DESCRIPTIVE STUDY OF *AIPTASIA MUTABILIS* (GRAVENHORST, 1831) (ANTHOZOA: ACTINIARIA) IN THE CANARY ISLANDS

O. OCAÑA*, J. NÚÑEZ* & J. J. BACALLADO**

With 1 table and 8 figures

SUMMARY. *Aiptasia mutabilis* is an Actinian found in areas of the Atlantic and Mediterranean. Its habitat extends as far south as the Gulf of Guinea but STEPHENSON (1935) and CARLGREN (1949) doubted its presence in the Canarian Archipelago. this paper confirms the existence of *A. mutabilis* Canarian waters and analyses its habitat and anatomy and provides new data regarding its adaptability.

RESUMO. Os autores confirmam a presença de *Aiptasia mutabilis* no Arquipélago das Canárias assim como analisam a anatomia e habitat desta espécie, contribuindo com novos dados sobre a sua adaptação ecológica.

INTRODUCTION

The family Aiptasiidae (CARLGREN, 1924) (Tenaria, Acontiaria) includes all the sea anemones that exhibit acontias with a high number of b-mastigophore and p-mastigophore nematocysts, a weak mesogloeal sphincter and non-dividing mesenteries in macro and microcnemes. The genus *Aiptasia* is characterized by a long, thin column with cinclides around the middle area. Long or very long simple tentacles, without any type of projections. Siphonoglyphs present with six pairs of perfect mesenteries. The cnidom has spirocystes, b-mastigophores and p-mastigophores.

The specimens studied come from collections taken during several expeditions on the Canarias Coasts (1983-1991).

The geographical distribution of this species is along the Atlantic-Mediterranean coasts of England, Ireland, Channel Islands, northern France and Spain, Portugal, Madeira, Canary Islands and Gulf of Guinea.

This anemone is found in shallow intertidal waters and in depths up to 40 m. Those around the Canary Islands are never found at depths greater than 10 m.

* Departamento de Biología Animal (Zoología), Facultad de Biología, Universidad de La Laguna. 38206 La Laguna, Tenerife, Islas Canarias.

** Museo de Ciencias Naturales de Santa Cruz de Tenerife. Aptdo. 835. 38080 S/C de Tenerife, Tenerife, Islas Canarias.

MATERIAL AND METHODS

The material studied was from intertidal and upper infralittoral areas and was collected by direct methods using inmersion equipment. The specimens were taken from depths between 0,5 and 10 m.

The specimens were given an anesthetic of menthol crystals and then fixed with 8% formaldehyde. For the anatomical study, dissections were made using a stereo dissecting microscope and histological sections were taken following the classic Cajal method of surface staining (GABE, 1968). More than 50 sections taken from two specimens have been analyzed under the microscope.

Stations and date of capture of the material.- TENERIFE: Puertito de Güimar, 21-3-89; Santa María del Mar, 25-4-89; Los Abrigos, 29-4-90; Punta Hidalgo, 20-3-90. FUERTEVENTURA: Riscos de Taburiaste, 21-6-90; Isla de Lobos, 23-6-90. LANZAROTE: Puerto de Arrecife, 22-6-90; Caleta del Mojón Blanco, 5-8-90; Playa del Risco, 10-8-90; La Santa, 11-8-90. GRAN CANARIA: Arinaga, 26-7-91; Playa de las Canteras, 27-7-91; Agaete, 28-7-91.

Four specimens have been put in the Museum of Natural Sciences of Santa Cruz de Tenerife (TFMC CN/0179).

EXTERNAL ANATOMY

The column is whitish to greyish in colour, the tentacles and disks are brownish-green due to the zooxanthellae, and, on rare occasions, whitish. The base has a dark chestnut colour.

The base is cylindrical and adheres to a well-developed limbus. The column is thin, without any cuticle, and the mesenteries can be distinguished by their transparency. Along the column the ectoderm forms folds and cinclides can be observed. Capitulum withouth parapet, rounden disk, without peristome. The mouth has two white coloured siphonoglyphs. The mesenteric radius can be recognized for its transparency.

The tentacles are long and thin and inside them one can see acontias; variations can be observed with respect to the thickness of the ectoderm. The number of tentacles varies from 90 to 96 and they are arranged in five whorls with a perfect gradation in size. The last whorl is not complete.

INTERNAL ANATOMY AND HISTOLOGY

Four whorls of mesenteries can be observed (6, 6, 12, 17-19), a total of 41-43 pairs, of which the first is complete and the second and third are macrocnemes of more or less the same size; but the last whorl is formed by less developed macrocnemes. Trilobulated and unilobulated filaments can be observed in the first threewhorls. All of the macrocnemes are

acontifers, and it is not possible to give an exact number of acontias per mesentery. No stomas were observed. The acontias are numerous and easy to distinguish.

Ectoderm.- The thickness of the ectoderm of the column and base is from 90-120 μ, 50-90 μ at the tentacles and 40-150 μ at the disk.

On the column and base there are a large number of wide, elongated glandular mucous cells and other narrow, thick-grained cells, both forming a pseudostratified prismatic epithelium, with the nematocysts arranged in several interspersed layers. The epithelium displays external cilia, looking like a brush in certain areas. A basal plexus is evident. In some areas of the ectoderm it is possible to observe glandular formations of an elongated morphology with refringent bodies in their interior.

The tentacles have spirocysts and b-mastigophores distributed in layers with varying degrees of concentrations over the length of the tentacle. The ectoderm has little external cilia, shows no brush-like appearance and exhibits a large number of thick-grained glandular mucous cells.

The disk has pseudostratified prismatic epithelium and is highly ciliated, giving a brush-like appearance. The glandular cells are abundant, elongated and of thick grain. There are abundant nematocysts and these are distributed in several layers.

Mesogloea.- The thickness of the column and base is 20-40 μ, the tentacle 15-30 μ, the disk and actinopharynx 2-30 μ and the mesentery 1-7 μ.

Usually it has a fibrillar and random structure, with the outer areas being denser than the central matrix. There are few lacunas and the few that do exist are full of cells.

There is high cellular density in the column and base and it has a highly developed sensitive plexus.

In the tentacles and disk there are a large number of lacunas which in the actinopharynx give way to the formations of a double spike.

Few cells can be observed in the mesenteries, and in the filaments these are either few or absent.

Endoderm.- The thickness of the endoderm in the column and base is 40-100 μ, in the tentacles and disk, 90-150 μ, the actinopharynx 5-35 μ and the mesentery 3-60 μ.

The column and base consist of a simple prismatic epithelium, lax, composed of absorption cells and some thick-grained glandular cells, among which there are overlapping cnidocysts. In some areas the absorption cells elongate and transport a large number of zooxanthellae.

The endoderm of the tentacles is totally obliterated by the zooxanthellae. No cnidocysts or glandular cells can be observed; the absorption cells are found to be very deformed due to the accumulation of symbiont algaes. The span of the tentacle can be closed.

The disk has an endoderm with characteristics similar to that of the tentacles.

In the span of the pharynx the siphonoglyph consists of a simple ciliated epithelium, with few thick-grained glandular cells and a large number of cnidocysts distributed apically.

Appearing in this area is a well-developed sensitive plexus. The rest of the endoderm of the pharynx's span displays a double spike morphology in an alternating arrangement of numerous nematocysts (b-mastigophores) and thick-grained glandular cells. The endoderm closed by the mesenteries is not well-developed, it is lax and formed by absorption cells and thick-grained glandular cells. The area of the siphonoglyph displays numerous zooxantellae which decrease as double spike formations.

The mesenteries display an endoderm which is similar to that of the pharynx region which is closed by them, being differentiated by a large number of cnidocysts found between the absorption cells and glandular cells. Unilobulated filaments with pseudostratified prismatic and ciliated epithelium. Elongated, thick-grained glandular cells; numerous nematocysts. Lax trilobulated filament. Ciliated cnidoglandular tract, with few glandular cells and cnidocysts; intermediate tract with zooxanthellae; ciliated tract formed by epithelial and glandular cells; reticular tract with clusters of glandular cells and dispersed zooxanthellae.

Musculature.- The circular muscle, generally endodermic, covers the column and the base; in some areas it enters the mesogloea and remains isolated by it. Towards the base the muscle diminishes and longitudinal and radial processes appear. The basilar muscle is not very developed, it is vestigial and is absorbed in the mesogloea.

Mesogloeal sphincter diffuse and not highly developed.

The tentacles display a longitudinal ectodermic muscle of varying thickness and another circular ectodermic muscle, the latter one being thin and tightly adhered to the mesogloea.

Disk with radial muscular processes not highly developed. Pharynx with alternating longitudinal and circular muscular bands.

Macrocnemic mesenteries with the parietobasilar muscle developed on both faces, diffuse and lobulated. This disappears where the retractor muscle begins. The retractors occupy more than two thirds of the area in the mesenteries and they are endocoelics. In general, the retractor is highly developed especially in the middle of the mesentery. The circular muscle begins at the parietobasilar, it is little developed and adheres very tightly to the mesogloea.

Cnidom.- 2 categories of spirocysts, 1 category of holotrichs, 7 categories of b-mastigophores and 6 categories of p-mastigophores were identified.

REPRODUCTION

Processes of basal laceration in the specimens were observed and none of those analyzed showed any signs of sexual development.

BIOLOGICAL OBSERVATIONS

The anemone is very abundant in the littoral of the islands, from the supralittoral areas

to depths of 10 m. It is located on hard substrates (rock and petrifying calcareous algaes), occupying biotopes that receive little light (vertical walls, under stones and cracks of pools), and not found inside caves.

On infralittoral vertical walls it forms some very characteristic *facies* which appear accompanied by a wide variety of algae, most having an abundance of *Lobophora variegata*; it in association with the «spider crab» (*Stenorinchus septicornis*). In these biotopes the *A. mutabilis* is very abundant, up to 20 specimens per 20 x 20 cm^2.

Little is know about the nutritional requirements of *A. mutabilis* but in other species there is a nutritional relationship with the zooxanthellae. In one of the specimens examined quills of sea urchin *Paracentrotus lividus* were found.

This anemone is very mobile and relocates frequently, sometimes taking inverted positions. It has a great capacity for changing its dimensions, it expells a large number of acontias with no difficulty, and although, in general, it is not very retractible, on one occasion it was found completely closed.

DISCUSSION

The first record of the *A. mutabilis* in the Canarian Archipelago were made by Pax (1909) and May (1912), both around the island of La Gomera. This studyconfirm the presence of this species, but earlier, STEPHENSON (1920, 1935) and CARLGREN (1949). STEPHENSON refuted the presence of the *A. mutabilis* based on the description that PAX made of his specimens. His description differs from that of STEPHENSON's in what he considered two key characteristics for identifying this species. The first was the mesogloeal nature of the sphincter, compared to the non-mesogloeal characteristics proposed by PAX; the second was the high number of tentacles found on the Canarian specimens, 72 compared to the 48 found on the English specimens. These differences and perhaps a very simplified anatomical definition led STEPHENSON to propose a new species wich would be named the *Aiptasiomorpha paxi* STEPHENSON, 1920, thereby refuting the initial citing by PAX. We find that the sphincter in our specimens is weak and mesogloeal, and although it is contained in the mesogloea, it does not display the typical concatenate morphology that STEPHENSON describes. The cnidom, the number of tentacles and the anatomical and ecological characteristics coincide quite well with the specimens described from the Mediterranean, which lived in intertidal and well-lighted infralittoral environments, SCHMIDT (1972). According to this author there are in the Mediterranean two types of *A. mutabilis*: type 1, typical of the intertidal pools and well-lighted seabeds, which is the type that corresponds to our specimens; type 2, which is located in coral and pre-coral bottoms, this type has not been found in the Canarian Archipelago.

In the species of the family Aiptasiidae it is not possible to differentiate the macrocnemic mesenteries from the microcnemic ones (CARLGREN, 1949). In our specimens, although it is practically impossible to differentiate between macro and microcnemes in a

dissection under a stereo microscope, an analysis of thinly cut sections (8-10 μ) reveals that this is possible. In some studies, where other species of *Aiptasia* are described, this characteristic is not mentioned, VERRILL (1901), CARLGREN (1952); nevertheless, MAC MURRICH (1889), in his description of the *A. tagetes*, differentiates macrocnemes from microcnemes.

It is considered that this character should be revised and, if necessary, modified to preclude confusion.

The elongated glandular formations in the ectoderm of the base could be related to the floatational qualities and the swimming abilities of this species, already observed by STEPHENSON (1935) and ourselves; these formations could serve to maintain it in an erect position and function as a statocyst.

TABLE: CNIDOMA

BODY REGIONS	CLASS	DIMENSIONS (µ)	OBSERVATIONS
ACONTIAS	P - MASTIGOPHORES	94-102 x 7,5-10	ABUNDANT
	B - MASTIGOPHORES	31-35,5 x 2-3	ABUNDANT
TENTACLES	SPIROCYSTES	11-24 x 1,5-4	ABUNDANT
	P - MASTIGOPHORES	20-44 x 2-6,5	COMMON
	B - MASTIGOPHORES	10-20 x 1-2	COMMON
PHARYNX	P - MASTIGOPHORES	31-40 x 2-4	ABUNDANT
	B - MASTIGOPHORES	14-33 x 1-4	COMMON
	_____	_____	PRESENCE OF SPIROCYSTS
FILAMENTS	P - MASTIGOPHORES	31-100 x 2-2,5	ABUNDANT
	P - MASTIGOPHORES	12-17 x 2-3	ABUNDANT
	B - MASTIGOPHORES	31-33 x 2-2,5	RARE
	_____	_____	PRESENCE OF SPIROCYSTS
BODY WALL	P - MASTIGOPHORES	14-22 x 2-3	ABUNDANT
	B - MASTIGOPHORES	13-27 x 1,5-3	ABUNDANT
	_____	_____	PRESENCE OF SPIROCYSTS

TABLE 1.- Measurements of the nematocysts from five specimens.

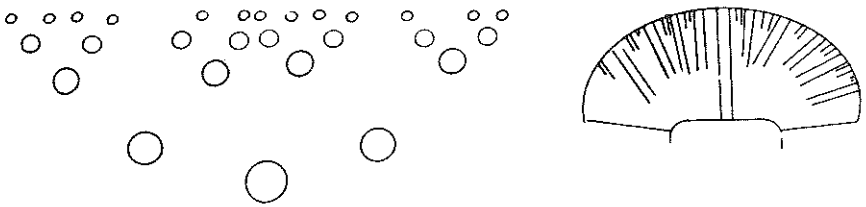

Fig. 1.- Diagrams showing the arrangement of tentacles (a) and mesenteries(b).

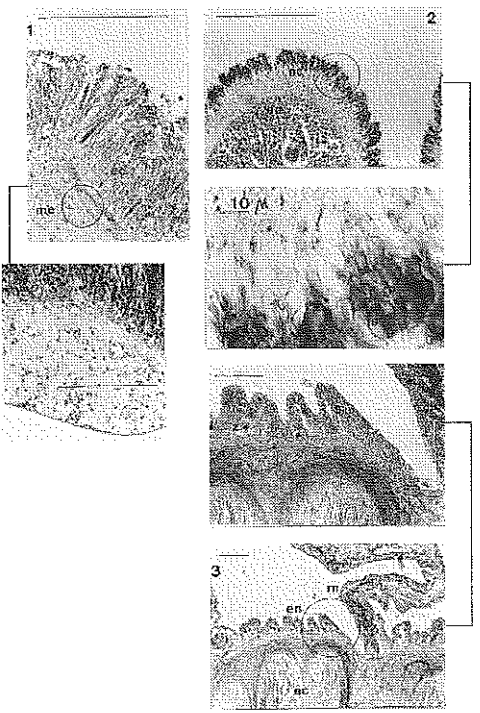

Fig. 2.- Scales: 100 µ. 1. Longitudinal sections of the wall; ec= ectoderm; me= mesogloea. 2. Transversal section of the tentacle; ec= ectoderm; en= endoderm; s= spirocyst. 3. Endoderm of the wall; en= endoderm; ec= ectoderm; m= mesenteries; z= zooxanthellae.

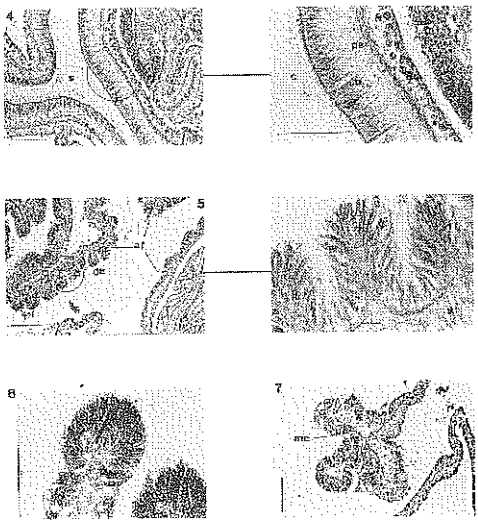

Fig. 3.- Scales: 100 m. 4. S= sifonoglyphe; c= cilium; n= nematocysts; ps= sensitive plexus; z= zooxanthellae. 5. af= actinopharynx; de= double spike. 6. Unilobulated filament; n= nematocyst. 7. Trilobulated filament; me= mesogloea.

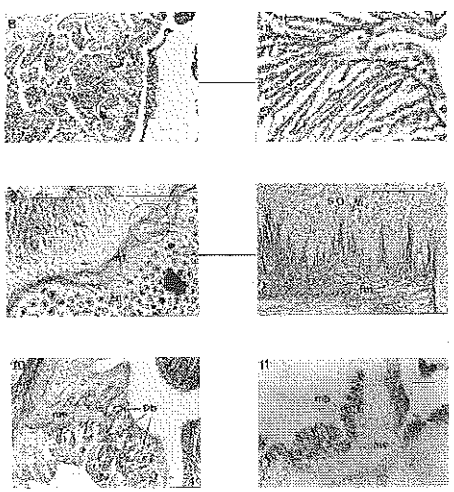

Fig. 4.- Scales: 100 m. 8. Vision of the mesenteries; a= acontia; r= retractor. 9. sf= sphincter; ec= ectoderm; en=endoderm; fm= mesogloeal sphincter. 10. pb= parietobasilar muscle; me= mesogloea. 11. mb= basilar muscle; me= mesogloea.

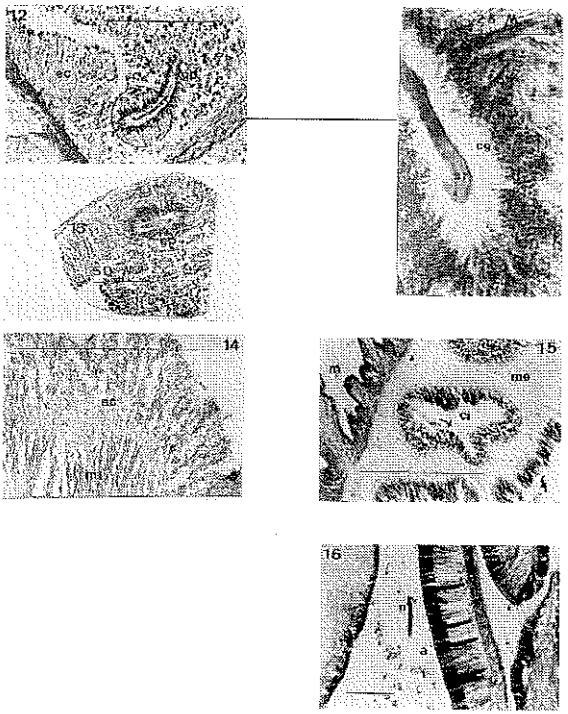

Fig. 5.- Scales: 100 m. 12 and 13. Basal glandular formations; ec= ectoderm; gp= basal gland; cg= cilliated glandular cells; sr= refringent substance. 14. Transversal section of the tentacle; ec= ectoderm; ml= longitudinal musculature. 15. ci= cinclide; me= mesogloea. 16. a= acontias; n= nematocyst.

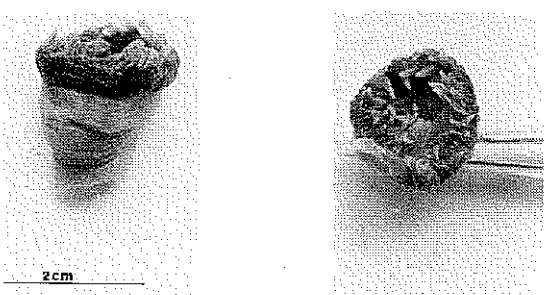

Fig. 6.- Frontal and upper views.

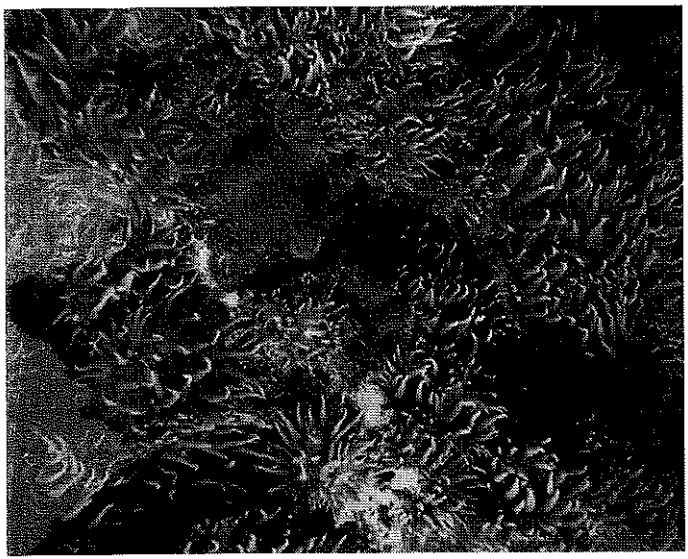

Fig. 7.- Habitat of *A. mutabilis*

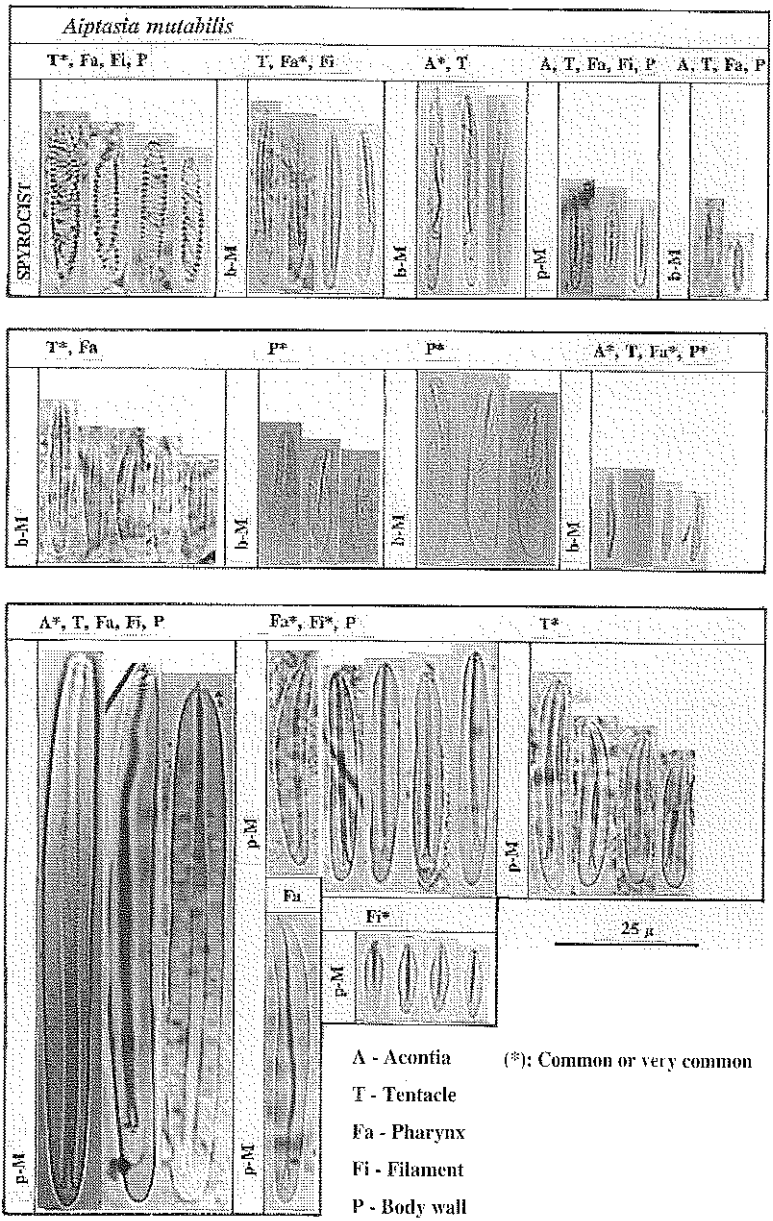

Fig. 8.- Cnidom of *A. mutabilis*.

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