# A new endemic *Actinia* species (Actiniaria: Actiniidae) from the central Macaronesian Archipelagos

**J.C. den Hartog & O. Ocaña**

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Key words: *Actinia;* Actiniaria; Actiniidae; Macronesian Archipelagos; Atlantic.
The presence of some endemic taxa of the genus *Actinia* from Madeira and the Canary Islands is discussed. A new species, *Actinia nigropunctata*, is described, and some characters of the poorly known *Actinia virgata* are discussed. In addition, we discuss the main characters proposed by Schmidt (1971) to distinguish species of *Actinia*.

## Introduction

In 1861 James Yate Johnson published his paper on the actinians of Madeira, in which he recorded two species of the genus *Actinia*. He identified one species as *Actinia mesembryanthemum* Ellis & Solander, 1786, describing some interesting findings on the coloration: “The commonest variety is coloured a red-purple, with numerous black dots on the column....”. More than a century later, we recorded specimens with this coloration from Madeira, and also from the Canary Islands, extending its geographic range (see Ocaña, 1994). The species identified by Johnson (1861) as *A. mesembryanthemum* is presently considered a new endemic species from the central Macaronesian Archipelagos (Canary Islands and Madeira), and is here described as *A. nigropunctata*.

In the same paper the author described the new species *Actinia virgata*: “ ...with purplish-blue lines, which extend from the margin of the disk to the angle of the column and base, where there is a circumferential line of the same colour....”. It can be perceived from Johnson’s description that the species could be viviparous: “....I found, to my surprise, that it had in the meantime surrounded itself with a progeny of fourteen young ones....” According to Johnson the species is not common in Madeira, and we were not able to find it in Canary Islands (see Ocaña, 1994).

The presence of endemic intertidal and shallow-water taxa is a remarkable fact that could indicate a marine speciation process occurring in the Macaronesian Archipelagos during the pleistocenic period. Thanks to the CANCAP expeditions (see Van der Land, 1987), and other expeditions and exploration efforts (currently headed by local Universities placed at the Canary Islands, Madeira and Azores), we can be reasonably sure *A. nigropunctata* and *A. virgata* do not occur in the Cape Verde and Azores Archipelagos. New exploration efforts have confirmed this (Wirtz & Molodtsova, in press). Recently, an intensive research along the Atlantic coast of Morocco from the Strait of Gibraltar to the West Sahara has confirmed that these taxa are not present in this geographical area (Ocaña & Saoud, in prep.).

## Material and Methods

The material studied in the present work was mainly collected by intertidal and SCUBA diving sampling trips during the CANCAP expedition (Rijksmuseum van Natuurlijke Historie, Leiden, 1976-1986) and also the BENTHOS Project (Universidad de La Laguna, 1980-1985). After those expeditions several scientific projects along the Canary Islands (FARMAMAR Expedition, 1990) and Madeira Archipelagos, headed by La Laguna University and Museu Municipal do Funchal (1985-1994), have extended the collecting efforts in the area. The type material, and numerous specimens, are deposited in the Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (formerly known as Rijksmuseum van Natuurlijke Historie, RMNH), and Departamento de Zoología de la Universidad de La Laguna, Tenerife, Spain (DZUL, as DZ AA-….). Part of the material examined belongs to the private collection of Oscar Ocaña (Priv. Col.).

The specimens were anaesthetized with menthol crystals and preserved in 8% formaldehyde. The general morphology and anatomy were studied by means of a stereo dissecting microscope. The anatomical and histological details were studied following the Ramon & Cajal method for topographic staining (see Gabe, 1968). Histology and nematocysts were examined with a light microscope. The used classification and terminology of nematocysts is essentially after Schmidt (1972), as adapted by den Hartog (1980: 7-9) and by the present authors. The surveys of the cnidom are summarised in tables in which the means and ranges of length and width of nematocysts are included. Although the frequencies given are subjective impressions based on squash preparations, they do at least give some idea of the absolute and relative abundance of the types.

## Systematics

### Family Actiniidae Gosse, 1858

Thenaria (Endomyaria). Column smooth or provided with projections in the form of verrucae, marginal spherules, pseudospherules or vesicles which never have macrobasic amastigophors. Sphincter absent or endodermal diffuse to circumscribed. Tentacles simple, arranged in cycles. Never more than one tentacle communicating with each endocoel and exocoel. Mesenteries not divisible into macrocnemes and microcnemes (*sensu* Carlgren, 1949).

Remarks.— According to Carlgren (1949) macrocnemes are those mesenteries that present very strong retractor muscle, filaments and gonads, while microcmenes do not present those attributes. The character "the mesenteries not divisible into macrocnemes and microcnemes" was added by Carlgren (1949) to a number of Actiniaria families, such as Actiniidae, Sagartiidae or Aiptasiidae. This character can lead to confusion as intermediates between macrocnemes and microcnemes may occur (Carlgren, 1949), making it difficult to decide what are macrocnemes or microcnemes. After all, the mesenteries are growing with the rest of the body of the actinian and several stadiums can occur, from less to more development. Certainly, one mesentery can be a microcneme and become a macrocneme some time latter.

What concerns the microcnemes, we easily recognised microcnemes in all the species of Actiniidae studied (see Ocaña, 1994). We have observed and described microcnemes in *Actinia nigropunctata* and *Actinia virgata*. Furthermore, our analysis of thinly cut sections of other species belonging to different families, like *Aiptasia mutabilis*, reveals that this differentiation between microcnemes and macrocnemes is quite possible in this species (Ocaña et al., 1994), as was also already observed by McMurrich (1889) for *Aiptasia tagetes*. Therefore we decided to use microcnemes and macrocnemes in our present paper, as the second author also did for the family Aiptasiidae (see Ocaña et al., 1994).

## *Actinia nigropunctata* spec. nov.
(figs 1-3)

*Actinia mesembryanthemum*; Johnson, 1861:301, brief description and colour, some biological observations, Madeira.
*Actinia equina nigromaculata* Ocaña, 1994: 75-82, Anexo A/2, B/4-6, C/VI figs. 6-9, description, ecology, biological notes and discussion, Canary Islands and Madeira.
Not *Actinia mesembryanthemum* Ellis & Solander, 1786: 4.

Type Material.— Holotype: RMNH 19971, **Canary Islands**, La Palma, Playa de los Cancajos, Breña Baja, 10.ix.1987, BS307723, intertidal, A. Brito leg., under stone on stony platform with algae, red and blue colours. Paratypes: RMNH 19972, Canary Islands, Gran Canaria, Playa del Cabrón, Arinaga, Agüimes, 1.vii.1991, DR624828, O. Ocaña leg., 1 specimen, intertidal (mesolittoral) in crevice, blue colour. RMNH 19967, Canary Islands, Tenerife, Mesa del Mar (old harbour), Tacoronte, 30.i.1994, CS606535, 8 m, O. Ocaña leg., 4 specimens, under stones on stony bottom with algae, red colour.
Other material.— **Madeira** (RMNH Coel. 24977) Funchal, W of Harbour, 32°28′N 17°05′W, 19.iii.1976, 65 specimens, J.C. den Hartog leg., rocky littoral/sublittoral with boulders, ONVERSAAGD Madeira-Morocco Exp. sta. 8. N. 28; (RMNH Coel. 24978) Museo Municipal do Funchal, from aquarium, 23.ii.1976, 1 specimen, J.C. den Hartog leg., ONVERSAAGD Madeira-Morocco Exp; (RMNH Coel. 24979) Funchal, 32°38′N 16°56′W, 9-13.x.1978, 2 specimens, J.C. den Hartog leg., polluted rocky littoral, tide-pools, crevices, TYDEMAN Madeira-Morocco Exp. sta. 3.K02, CANCAP III; (RMNH Coel. 24980) Funchal, 32°38′N 16°56′W, 9-13.x.1978, 1 specimen, J.C. den Hartog leg., polluted rocky littoral, tide pools, crevices, TYDEMAN Madeira-Morocco Exp. sta. 3.K02, CANCAP III; (RMNH Coel. 24981) Funchal, 32°41′N 16°55′W, 24.v.1980, 6 specimens, J.C. den Hartog leg., outer side of pier, littoral with large boulders, TYDEMAN Selvagens-Canary Isl. Exp, STA 4.K15: CANCAP IV. N. 49; (RMNH Coel. 24982) Funchal, 32°38′N 16°55′W, 10-17.x.1978, 10 specimens, polluted rocky littoral, pools, TYDEMAN Madeira-Morocco Exp. sta. 3.K03, CANCAP III. N. 29; (RMNH Coel. 24983) Funchal, 32°38′N 16°55′W, 10-17.x.1978, 2 specimens, polluted rocky littoral, pools, TYDEMAN Madeira-Morocco Exp. Sta. 3.K03, CANCAP III. N. 29; (RMNH Coel. 24984) Funchal, harbour, 32°38′N 16°56′W, 19-20.iii.1976, 7 specimens, J.C. den Hartog leg., 4 to 20 m, ONVERSAAGD Madeira-Morocco Exp. sta 117. N. 32; (RMNH Coel. 24985) Funchal, 32°38′N 17°05′W, 24.ii.1976, 28 specimens and small specimens inside the big ones, J.C. den Hartog leg., rocky littoral, sublittoral with boulders, ONVERSAAGD Madeira-Morocco Exp. sta. 8**.** N. 17; (DZ AA-20) Seixal, 9.ix.1991, CB037335, O. Ocaña leg., 3 specimens, 8 meters deep, under stones on stony bottom, without gonads, red with black spots; (DZ AA-21) Lido swimming-pool beach, Funchal, 10.ix.1991, CB190123, O. Ocaña leg., 3 specimens, under stones on stony beach, intertidal, without gonads, red colour with black spots; Several red specimens with black spots were observed in Praia de Forte de Sao Tiago, Funchal and Ponta da Cruz, Funchal. **Tenerife**, (RMNH Coel. 24992) Las Galletas, 28 N 16°41′W, 8.xi.1978, 2 specimens, J.C. den Hartog leg., rocky littoral, rockflat, pools subtidal sand, TYDEMAN Madeira-Morocco Exp. sta. 3.K08, CANCAP III. N. 67; (RMNH Coel. 24993) El Medano, xi.1978, 1 specimen, J.C. den Hartog leg., greyish brown with black dots, stripes in addition; (RMNH Coel. 19969) la Tejita beach, el Médano, Granadilla de Abona,

27.iii.1989, CS476012, 1 specimen, O. Ocaña leg.; (RMNH Coel. 19970) Garachico, 15.x.1993, 1 specimen, J. Núñez leg.; (DZ AA-77) Tejita beach, el Médano, Granadilla de Abona, 27.iii.1989, CS476012, 1 specimen, M. Zabala leg. Intertidal, on stone in dark place, red colour with black spots, without gonads; (DZ AA-100) Garachico, 15.x.1993, 1 specimen, J. Nuñez leg., intertidal, under stones, blue colour with black spots, without gonads. Other specimens were observed, but not collected, on different areas of the Island: Los Abrigos, Arico, several specimens, red colour. Radazul, El Rosario, 2 specimens, under stones, blue colour with black spots. Candelaria, intertidal and shallow waters, blue colour with black spots. Playa San Juan, Guía de Isora, under stones, intertidal, red and blue colour with black spots. Agua Dulce, Los Abrigos, Granadilla de Abona, in caves and tunnels, shallow waters, rose colour with black spots. **La Palma**, (RNMH Coel. 19966) Puerto Naos, Los Llanos de Aridane, 9.vii.1983, BS150659, 4 specimens, 4 meters, A. Brito leg; (DZ AA-76) Puerto Naos, Los Llanos de Aridane, 9.vii.1983, BS150659, 2 specimens, 4 meters deep, under stones, we notice male gonads. Other specimens were observed at: El Remo, Los Llanos de Aridane, under stones at intertidal and shallow waters, several specimens, red colour with black spots. **La Gomera**, (DZ AA-44) Alojera, Vallehermoso, 16.ix.1992, BS709176, 1 specimen, O. Ocaña leg. 1-3 meters in shallow waters, under stone in sandy bay, blue and red colour with black spots. Other specimens were observed at: Puntallana, San Sebastián de la Gomera, several specimens, under stones, blue colour with black spots; Playa de Tapahuga, Playa Santiago, San Sebastian de la Gomera, several specimens, in crevices and small caves at intertidal area. **Gran Canaria**, (RMNH Coel. 24986) Arinaga, Aguimes, 27°51′N 15°24′W, 4.v.1980, 1 specimen, J.C. den Hartog leg., 5 m depth, rocks, tide pools, sandy bay, sea-grass, TYDEMAN Selvagens-Canary Isl. Exp, STA 4.K06: CANCAP IV; (RMNH Coel. 24987) Arinaga, Aguimes, 27°52′N 15°23′W, 18.viii.1977, 2 specimens, J.C. den Hartog leg., rocky littoral, pools, CANCAP II: TYDEMAN Canary Isl. Exp. sta. K7. N. 8; (RMNH Coel. 24988) Guia, 28°10′N 15°38′W, 5.v.1980, 4 specimens, J.C. den Hartog leg., rockflat, tide pools, TYDEMAN Selvagens-Canary Isl. Exp, STA 4.K07: CANCAP IV; (RMNH Coel. 24989) Las Palmas, 28°8′N 15°27′W, 15.ix.1977, 6 specimens, J.C. den Hartog leg., sublittoral to 6 m depth, rocks, stones and sand, CANCAP II: TYDEMAN Canary Isl. Exp. sta. K19. N. 2. Other specimens were observed at: La Lajita beach, Las Palmas de Gran Canaria, several specimens in pools at intertidal area, green colour with black spots; Playa del Cura, Mogan, 1 specimen, under stone at intertidal and shallow waters, red colour with black spots. **Fuerteventura**, (RMNH Coel. 19968) Gran Tarajal, Tuineje, 30.vi.1994, ES967208, 1 specimen, 1-2 meters, O. Ocaña leg.; (DZ AA-102) Ugán beach, Istmo de la Pared, Pájara, 28.vi.1994, ES773246, 1 specimen, O. Ocaña leg., 2 meters deep on stones, in shady bottoms colonized by red algae, big specimens with red colour and black spots; (DZ AA-103) Amanay point, Pájara, 28.vi.1994, ES774290, 3 specimens, O. Ocaña leg., 1-5 metres deep, on and under stones on bottoms colonized by red algae, big specimens with red colour and black spots; (DZ AA-109) Gran Tarajal, Tuineje, 30.vi.1994, ES967208, O. Ocaña leg.,1 specimen, under stone on stony bottoms, red colour with black spots; (DZ AA-112) Joros, Morrojable, Pájara, ES588037, 1 specimen, O. Ocaña leg., under stone on stony bottom, red with black spots; (DZ AA-75) several localities around Fuerteventura, 3.ix.1982, A. Brito leg., 4 specimens, red with black spots. Other specimens were observed at: Morrojable, Pájara, several specimens under stones in pools at intertidal area, red colour with black spots; Caletilla Negra, Corralejo, La Oliva, numerous specimens, under stone, intertidal and shallow waters, red colour with black spots, Majanicho, La Oliva, numerous specimens, under stone at intertidal and shallow waters, red colour with black spots; several red specimens with black spots were observed also in Morros Negros, Istmo de La Pared, Pájara; El Puertito de los Molinos, Puerto del Rosario. **Lanzarote**, (RMNH Coel. 24990) Punta Papagayo, 28°50′N 13°47′W, 14-19.v.1980, 1 specimen, J.C. den Hartog leg., TYDEMAN Selvagens-Canary Isl. Exp, STA 4.D01: CANCAP IV; (RMNH Coel. 24991) Rada de Arrieta, 29°9′N 13°25′W, 22.v.1980, 1 specimen, J.C. den Hartog leg., 0-4 m, rocky shore with tide flat and pools, TYDEMAN Selvagens-Canary Isl. Exp, STA 4.K13: CANCAP IV. (DZ AA-13) Laja del Cochino, Costa Timanfaya, Yaiza, 7.viii.1990, FT154116, 3 specimens, O. Ocaña leg., intertidal cave in a steep, close to *Anemonia melanaster*, we found several rests of isopoda inside coelenteron, without gonads, red with black spots; (DZ AA-14) Los Camellitos, Costa de Timanfaya, Tinajo, 1 specimen, 7.viii.1990, FT189152, O. Ocaña leg., intertidal light exposed pool, tiny gonads were notice, red with black spots; (DZ AA-15) Laja del Cochino, Costa de Timanfaya, Yaiza, 8.viii.1990, FT154116, 1 specimen, O. Ocaña leg., intertidal on cliff, red with black spots;

(DZ AA-16) Bonanza del Buey, Costa de Timanfaya, Yaiza, 8.viii.1990, FT153113, O. Ocaña leg., 1 specimen, shallow waters 2 to 8 meters deep, on cliff and stony bottoms, without gonads, red with black spots; (DZ AA-18) Caleta del Congrio, Papagayo, Yaiza, 16.viii.1990, FS189910, O. Ocaña leg., 1 specimen, in crevices in intertidal sandy pool, close to *Anemonia sulcata* and *Anemonia melanaster*, with gonads, red with black spots.

Material other species examined.— *Actinia fragacea*: **Morocco**, (Priv. Col.) Sidi Rahal (South of Casablanca), 29.vii.2000, 3 specimens, O. Ocaña leg., in intertidal crevices and holds, plateaus colonized by numerous algae, big specimens with red colour and green spots; (Priv. Col.) Sidi Abad (South El Jadida-Hotel El Repos beach), 30.vii.2000, 7 specimens, O. Ocaña leg., in crevices among *Sabellaria alveolata* in large plateau zones mainly colonized by red algae, red colour and green spots; (Priv. Col.) Bhiha beach, North Essauira, 30.vii.2000, 5 specimens, O. Ocaña leg., in pools crevice, large intertidal plateaus, red colour and green spots; (Priv. Col.) Sidi Ifni beach, 1.viii.2000, 3 specimens, O.Ocaña leg., in small crevices and also understones, sometimes partially buried, red colour and green spots; (Priv. Col.) Sidi M'gahi, (Asilah), 17.vi.2000, 4 specimens, O. Ocaña leg., in crevices among *Sabellaria alveolata*, red colour and green spots; (Priv. Col.) Punta Siri (Tetuán), 11.ii.2001, 2 specimens, O. Ocaña leg., understones in shallow waters (1-2 m depth), red colour and green spots.

*Actinia cari*: **Adriatic Sea**, Dugi Otok island, Babiuscica inlet, 44º03'04"N 14º59'00"E, 19.i.2000, 2 specimens, P. Mruzic leg, J.C. den Hartog det., under stones, 0.5 m depth.

*Actinia tenebrosa*: (NZOI Stn Z8864) (lot 73) Paratutai Island, Whatipu, Auckland West Coast (New Zealand), 9.viii.1996, 12 specimens, 37º03'S 174º31'E, O. Ocaña leg, intertidal; (NZOI Stn Z8866) (lot 108) Leigh Harbour (New Zealand), 13.viii.1996, 15 specimens, 36º17'S 174º49'E, O. Ocaña leg., intertidal; (NZOI Stn Z8860) Piha-Lion rock, Auckland West Coast (New Zealand), 7.viii.1996, 7 specimens, O. Ocaña leg., on rocks and also under stones, from upper to mesolittoral, red colour.

*Actinia equina mediterranea:* Ceuta**, North Africa, The Mediterranean**, (DZ AA-8) Punta de la Mala Pasada, 4.i.1990, 2 specimens, O. Ocaña leg. Upper intertidal to mesolittoral, on walls, red colour. **Torres de Alcalá, Morocco, The Mediterranean,** (Priv. Col.) Cala Iris, 10.vi.2000, 4 specimens, O. Ocaña leg., upper littoral on boulder, red colour.

*Actinia equina equina sensu* Schmidt, 1971: (DZ AA-7) **Great Britain,** Holyhead (Whales), 4.viii.1990, 5 specimens, N.García leg., in intertidal pools, with many juveniles in coelenteron, red colour.

*Actinia equina atlantica sensu* Schmidt, 1971: (Priv. Col.) Horta, Faial, (**Azores**), 28.iii.2001, 4 specimens, P.Wirtz leg., inside the harbour wall, green colour.

*Actinia equina sensu lato*: (DZ AA-23) Caleta Mosquito, Isla Santiago (**Cape Verde Islands**), 2.i.1988, 3 specimens, A.Brito leg., intertidal pool, one juvenile inside an adult, no acrorhagi, red colour.

Description.— Medium sized sea anemone, 1 to 4 cm high and 1.5 to 5 cm wide. Rounded-elliptical; very adherent basal disc with a well-developed limbus. Short and tender scapus with pronounced parapet with 24 to 70 acrorhagi inside. The arrangement of the acrorhagi corresponds with the two last cycles of tentacles. Their shape varies from rounded to reniform. The mouth can form a hypostome, normally the siphonoglyphs cannot be observed externally. As in the other species of the genus, the tentacles are pointed, sticky, and rather short. They are entacmeic and show six cycles arranged as 6+6+12+24+48+96=192. It is rather common to find big tentacles in the last cycles, similar to those of the first cycles.

Apparently, this species can show a great deal of colour variation, but black spots are always present on the column. The black spots can even remain for some years after fixation of the specimen. Scapus and tentacles were grey, rose, red, green, and blue. The acrorhagi, when observed, were white or light blue.

There are 4 cycles of mesenteries arranged as 6+6+12+24=48. The first and second cycles are complete, the 3$^{rd}$ has well-developed macrocnemes and the last one has mainly microcnemes but also some macrocnemes. Pharynx large and hyperfolded,

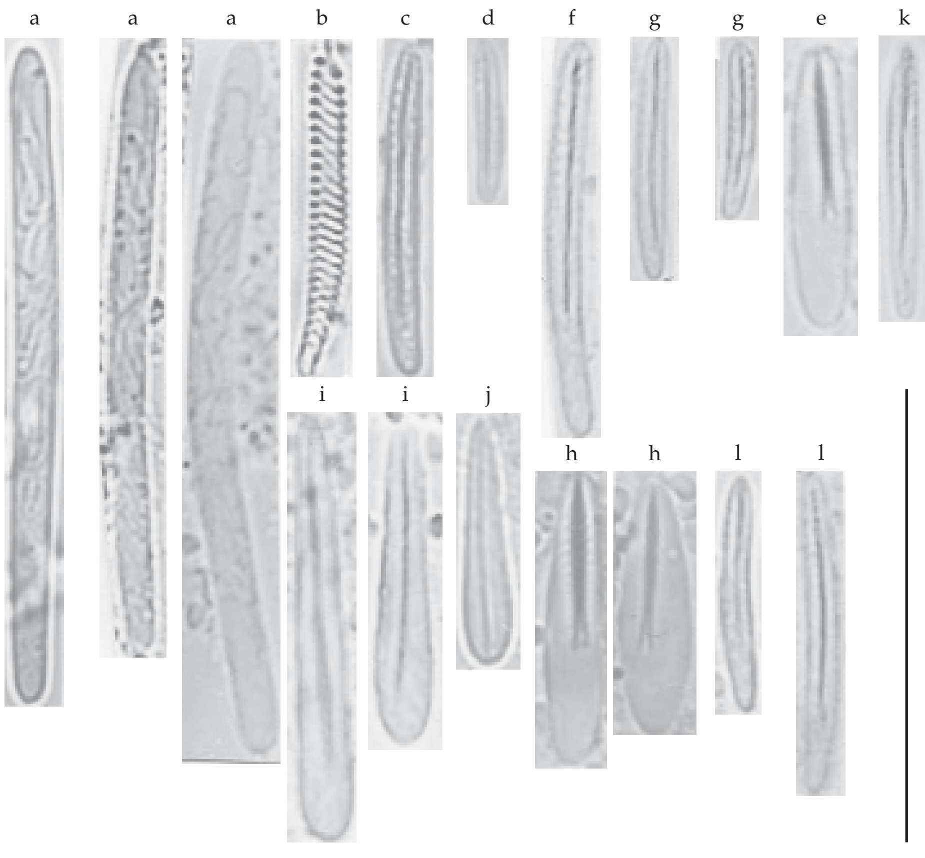


Fig. 1. Cnidom of *Actinia nigropunctata*. The letters refer to those in Table I and II, (scale bar = 50μ).

75% or more of which is folded. We have not observed stoma and there are two pronounced siphonoglyphs.

The column ectoderm presents two different glandular cells and it shows a brush border morphology. Nematocysts are common and arranged in batteries. In the pedal disc the cells are longer and the brush border is more developed. The ectoderm of the tentacles presents a high number of glandular cells.

The mesogloea of the column shows a low cellular density, lacunae are common and they hardly have any content. High to medium cellular density was noticed at the pharynx. As a common Actiniidae characteristic the mesogloea of trilobulated filaments shows a high cellular density.

We noticed a not well-developed folding endoderm along the column which doesn't include zooxanthellae, the endoderm is more developed close to the base region and has numerous mucous cells. In the pharynx there are furrows with wide mesogloea projections, furthermore the ectoderm is glandular-like with many glandular cells and few nematocysts. There are two siphonoglyphs with aboral reticulate projections.

Circular muscle from column and base well-developed and branched. Restricted to diffuse endodermic sphincter with a morphological range (fig. 2). Tentacular longitu-

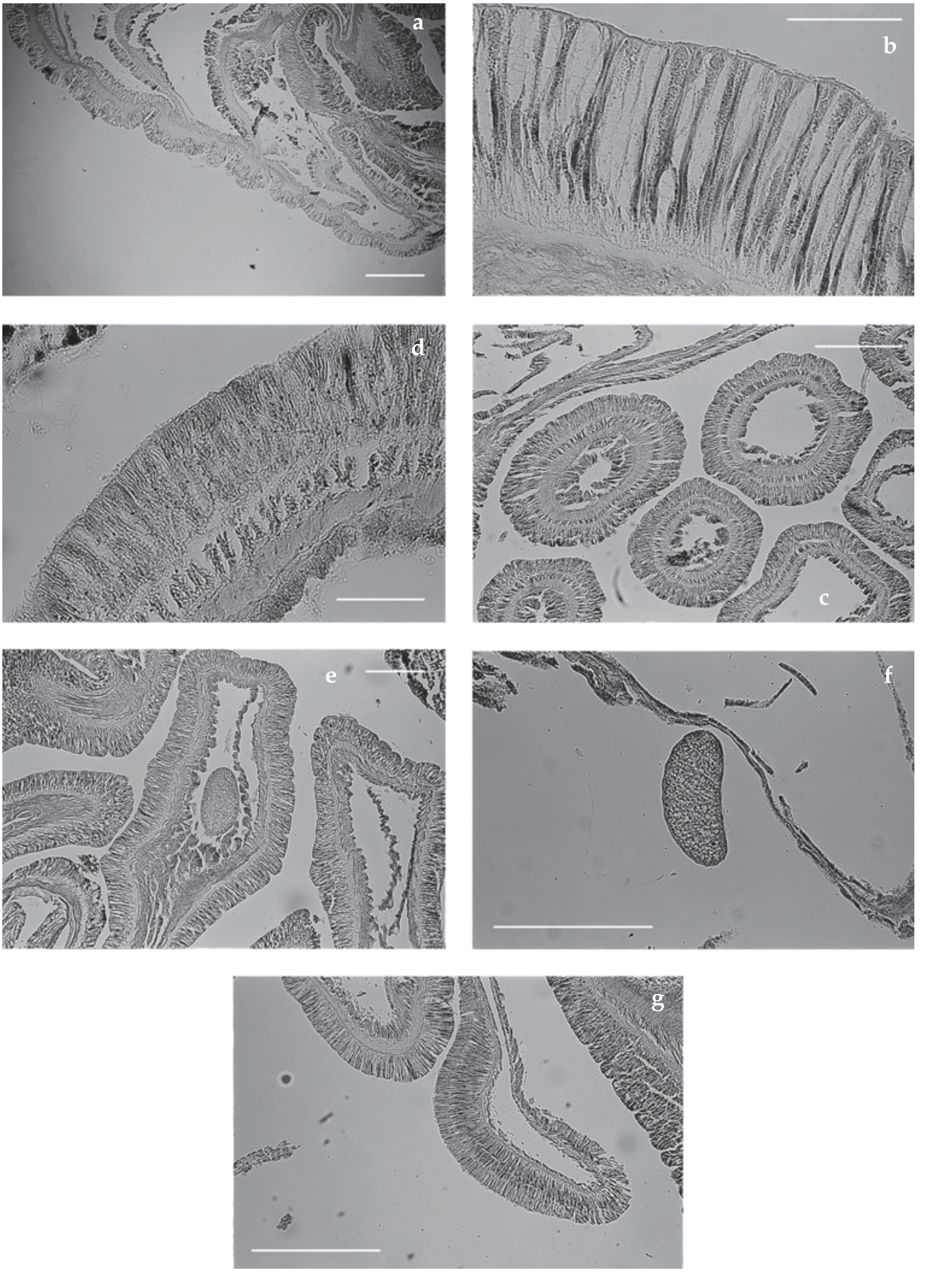


Fig. 2. Histology of *Actinia nigropunctata*. **a**, body wall ectoderm (scale bar = 500 μ); **b**, body wall ectoderm detail (scale bar = 50 μ); **c**, cross sectioned tentacles (scale bar = 200 μ); **d**, cross sectioned tentacles detail (scale bar = 200 μ); **e**, parasite inside tentacles (scale bar = 200 μ); **f**, parasite detail in coelenteron (scale bar = 200 μ); **g**, longitudinal section of acrorhagi (scale bar = 200 μ).

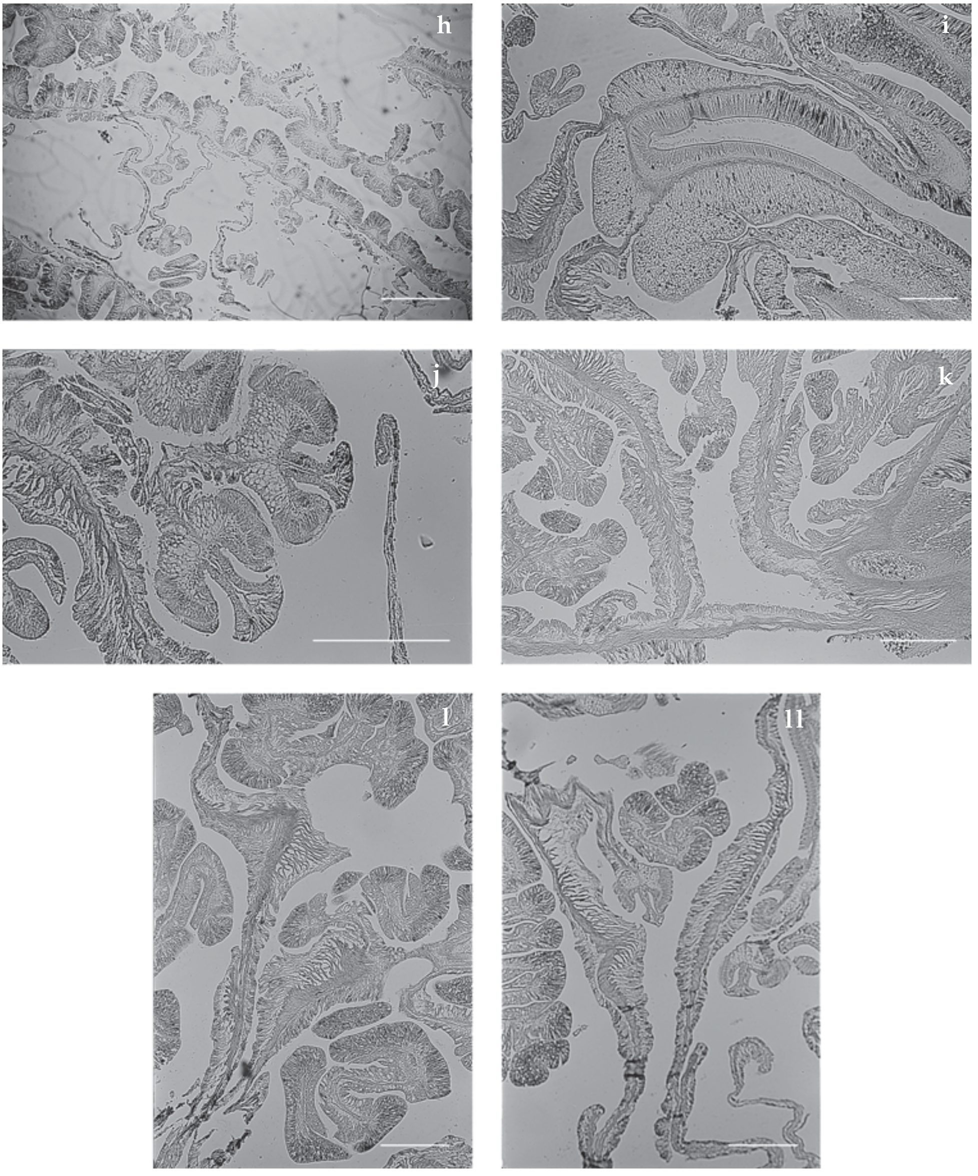


Fig. 2. Histology of *Actinia nigropunctata*. **h**, cross sectioned pharynx (scale bar = 200 μ); **i** , cross sectioned siphonoglyph (scale bar = 200 μ); **j**, details of trilobulated filaments (scale bar = 200 μ); **k**, parietobasilar muscles (scale bar = 200 μ); **l**, retractor muscle (scale bar = 200 μ); **ll**, retractor muscle (scale bar = 200 μ).

dinal muscle generally well-developed, in the oral disc the ectodermical musculature is even a bit more developed than in the tentacles. Well-developed retractor with a wide morphological range (fig. 2), the perfect macrocnemes are restricted-diffuse to diffuse although imperfect macrocnemes and microcnemes have a restricted-reniform

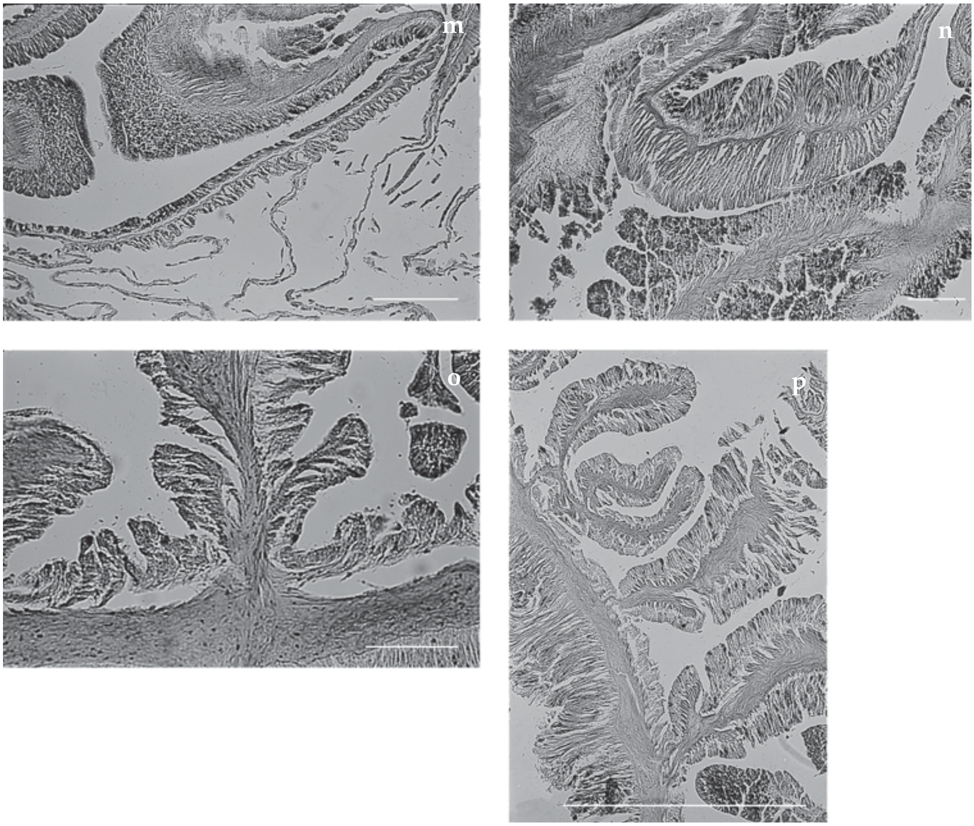


Fig. 2. Histology of *Actinia nigropunctata*. **m**, sphincter (scale bar = 200 μ); **n**, sphincter (scale bar = 200 μ); **o**, basilar muscle (scale bar = 200 μ); **p**, basilar muscle, detail (scale bar = 200 μ).

retractor. Strong parietobasilar muscles projecting as free flaps. Basilar muscles strongly developed, visible as prominent ridges along both sides of the mesenteries (palm-like).

Cnidom.— We found small spirocysts, 1 category of homotrichs, 3-4 types of spirulae and only 1 type of p-mastigophores.

Homotrichs: They are enlarged, elliptical, very common capsules, with the tube not arranged spirally; this category is only present in the acrorhagi.

Spirulae: There are two main morphological categories: 1) elliptical enlarged, common in the tissues; 2) ovoid, exclusively from filaments.

P-mastigophores: We only noticed type A, this category is always present in the filaments of the Actiniidae.

The relative abundance of the cnidom categories is presented in tables 1-2.

Distribution, ecology and other miscellaneous notes.— *Actinia nigropunctata* is only known from Central Macaronesia (Canary Islands and Madeira). The species is much more abundant in Madeira than in the Canary Islands. Furthermore, it is appar-


Fig. 3. *A. nigropunctata*; a, from Tenerife, 1980, red variety (Photo A. Brito, aquarium); b, from Tenerife, 1980, grey variety (Photo A. Brito, aquarium), (scale bar = 0.8 cm).

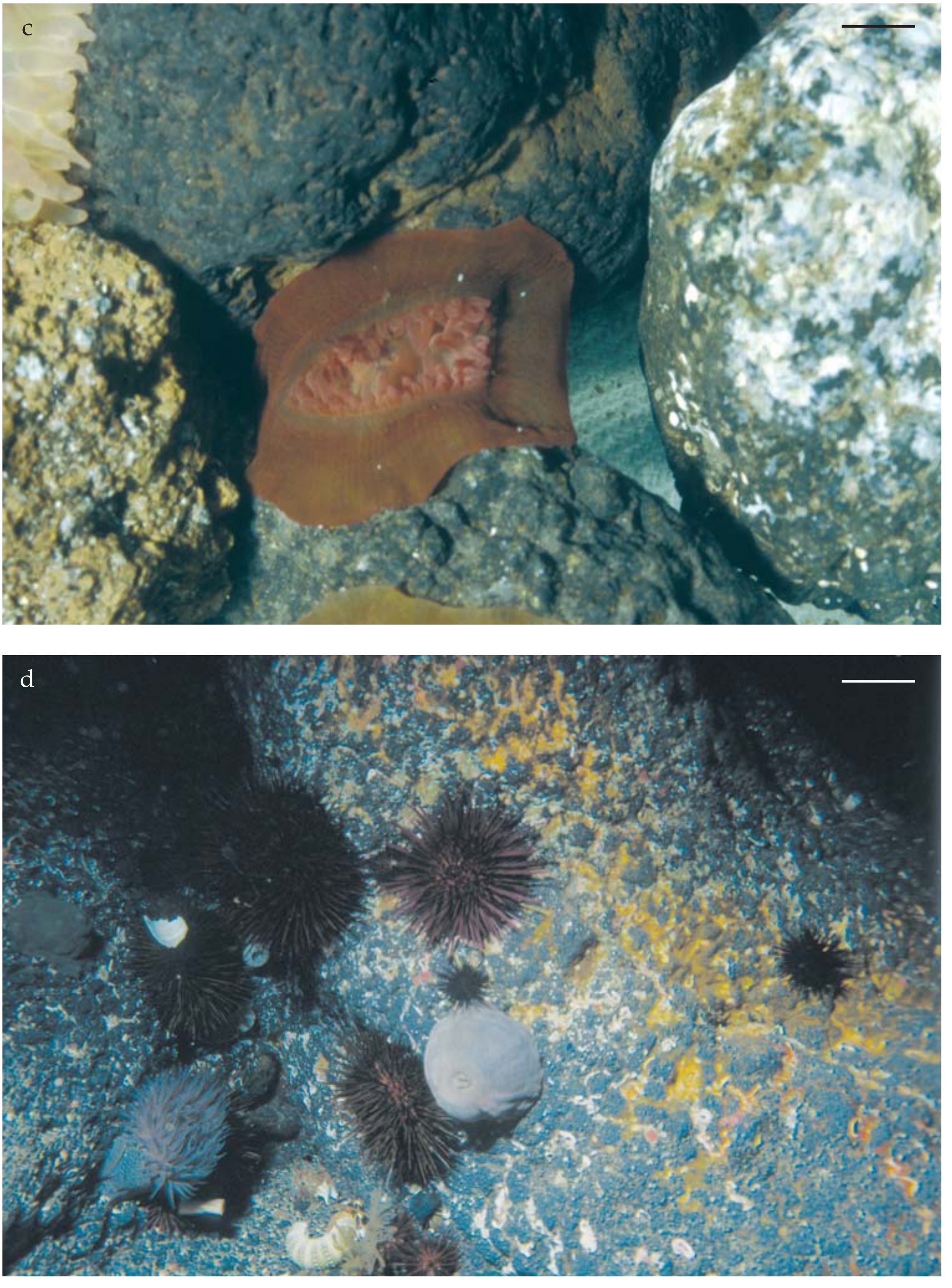


Fig. 3. *A. nigropunctata*; c, flat specimen from Tenerife, 30-1-94, (DZ AA-91) (scale bar = 0.8 cm); d, from Tenerife, nov. 1991, pink variety in cave and tunnels, shallow water, 5 m depth, (scale bar = 4 cm).

Table 1. Survey of the cnidom of *Actinia nigropunctata* spec. nov. (RMNH 19971).

| Tissue | | Type | Lenght | Width | Nº | Abundance |
|---|---|---|---|---|---|---|
| Acrorhagi | **a** | Homotrichs | 52.5 (44.4-55,5) | 3.3 | 11 | Very common |
| | | Spirocysts | | | | Present |
| Tentacles | **b** | Spirocysts | 23.6 (13.3-27.8) | 2.5 (2.2-2.8) | 4 | Very common |
| | **c** | Spirulae | 20.6 (18.9-22.2) | 2.3 (2.2-3.1) | 12 | Very common |
| Pharynx | **e** | P-mastigophores | 21.8 (21.1-22.2) | 3.4 (3.3-3.7) | 3 | Sporadic |
| | **f** | Spirulae | 25.6 (20-28.9) | 2.6 (2.2-3.3) | 12 | Common |
| | **g** | Spirulae | 14.7 (13.3-17.8) | 2.1 (1.7-2.2) | 12 | Common |
| Filament | **h** | P-mastigophores | 20.8 (17.8-25.5) | 4.5 (3.3-5.6) | 16 | Very common |
| | **i** | Spirulae | 30.7 (22.2-35.5) | 3.7 (3.3-4.4) | 15 | Common |
| | | Spirulae | 28.9 | 2.2 | 1 | Sporadic |
| | **k** | Spirulae | 17.6 (13.3-21.1) | 1.9 (1.7-2.2) | 11 | Common |
| | **j** | Spirulae | 18.3 (15.5-22.2) | 3.6 (3.3-4.4) | 8 | Uncommon |
| | | Homotrichs | 46.6 | 3.3 | 1 | Sporadic |
| | | Spirocysts | | | | Present |
| Body wall | **l** | Spirulae | 18 (15.5-20) | 2.2 (2-2.6) | 10 | Common |
| | | Homotrichs | 50.5 (46.6-55.5) | 3.3 | 10 | Common |
| | | Spirocysts | | | | Present |

Table 2. Survey of the cnidom of *Actinia nigropunctata* spec. nov. (DZ AA-14).

| Tissue | | Type | Lenght | Width | Nº | Abundance |
|---|---|---|---|---|---|---|
| Acrorhagi | | Spirulae | 15.5 | 2.2 | 1 | Sporadic |
| | **a** | Homotrichs | 50.2 (44.4-55.5) | 3.9 (3.3-4.4) | 10 | Very common |
| Tentacles | **b** | Spirocysts | 29.4 (17.8-35.5) | 2.6 (2-2.8) | 4 | Very common |
| | **d** | Spirulae | 14.6 (13.3-16.7) | 2.2 (2-2.2) | 8 | Common |
| | **c** | Spirulae | 22.2 (20-25.5) | 2.1 (1.7-2.2) | 15 | Very common |
| Pharynx | **f** | Spirulae | 30.1 (23.3-31.1) | 2.5 (2.2-3.1) | 10 | Common |
| | **g** | Spirulae | 19.5 (14.4-20) | 2.4 (1.7-2.2) | 10 | Common |
| | | Homotrichs | | | | Present |
| Filament | **h** | P-mastigophores | 24.7 (20-26.6) | 4.4 (4.2-4.4) | 10 | Very common |
| | **i** | Spirulae | 32.4 (27.8-36.6) | 4.4 | 10 | Common |
| | **k** | Spirulae | 15.3 (13.3-17.8) | 1.9 (1.7-2.2) | 10 | Common |
| | | Spirulae | 20 | 3.3 | 1 | Sporadic |
| Body wall | **ll** | Spirulae | 22.7 (21.1-24.4) | 2.1 (1.7-2.2) | 7 | Common |
| | **l** | Spirulae | 17.3 (14.4-20) | 2.1 (1.7-2.2) | 15 | Common |
| | | Spirocysts | | | | Present |

ently more common in Tenerife, La Gomera, El Hierro, La Palma and Gran Canaria than in Lanzarote and Fuerteventura. It was found in many different habitats, proving its ecological potential. It can survive stressing intertidal environment, high sedimentation rates or wave action.

It has been recorded from the intertidal down to 10 m depth, attached to all kind of hard substrates in many different habitats. We found it in crevices of intertidal pools with or without sediment, and commonly close to *Anemonia melanaster*; inside crevices on marine intertidal platforms, or under stones on stony beaches. In this latter habitat it can occur with *Anthopleura thallia*. It can also be found under stones on shallow stony bottoms colonised by algae. Finally, it is not rare to observe this species in caves and tunnels where it can also occur with *Telmatactis elongata* (= *Telmatactis forskalii*) and *Anemonia melanaster*.

Remarkably, the species becomes quite large on the north coast of Fuerteventura, and this might be explained by the presence of an unusual marine richness produced by local up-welling. Furthermore, specimens of *A. nigropunctata* can expand their pedal base considerably, increasing their fixing potential and their possibilities to live in wave environment.

We have observed that *A. nigropunctata* feeds on isopoda, as rests of *Ligia italica* and *Gnathia phallanajopsis* were found in their coelenteron contents. On the other hand, we have noticed specimens of *Foettingeria actiniarum* inside the tentacles and coelenteron. The presence of this protozoan parasite is well known for the Actiniidae (Morgan, 1920; Jourdan, 1880; Grassé, 1987). Although we only recognised a single species of protozoan parasite, *sensu* Phillips (1973), there could be more protozoan species in relationship with different species of sea-anemones.

The specimens were collected in summer and autumn, but only three of them were fertile, and all of them were females. Apparently the species is not viviparous. We have found no zooxanthellae at all.

Discussion.— Schmidt (1971) recognised a number of *Actinia equina* subspecies on cnidom differences, the number of complete septa, geographical distribution and reproduction pathways. However, it is difficult to ascertain the geographical subspecies recognised by Schmidt without an accurate descriptive study of the taxa. The colour of most species is variable (red, brown, green, etc.), but several show spots or stripes, as in *A. striata*, *A. cari, A. fragacea*, *A. nigropunctata* and *A. virgata*. *A. fragacea* was considered by Schmidt (1971) to be a subspecies, however, Carter and Thorpe (1981) found significant genetic and ecological differences to recognise it as a species. Nowadays, most *Actinia* species are recognised on external characters and colour features. This should be supported by morphological, ecological or reproductive characteristics. Therefore it seems appropriate to consider a general survey of this genus. We have checked the histology of several species of *Actinia* (Ocaña, 1994; den Hartog & Ocaña, in prep.) and, as a result of this analysis, we conclude that there are not many histological characters to distinguish the species properly. However, according to Schmidt (op. cit.) the cnidom can be of great help for the taxonomy of this genus (see below).

*Actinia nigropunctata* has two main characteristics to distinguish it from any other species of this genus, the presence of black spots on the column and homotrichs with the tube not arranged spirally in their acrorhagi. These characters have never been found in any other species belonging to this genus (see figs 1, 3). In addition, there are no p-mastigophores B1 in the filaments, which are rather common in *A. equina mediterranea* and other *Actinia* species (see den Hartog, 1987). Furthermore, it has the b-mastigophores of the filaments longer than the b-mastigophores of the pharynx. This character is shared by most of the species of *Actinia*, except for *A. e. mediterranea*. Finally, the species seems to be oviparous as no evidence of viviparism has been noticed.

*A. cari* and *A. striata* possess homotrichs with their tubes arranged spirally and have a very characteristic colour pattern, quite different from *A. nigropunctata*.

*A. equina atlantica* and *A. equina equina* also have homotrichs with tubes spirally arranged, but they are mainly red or brown without any spots or stripes on the body wall. In addition, those species can brood juveniles but no trace of this phenomenon was observed in *A. nigropunctata*.

There is not much similarity between *A. nigropunctata* and *A. fragacea,* except that both species show spots on the body wall. *A. fragacea* differs from *A. nigropunctata* in having green spots and homotrichs with their tubes arranged spirally. Both species share the same habitats (from intertidal to infralittoral) and the oviparism.

## Notes on Biogeography

The presence of endemic species of *Actinia* in the Canary Islands and Madeira is a phenomenon that is also known for other groups of intertidal and shallow-water species (see Miller, 1984). It could be caused by the genetic isolation that occurred in those Islands during the Pleistocene period. The Pleistocene glacial and interglacial period brought important changes to the West African and Macaronesian biota. As far as we know, the Pleistocene was a clime fluctuated period where cold and warm weather successions took place, as proven by many fossil records from the islands (see García-Talavera, 1978; Petit-Maire et al., 1986; Rognon et al., 1989; Meco et al., 1992). Many species that were established in Canary Islands and Madeira during the Pleistocene are nowadays distributed over several zones of West-Africa and America (Zibrowius & Brito, 1986).

One of the key events that could help us to understand this genetic isolation and speciation process are the changes in the average sea-water temperature from Pleistocene time towards the present. According to Petit-Maire et al. (1986) the influence of cold temperatures in the Pleistocene was not as pronounced near the islands as at the African continent. As a consequence of this glacial exposure, the temperature was 2ºC higher around the Canary Islands than nearby the Africa coast, 4ºC was the difference at Madeira (see McIntyre, 1974, in Miller, 1984). García-Talavera (1978) and Rognon et al. (1989) found some fossils that support the idea sea temperature at the Canary Islands was lower than at Madeira.

Because of those sea temperature differences and the distance between Africa and Madeira, it is obvious that Madeira developed some special environmental conditions that could have resulted in an endemic fauna. This way Madeira could have become a speciation centre in the Central Macaronesian Archipelagos where *A. nigropunctata* and *A. virgata* were possibly originated. Assuming that the Canary Island current has not changed at all since those days (Miller, 1984), it is a plausible that after the Pleistocene the species started the colonisation of the Canary Islands. However, as far as we know, only *A. nigropunctata* has been recorded at the Canary Islands, being the only species becoming widespread in Central Macaronesian islands. *A. virgata* seems to be absent from the Canary Islands. Its ecological requirements, a scarce population and its reproduction pathways (see below) can offer an explanation for that absence.

In this context we have to mention that most species of *Actinia* are clearly viviparous, although the juveniles can be produced sexually or asexually (Ottaway & Kirby, 1975; Black & Johnson, 1979, Carter & Thorpe, 1979, Gashout & Ormond, 1979; Fautin, 1997). This reproduction pathway assures the settlement of juveniles close to the adults, not the best strategy to distribute across the ocean. However, we also know some examples of oviparism in the genus (see Schmidt, 1971:164) extending the possibilities for occupying remote zones, a plausible explanation in order to understand how the genus could reach farthest Macaronesian islands.

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