974, L17847, 34º25'S 173º08'E, 143-165 meters, 15 polyps encrusting on the antipatharian skeleton. SAM H 1382 Tasmania, Bicheno, East of Governors Island, 41º52'S 148º18'E, 20.iv.1993, 25-35 meters, 4 polyps encrusting on the octocoral *Primnoella australasiae*. SAM H 1383 Tasmania, Bicheno, East of Governors Island, 41º52'S 148º18'E, 20.iv.1993, 25-35 meters, 12 polyps encrusting on the octocoral *Primnoella australasiae*. RMNH Coel. 32022, "New Zealand region, off Fiords coast, 5.vi.1961, NZOI Stn B480, 45º16.8'S 166º51.3'E, 116 meters, 26 polyps forming a pseudo-colony, polyps connected by basal expansions, forming a small cluster of 5 specimens on the thicker end of the branch of the antipatharian skeleton and a larger cluster of 21 polyps placed at the other end of the branch of the antipatharian skeleton.

Description.— Morphology: The base of each polyp of the pseudo colony is irregular in outline, 5 by 18 mm in diameter. A conspicuous thick cuticle is present in the pedal disc of each single polyp studied. The polyps can be isolated from each other but they are connected by basal expansions forming a pseudo-colony.

Column not divided into regions, 0.5 (tiny specimens) to 1.5 cm (large ones) high and it varies in shape from flat mammiform to medium short cylindrical. In preserved specimens the base is wider than the oral disc but in expanded conditions the oral disc exceeds the diameter of the base.

The tentacles are ectacmaceous; 4 (5) to 8 (9) arranged in rows of about 25 to 30 endocoelic radial rows, although it is difficult to state this with certainty due to their contracted condition. The radial rows bear four to nine tentacles each. The number of tentacles varies between 150 (small specimens) to more than 200 (large ones).

Little is known about the colour of this species but a single colony from Tasmania has a pink colour in the column and the acrospheres strongly white (fig. 2). In fixed specimens we noticed a general pale pink colour with some whitish areas along the body wall, tentacles whitish especially in the acrospheres, in the pedal disc the ectoderm is thicker giving it a brownish colour.

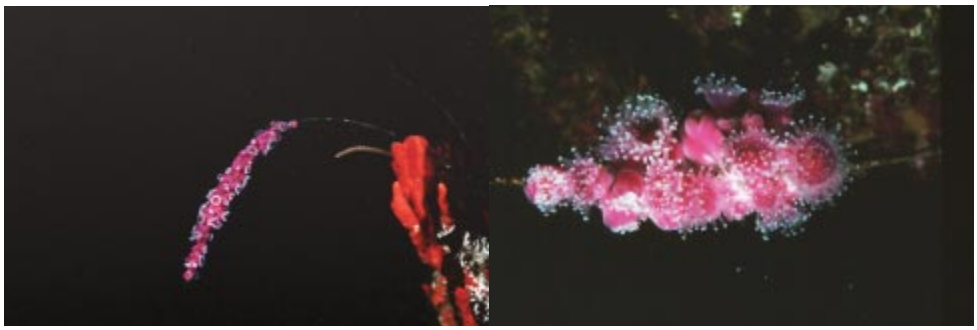

Fig. 2. Habitus of *Corynactis denhartogi*, underwater photographs.

Anatomy.— Four cycles of mesenteries with a maximum of 35 pairs, the last cycle appears incomplete in all the specimens examined. The first and second cycle are well developed with mesenteries equal in size, with pennon muscle, and ova along the filaments. The third cycle is a less developed macrocneme but a retractor and filaments with ova are also present. The fourth cycle is incomplete, the microcnemes lack filaments or ova and it has a poorly developed retractor.

The pharynx is richly folded (fig. 4A) and ciliated; siphonoglyphs were not observed. The furrows bear wide or thin mesogloeal branches.

The sphincter is well developed, diffuse but with a strong branched pennon in its first part (figs 5A-5B). Tentacular musculature is weak but firmly adhered to the mesogloea and slightly more developed in the stalks (figs 3A, 3C).

The first three cycles of mesenteries have a well developed retractor, forming numerous mesogloeal pennons (figs 5C, 5D). A secondary little developed retractor process (consisting of a few small pennons, as occurs also in *P. caribbeorum*) placed close to the mesenterial filaments was present in a single mesentery. Even in the microcnemes from the fourth cycle some pennons were seen (fig. 5D). Parietobasilar muscle is weak and inconspicuous. Basilar muscle is absent.

The mesogloea is 50 to 180 μm thick in the column, with few cells in very low densities detected; no lacunae were noticed. A similar but less thick mesogloeal structure is present in the tentacles and mesenteries. In the pharynx I observed a high cell density.

The ectoderm of the column and base is 60 to 100 μm thick, and consists of glandular cells with scattered nematocysts. The acrosphere ectoderm is considerably thicker (up to 125 μm thick) than that of the stalk (up to 75 μm thick) (fig. 3B). The number of epithelial cells and spirocysts is larger but nematocysts are less abundant. In the stalk ectoderm we mainly observed spirocysts and sporadic penicilli E. The endoderm of the column and base is well developed, 25 to 40 μm thick. The tentacle endoderm is well developed, sometimes filling the inner part of the tentacles. The endoderm of the mesenteries is greatly misshapen by the presence of ova (fig. 4D) and filaments, which are rounded at their tips and bear many conspicuous penicilli E (fig. 4C). The ova disposed along the mesenteries vary in diameter from 12.5 to 50 μm. Spermatozoa were also observed in some dissected specimens but they were not analysed using histological sections.

Cnidom.— A complete survey of the cnidom of one of the clones from the type locality is presented in table I. No significant differences were found in the cnidom of the specimens examined, probably because all of them came from the same locality.

Table 1. *Corynactis denhartogi*. Survey of the cnidom of RMNH Coel. 32022.

Tissue		Type	Lenght	Width	Nº	Abundance
Tentacles	**A**	Spirocysts	(16-60)	(2-4,5)		Very common
	B	Spirulae	52,4 (40-62)	6,2 (4-8)	40	Common
		Spirulae	21,5	5,1	1	Sporadic
	C	Penicilli D	64 (50-80)	5,1 (4-6,5)	20	Common-Rather common
	D	Penicilli D	45,5 (35-52)	9,3 (8-12)	12	Rather common-Uncommon
	E	Penicilli D	32,8 (23-41)	5,4 (4-7,5)	30	Common
	F	Penicilli E	82,3 (70-90)	21,8 (15-28)	25	Common
		Penicilli E	(45-50)	(9-10)	2	Sporadic
Column	**G**	Spirulae	45	5	1	Sporadic
	H	Penicilli D	47,7 (41-60)	9,1 (7-11)	30	Very common-Common
	I	Penicilli D	22 (20-24)	5,7 (5-7)	5	Uncommon
	J	Penicilli E	42,1 (35-60)	9,2 (8-12)	20	Common
Filament	**K**	Penicilli D	42,7 (37-48)	9,9 (8-12)	15	Common
	L	Penicilli E	93,4 (80-100)	31,8 (29-35,5)	20	Common
Pharynx	**LL**	Spirulae	20,9 (16-31)	3,2 (2,5-4)	20	Rather common-Common
	M	Penicilli D	35,5 (21-48)	7,6 (6-12)	15	Rather common-Common
	N	Penicilli E	92,5	26	1	Sporadic
	O	Penicilli E	43,07 (35-55)	12,5 (8,5-18)	52	Very common

Etymology.— The species is named after Jacobus Cornelis den Hartog, former curator of Coelenterata of the National Museum of Natural History, Leiden, The Netherlands, for his contributions to the study of Coelenterata. Among a variety of important papers about the soft Anthozoa fauna written by den Hartog are some of the most influential contributions ever made to our knowledge of the Corallimorpharia.

Distribution.— So far, the species is exclusively known from three localities, two in New Zealand (off Fiorland and North Cape) and one in Tasmania.

Habitat and Biological remarks.— *Corynactis denhartogi* has been collected in New Zealand at a depth of 116-175 meters growing on and encrusting dead branches of *Antipathes* cf. *fiordensis* Grange, 1990. The antipatharian occurs mainly in Fiordland from shallow waters down to 100 meters deep and possibly even deeper (Grange, 1988; 1990). The species has also been recorded in Tasmania, 25-35 meters deep, encrusting on the octocoral *Primnoella australasiae* (Gray, 1849).

A number of soft-hexacoral species can occur encrusting dead branches (it is not yet known if they can also encrust living parts of the colony) of *A. fiordensis* along the Fiordland shallow waters (personal observations). The common littoral species *Corynactis australis* was noticed at Milford Sound growing on *A. fiordensis* (personal observation), although I never noticed the presence of *Corynactis denhartogi* growing on the antipatharian.

Phellia aucklandica (Carlgren, 1924), a temperate taxon distributed along the southern hemisphere coasts (see Carlgren, 1924, Ocaña, 1997) and noticed on the shallow, vertical walls in Milford Sound, occurs on the same substrate with *C. denhartogi*. However, while both species occur in the same habitat they do not occupy precisely the

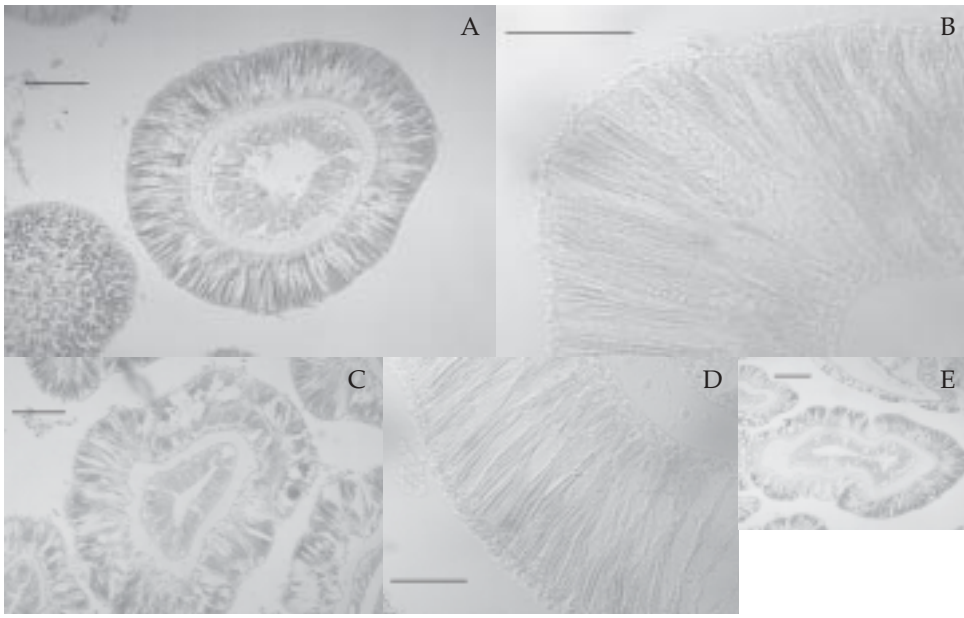

Fig. 3. Histology of *Corynactis denhartogi.* A: Acrosphere cross section (scale bar: 100 μm). B: Acrosphere ectoderm (scale bar: 50 μm). C: Stalk cross section (scale bar: 75 μm). D: Stalk ectoderm detail (scale bar: 25 μm). E: Tentacle longitudinal section (scale bar: 100 μm).

same spot on the substrate, *C. denhartogi* encrusts branches of the antipatharia where the polyps of both species are firmly compacted.

The presence of *C. denhartogi* growing on the octocoral *Primnoella australasiae* shows the tendency of this species to encrust long and flexible substrates as for instance sea whips.

Species of soft-hexacorals are also able to encrust other *Primnoella* species in the Southern hemisphere (see Dayton et al, 1997).

Forming pseudo-colonies (usually from asexual reproduction) connected by basal expansions is a common phenomenon, well known in many species of *Corallimorpharia* (den Hartog, 1980; den Hartog et al., 1993). However, the presence of clusters of polyps connected by their pedal discs is more common in shallow water species than in others.

Corynactis is mainly a shallow water genus but it is also known to reach depths of 100 meters, as shown by the occurrence of *C. viridis* in the Canary Islands (Ocaña, 1994: 420; Ocaña & den Hartog, in press), although this is an exceptional record.

I have noticed gonadal development in most of the specimens studied collected off Fiorland and Tasmania, and found many more with ova than with spermatozoa. This it is not very surprising as this is known to be the case in many species of soft hexacorals (see Ocaña, 1994). The sample was collected in June, which in the southern hemisphere corresponds approximately to the first month of winter. In that zone of New Zealand the sea water temperature can easily reach 8-10ºC in winter (Morton & Miller, 1968: 285) and 15-17ºC in summer (Adams, 1994: 14), and probably less at 116 meters

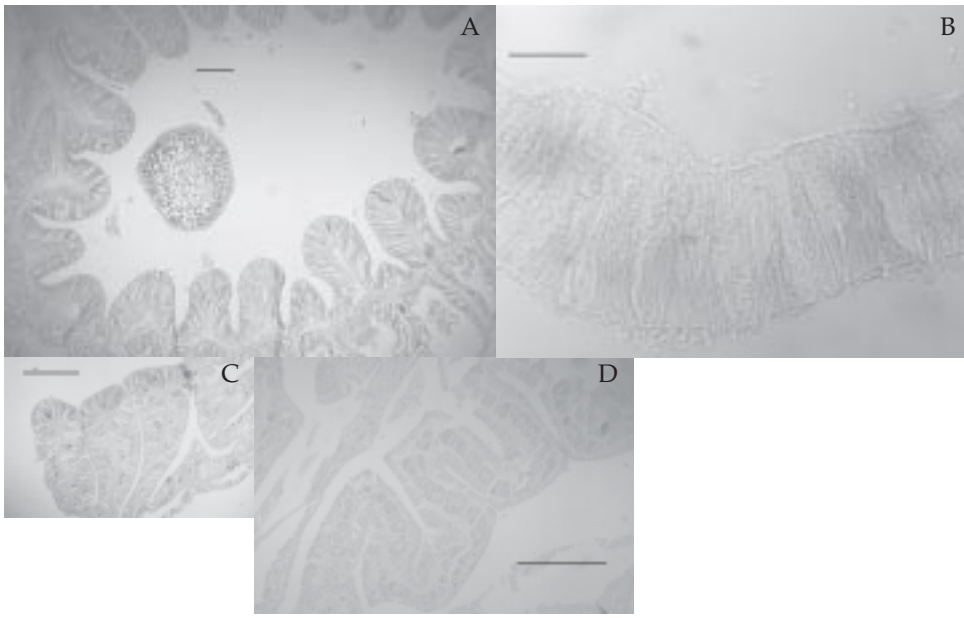

Fig. 4. Histology of *Corynactis denhartogi*. A: Cross section of pharynx (scale bar: 100 μm). B: Pharynx ectoderm detail (scale bar: 40 μm). C: Filament (scale bar: 150 μm). D: Mesenteries with ova (scale bar: 250 μm).

deep. The Fiordland ecosystem is also strongly influenced by the warmer Tasman front from the south and the Westland current (also derived from the Tasman front) from the north (Carter et al., 1998). If *C. denhartogi* is a temperate-cold element perhaps the key factor relating to gonadal development it is not temperature, but the food available during winter. The presence of gonadal development by *C. denhartogi* in April and June agrees very well with the maximum annual production of plankton that takes place in the region between March and May (Longhurst, 1998: 334). In addition, the sample from North Cape was collected in February, minimum annual production of plankton (Longhurst, 1998: 334), and did not show any gonadal development.

Comparison with other genera and species.— The cnidom coincides closely with that expected for any species of the genus *Corynactis*. There are also close similarities with the genus *Pseudocorynactis* and, to a lesser degree with other genera in the family Corallimorphidae, as is the case for the species of *Corallimorphus* (den Hartog et al., 1993). However, the new species lacks the large spirocysts disposed in two layers of the acrosphere found in *Pseudocorynactis* species.

The scarce, small spirulae categories in the tissues of *C. denhartogi* are the main cnidom differences between the new taxon and other species of *Corynactis* and *Pseudocorynactis* already described (den Hartog, 1980; den Hartog et al., 1993). As expected, most of the cnidom tentacles of this species are concentrated in the acrosphere, although spirocysts and penicilli E occur in the stalks too. Spirocysts are especially concentrated in the tentacles, although they are also spread throughout all the tissues, being very common in the pharynx. The main morphological character of the cnidom

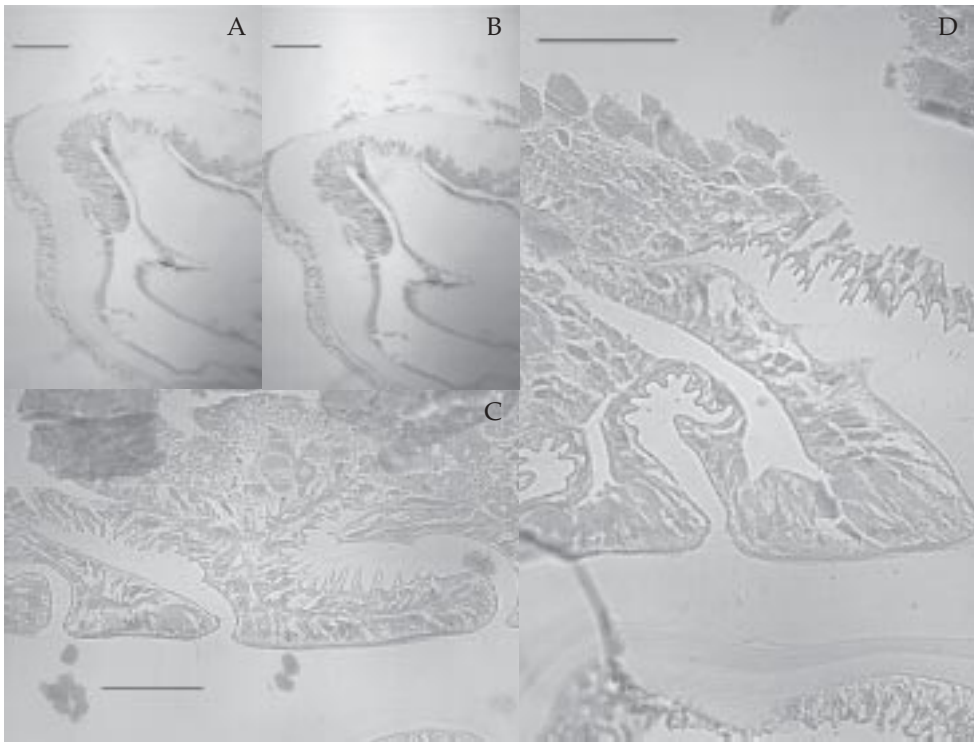

Fig. 5. Histology of *Corynactis denhartogi*. A: Sphincter detail (scale bar: 150 μm). B: General view of sphincter (scale bar: 150 μm). C: Retractor and parietobasilar muscles (scale bar: 150 μm). D: Retractor development in different mesenteries (scale bar: 150 μm).

that distinguishes *Corynactis denhartogi* from other species of the genus is the frequent presence of enlarged penicilli E, concentrated in the filaments. This last character places this taxon closer to *Corallimorphus,* a genus typical of deep bottoms. Other *Corynactis* species studied have oblong penicilli E in the filaments.

The absence of other characteristics typical of *Pseudocorynactis*, such as very large spirocysts, two layers of spirocysts disposed at the acrosphere, and a very differentiated histological structure between acrosphere and stalk (den Hartog et al., 1993: 27-35) are sufficient to place the species in *Corynactis*.

C. denhartogi differs from any other species of *Corynactis* by its large size (from 0.5 to 1.5 in contracted specimens, possibly up to 4 cm in expanded conditions), the presence of a differentiated sphincter with a large, strong, free flap (fig. 5A) and prominent retractors with mesogloeal pennons (fig. 5C). The absence of some categories of spirulae (b-mastigophores or microbasic b-mastigophores), especially in the column, and the more elliptical form of penicilli E (holotrichs or homotrichs sensu other authors) are some major cnidom characteristics which differentiate *C. denhartogi* from any other species of the genus (see Carlgren, 1941: 3; Hand, 1955: 35; den Hartog, 1980: 16; den Hartog et al., 1993: 14-17). In addition, *C. denhartogi* is the only species of this genus absent from intertidal to shallow waters. Other minor but still important

differences relating to cnidom sizes and morphology are mentioned below.

The conspicuous *Corynactis australis* (following den Hartog et al., 1993, the definitive taxonomic status of this species awaits the results of further comparison with the south Australian species) is recognized as a common intertidal to shallow waters corallimorpharian around New Zealand. *C. australis* differs from *C. denhartogi* in having large spirulae (b-mastigophores) in the tentacles, 80-90 μm long, the largest spirulae ever noticed in any species of *Corynactis*. This character of *C. australis* specimens collected in the New Zealand littoral, was apparently overlooked by Carlgren (1950). Furthermore, *C. australis* exhibits an extra category of penicilli D (p-mastigophore) in the filaments, which are absent in *C. denhartogi*. *C. denhartogi* also has other penicilli D in the pharynx which are not present in *C. australis*. *C. australis* has a much less developed sphincter than *C. denhartogi* (see description). Our data of *C. australis* for New Zealand material fits very well with those of Haddon & Duerden (1896) based on material of *Corynactis australis* from south Australia. Moreover, their observations about the sphincter of *C. viridis* (Haddon & Duerden, 1896: 153, plate viii, fig. 11) agree very well with our own observations (see den Hartog et al., 1993: 7, 12, figs. 2 & 12), proving that the morphology of the sphincter tends to have a constant structure and morphology in *Corynactis*.

Having demonstrated the differences between the intertidal species common in the New Zealand littoral and the present new taxon, there is little sense in discussing deeply the remainder of the intertidal to shallow water species of *Corynactis* from more distant regions.

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