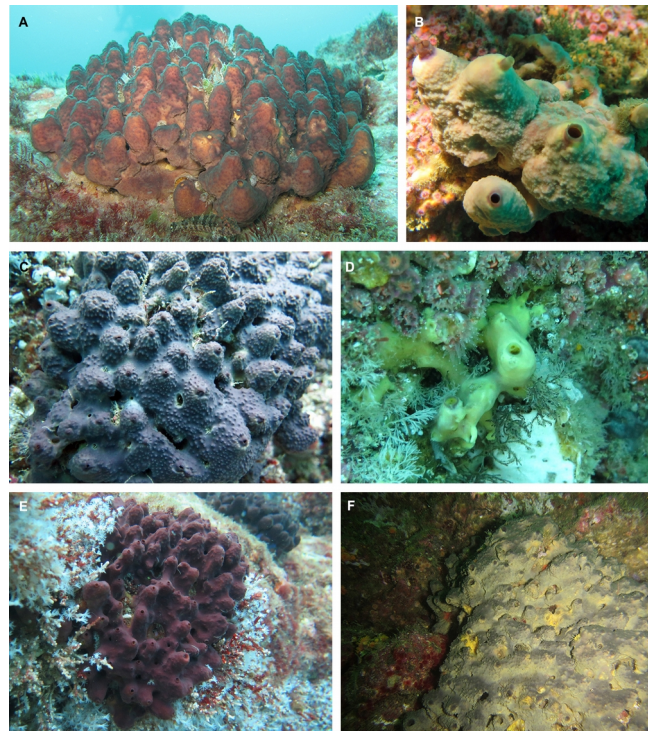


## Taxonomía integrativa en Porifera: morfología, ADN y metabolómica



# Taxonomía integrativa

## **Taxonomía**

Disciplina biológica que identifica, describe, clasifica y nombra especies existentes y extintas, y otros táxons - Padial *et al.*, 2010.

## **Taxonomía “tradicional”**

“Morfoespecies”

## **Taxonomía integrativa**

“Delimitar las unidades de diversidad de la vida a partir de múltiples perspectivas complementarias (filogeografía, morfología comparada, genética de poblaciones, ecología, desarrollo, comportamiento, etc.)” - Dayrat, 2004.

***Vansoestia caribensis* gen. nov., sp. nov.: first report of the family Ianthellidae (Verongida, Demospongiae) in the Caribbean**

MARIA C. DÍAZ<sup>1,2,7</sup>, ROBERT W. THACKER<sup>3</sup>, NIAMH E. REDMOND<sup>4</sup>,  
THIERRY PEREZ<sup>5</sup> & ALLEN G. COLLINS<sup>4,6</sup>

OPEN ACCESS Freely available online



**Integrative Taxonomy and Molecular Phylogeny of Genus *Aplysina* (Demospongiae: Verongida) from Mexican Pacific**

José Antonio Cruz-Barraza<sup>1\*</sup>, José Luis Carballo<sup>1</sup>, Axayacatl Rocha-Olivares<sup>2</sup>, Hermann Ehrlich<sup>3</sup>,  
Martin Hog<sup>3</sup>



SYMPOSIUM

The Integrative Taxonomic Approach Applied to Porifera: A Case Study of the Homoscleromorpha

Nicole Boury-Esnault,<sup>1,\*</sup> Dennis V. Lavrov,<sup>†</sup> César A. Ruiz\* and Thierry Pérez\*

*Zoological Journal of the Linnean Society*, 2017, **179**, 707–724. With 9 figures

**Descriptions of new sponge species and genus, including aspiculate Plakinidae, overturn the Homoscleromorpha classification**

CÉSAR RUIZ<sup>1</sup>, GUILHERME MURICY<sup>2</sup>, ANAÍRA LAGE<sup>2</sup>, CELSO DOMINGOS<sup>2</sup>,  
SANDRINE CHENESSEAU<sup>1</sup> and THIERRY PÉREZ<sup>1\*</sup>

**Integrative taxonomy of calcareous sponges (subclass Calcinea) from the Peruvian coast: morphology, molecules, and biogeography**

FERNANDA AZEVEDO<sup>1</sup>, BÁSLAVI CÓNDROR-LUJÁN<sup>1</sup>, PHILIPPE WILLENZ<sup>2</sup>,  
EDUARDO HAJDU<sup>3</sup>, YURI HOOKER<sup>4</sup> and MICHELLE KLAUTAU<sup>1\*</sup>

**Integrative Taxonomy of Amazon Reefs' *Arenosclera* spp.: A New Clade in the Haplosclerida (Demospongiae)**

Camille V. Leal<sup>1,2\*</sup>, Fernando C. Moraes<sup>3</sup>, Adriana M. Fróes<sup>2</sup>, Ana C. Soares<sup>2</sup>,  
Louisi S. de Oliveira<sup>2</sup>, Ana Paula B. Moreira<sup>2</sup>, Fabiano L. Thompson<sup>2</sup> and Eduardo Hajdu<sup>1</sup>

# Por qué en Porifera?



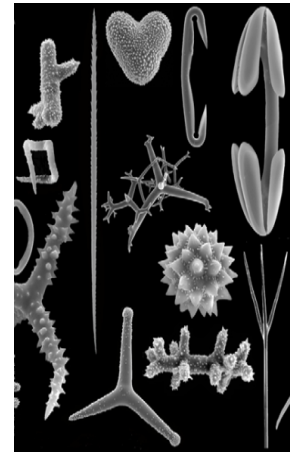
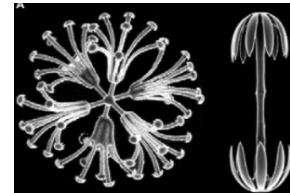
# Por qué en Porifera?

## *Morfología externa*

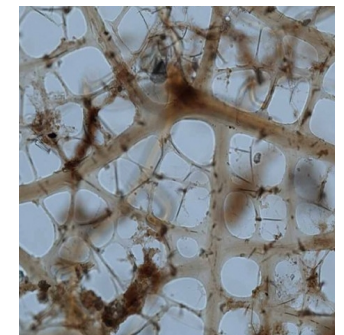
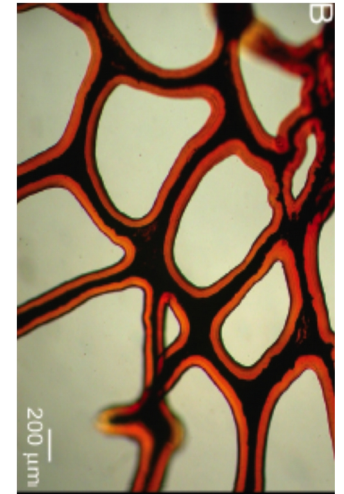


## *Esqueleto*

### Espículas



### Fibras



## Clasificación

e

## Identificación

(Van Soest & Hooper, 2002)

# Esponjas sin espículas

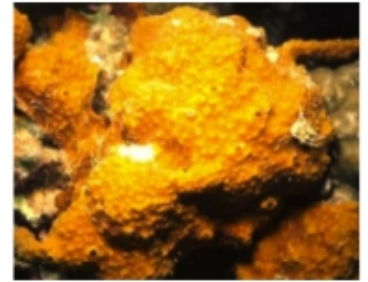
Filo Porifera Grant, 1836

Clase Demospongiae Sollas, 1885

Orden Verongiida Bergquist, 1978

Familia Aplysinidae Carter, 1875

Género *Aplysina* Nardo, 1834



# Genética

J Mol Evol (2005) 60:327–336  
DOI: 10.1007/s00239-004-0162-0

JOURNAL OF  
**MOLECULAR  
EVOLUTION**

## ITS-2 and 18S rRNA Gene Phylogeny of Aplysinidae (Verongida, Demospongiae)

Susanne Schmitt,<sup>1</sup> Ute Hentschel,<sup>1</sup> Sven Zea,<sup>2</sup> Thomas Dandekar,<sup>3</sup> Matthias Wolf<sup>3</sup>

PORIFERA RESEARCH: BIODIVERSITY, INNOVATION AND SUSTAINABILITY - 2007

## Molecular markers for species discrimination in poriferans: a case study on species of the genus *Aplysina*

Isabel Heim<sup>(\*)</sup>, Michael Nickel, Franz Brümmer

*Journal of the Marine Biological Association of the United Kingdom*, 2010, 90(4), 845–850. © Marine Biological Association of the United Kingdom, 2009  
doi:10.1017/S0025315409991202

## *Aplysina* (Porifera: Demospongiae) species identification through SSCP-ITS patterns

FLÁVIA RACHEL M. LAMARÃO<sup>1,2,3</sup>, ESTÉFANE C. REIS<sup>1</sup>, TATIANA A. SIMÃO<sup>3</sup>, RODOLPHO M. ALBANO<sup>3</sup>  
AND GISELE LÔBO-HAJDU<sup>1</sup>

*tive and Comparative Biology*

*Integrative and Comparative Biology*, volume 53, number 3, pp. 482–494  
doi:10.1093/icb/ict033

Society for Integrative and Comparative

### SYMPOSIUM

## Phylogenetic Novelty and Geographic Anomalies among Tropical Verongida

Maria C. Diaz,<sup>1,\*</sup> Robert W. Thacker,<sup>2,†</sup> Niamh E. Redmond,<sup>‡</sup> Kenan O. Matterson<sup>†</sup> and Allen G. Collins<sup>§,¶</sup>

# Química

OPEN ACCESS  
**Marine Drugs**  
ISSN 1660  
www.mdpi.com/journal/marine



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



Biochemical Systematics and Ecology 36 (2008) 283–296

[www.elsevier.com/locate/bi](http://www.elsevier.com/locate/bi)

biochemical  
systematics  
and ecology

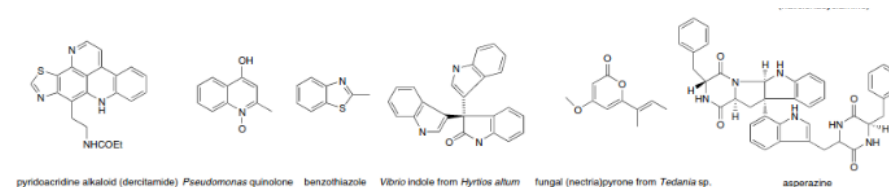
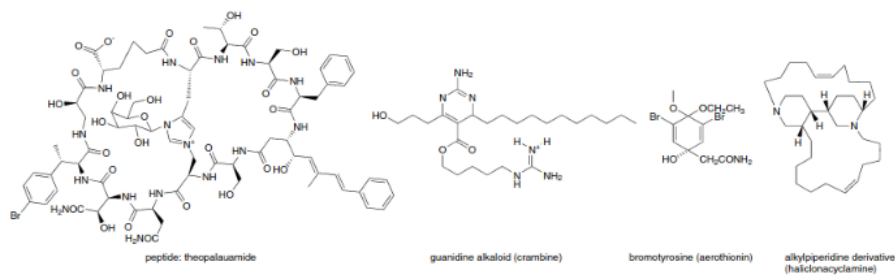
Review

## Brominated Compounds from Marine Sponges of the Genus *Aplysina* and a Compilation of Their $^{13}\text{C}$ NMR Spectral Data

Narlize Silva Lira <sup>1</sup>, Ricardo Carneiro Montes <sup>1</sup>, Josean Fechine Tavares <sup>1</sup>,  
Marcelo Sobral da Silva <sup>1</sup>, Emidio V. L. da Cunha <sup>2</sup>, Petronio Figueiras de Athayde-Filho <sup>1</sup>,  
Luis Cezar Rodrigues <sup>1</sup>, Celidarque da Silva Dias <sup>1,\*</sup> and Jose Maria Barbosa-Filho <sup>1,\*</sup>

## Chemical variability within the marine sponge *Aplysina fulva*

Cecília V. Nuñez <sup>a</sup>, Erika V.R. de Almeida <sup>a</sup>, Ana Claudia Granato <sup>a</sup>, Suzi O. Marinho <sup>a</sup>,  
Kelly O. Santos <sup>a</sup>, Fabio R. Pereira <sup>a</sup>, Mario L. Macedo <sup>a,b</sup>, Antonio G. Ferreira <sup>a</sup>,  
Eduardo Hajdu <sup>c</sup>, Ulisses S. Pinheiro <sup>c</sup>, Guilherme Muricy <sup>c</sup>, Solange Peixoto <sup>c</sup>,  
Christopher J. Freeman <sup>c</sup>, Daniel F. Gleason <sup>c</sup>, Roberto G.S. Berlink <sup>a,\*</sup>



Review

MARINE  
BIOTECHNOLOGY

## Status and Perspective of Sponge Chemosystematics

Dirk Erpenbeck,<sup>1,2</sup> Rob W.M. van Soest<sup>1</sup>

<sup>1</sup>Zoological Museum, IBED, University of Amsterdam, 1090GT Amsterdam, The Netherlands

<sup>2</sup>Current address: Biodiversity Program, Queensland Museum, South Brisbane, Queensland 4101, Australia





## Morfología + Genética + Química



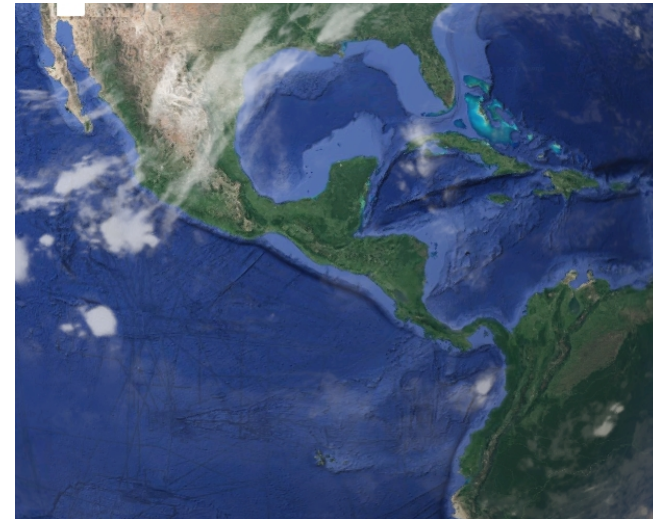
- *Aplysina*



# Integrative Taxonomy and Molecular Phylogeny of Genus *Aplysina* (Demospongiae: Verongida) from Mexican Pacific

José Antonio Cruz-Barraza<sup>1\*</sup>, José Luis Carballo<sup>1</sup>, Axayacatl Rocha-Olivares<sup>2</sup>, Hermann Ehrlich<sup>3</sup>, Martin Hog<sup>3</sup>

<sup>1</sup> Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México (UNAM), Mazatlán Sinaloa, México, <sup>2</sup> Departamento de Oceanografía Biológica, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Ensenada, Baja California, México, <sup>3</sup> Institute of Bioanalytical Chemistry, Dresden University of Technology, Dresden, Germany

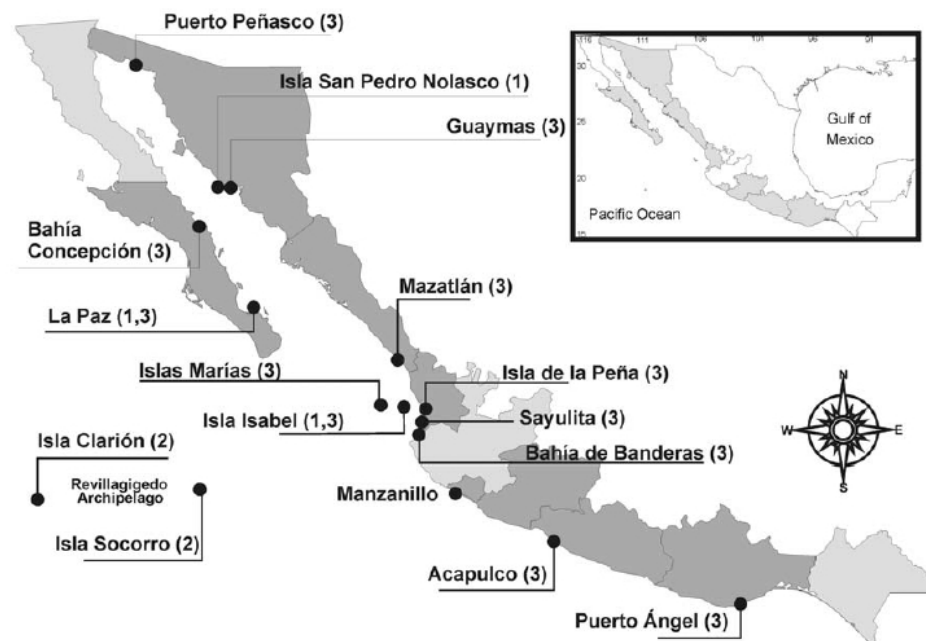


Orden Verongida  
 Familia Aplysinidae  
 Género *Aplysina*

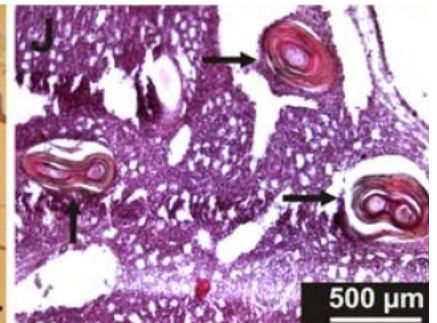
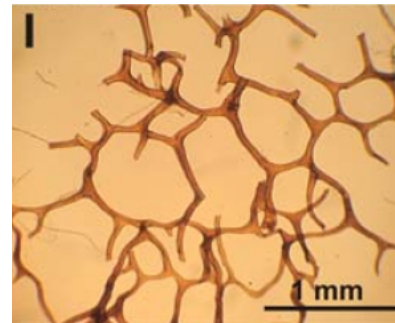
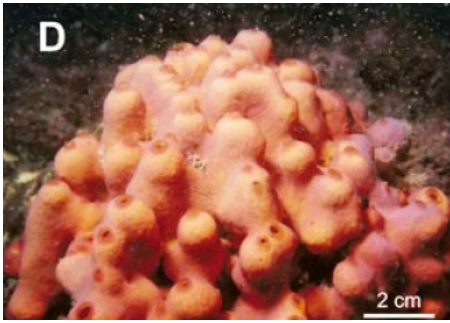
Esqueleto sin espículas, apenas fibras

*A. gerardogreeni* (México)

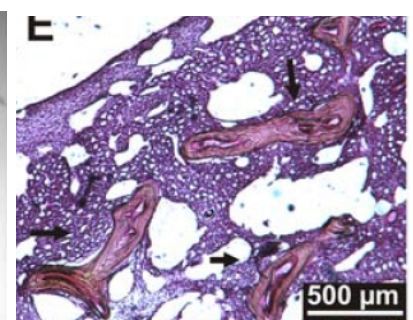
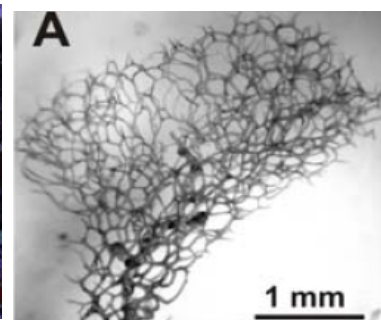
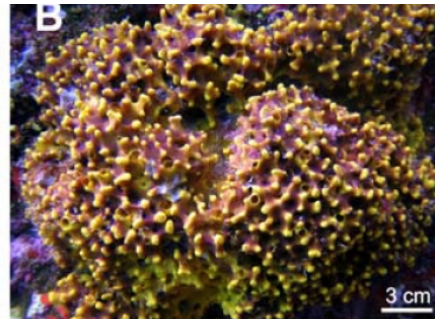
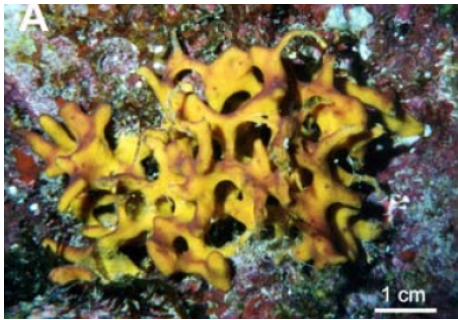
*A. chiriquenensis* (Panamá – Galápagos)



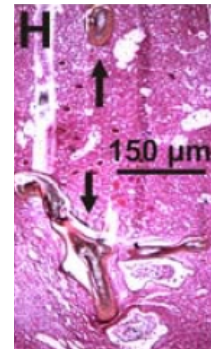
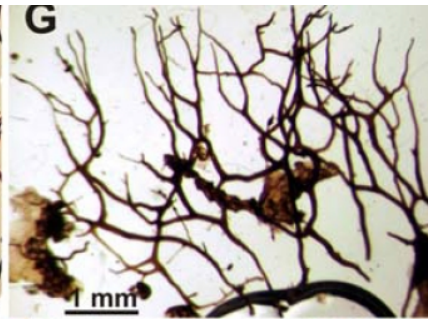
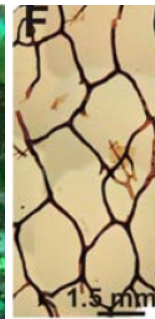
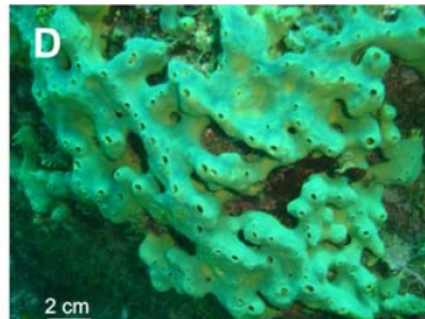
# Análisis morfológico



*A. gerardogreeni*

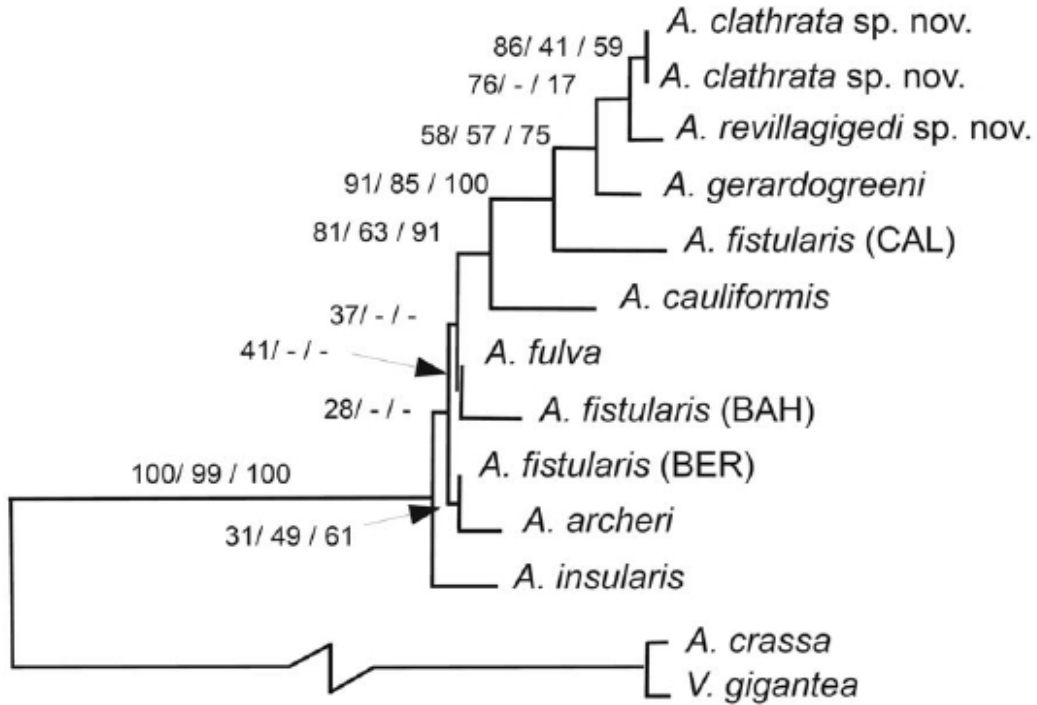


*Aplysina* sp. 1 “*clathrata*”



*Aplysina* sp. 2 “*revillagigedi*”

# Análisis genético



Análisis NJ, MP, Bayes

Región mitocondrial: COI

Región nuclear: ITS-1, 5.8S, ITS-2

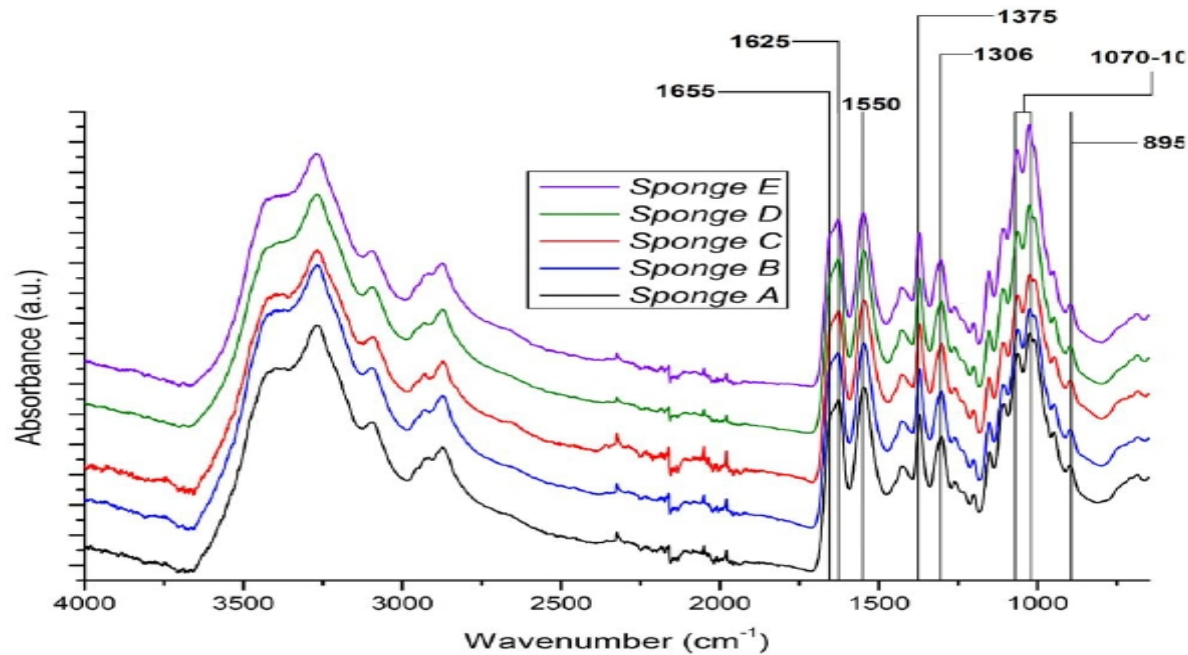
Diagnosis basada en caracteres  
(David & Nixon, 1992)

Mexican Pacific <i>Aplysina</i> species	rDNA						COI
	101	513	607	609	613	682	319
<i>Aplysina gerardogreeni</i>	A	G	T	C	G	G	T
<i>A. revillagigedi</i> sp. nov.	C	A	C	A	A	G	C
<i>A. clathrata</i> sp. nov.	A	A	C	A	A	A	T



# Análisis químico

Quitina: sinapomorfia de Verongida



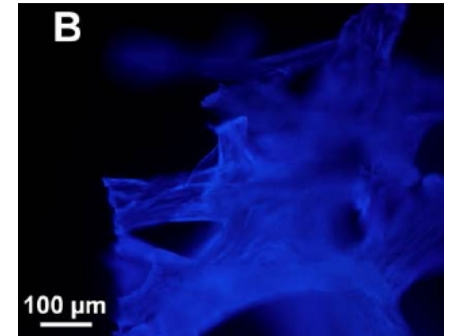
FTIR (Fourier Transform Infrared spectroscopy)  
Determinación de NAG (N-acetil D-glucosamina)

A: *Aplysina fulva*

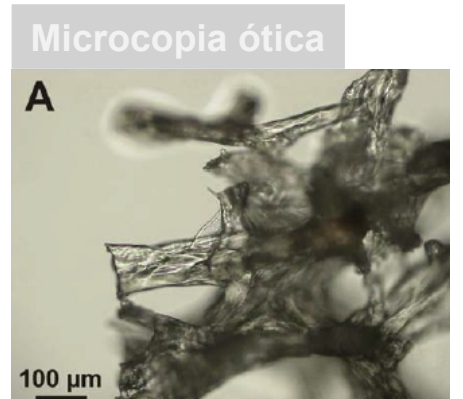
B: *A. gerardogreeni* (285 ± 10 µg/ng)

C: *A. clathrata* (375 ± 10 µg/ng)

D: *A. revillagigedi* (350 ± 10 µg/ng)



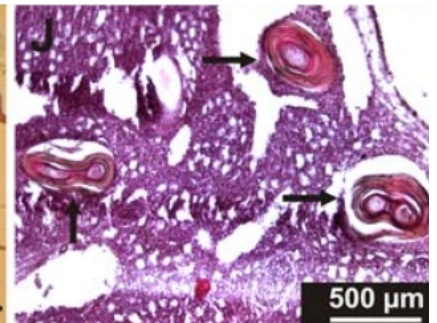
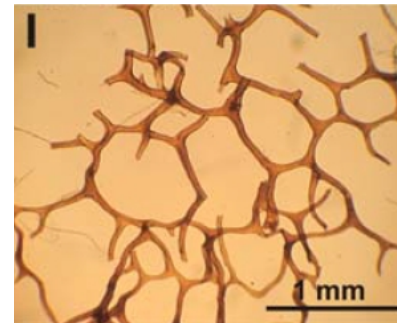
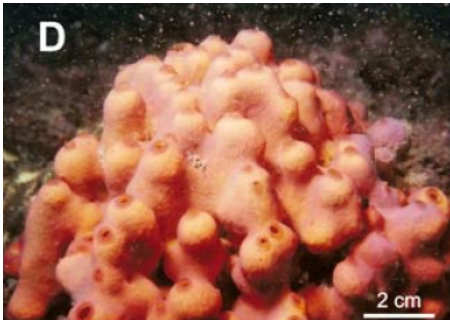
Coloração Calcofluor White



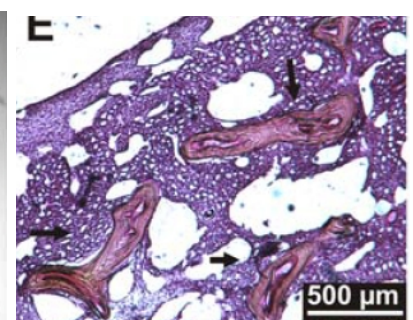
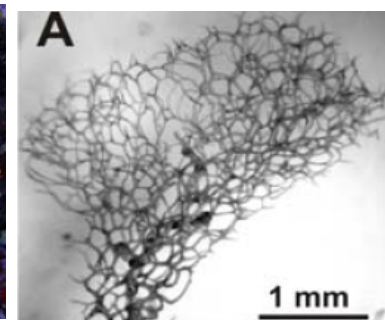
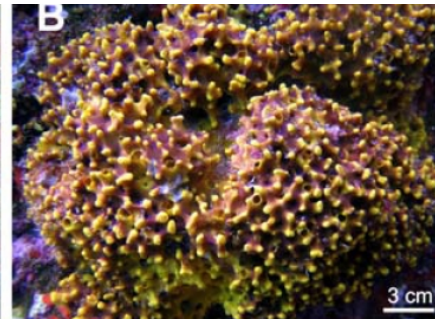
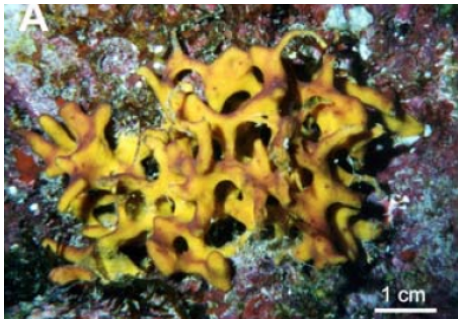
Microscopia ótica

Diferencias en absorbancia = Diferencias em taxonomía?

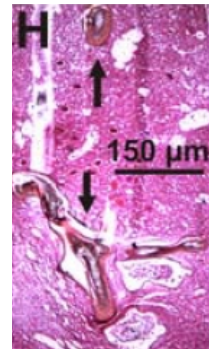
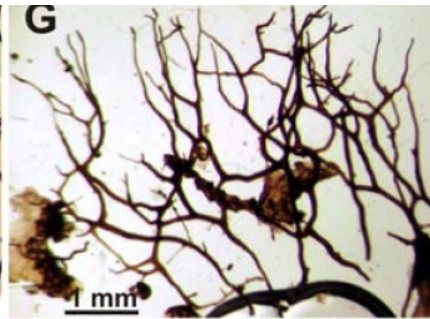
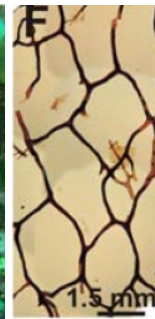
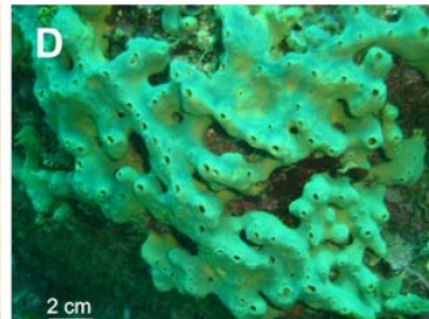
# Búsqueda de caracteres → especies nuevas



*A. gerardogreeni*



*A. clathrata* (especie nueva)



*A. revillagiedi* (especie nueva)





# Reserva Marina “El Pelado”

## Península de Santa Elena





*Muricea muricata*

*Muricea muricata*

*Favosites fava*

*Favosites fava*

*Leptasterias tuberculata*

*Muricea muricata*



*Muricea cf. muricata*

*Paramuricea cf. subulata*

*Favosites subulata*

*Metamaria hickmani* (Songmoand)

*Muricea muricata*

*Muricea muricata*



Unidentified

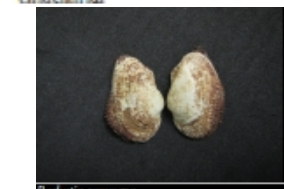
*Cordia ziliata*

*Leptasterias alba*

*Leptasterias muricata*

*Muricea muricata*

*Muricea muricata*



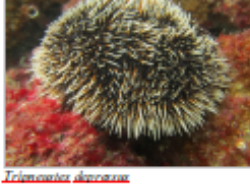
*Bastula rosicoma*

*Osma buxiformis*



*Plexia australis*

*Bastaria antarctica*



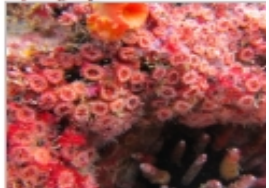
*Trimeria alpestris*

*Leptochinus ramuliferus*



*Mabolia cupus*

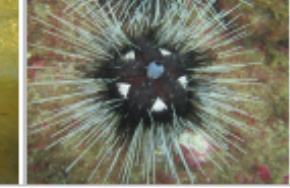
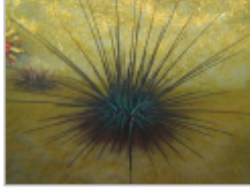
*Hyssia hyotis*



*Plyllongia* sp. 1

*Notostella acuta*

*Pentasterias australis*



*Diodema maculatum* \*

*Asterias subulata*



*Pinctada mazatlanica*

*Perna sterna*



*Plyllongia* sp. 2

*Echinasteris subulata* \*

*Luxurasterias mazae*

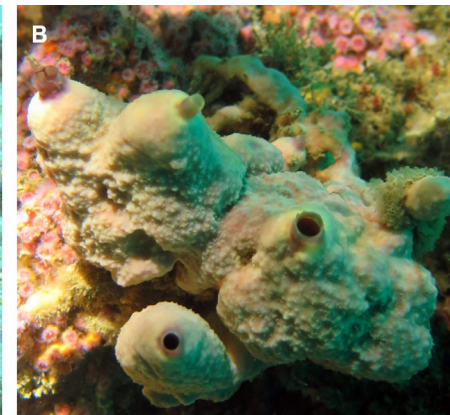


*Echinasteris australis*

Ferlation on juvenile *E. Australis*

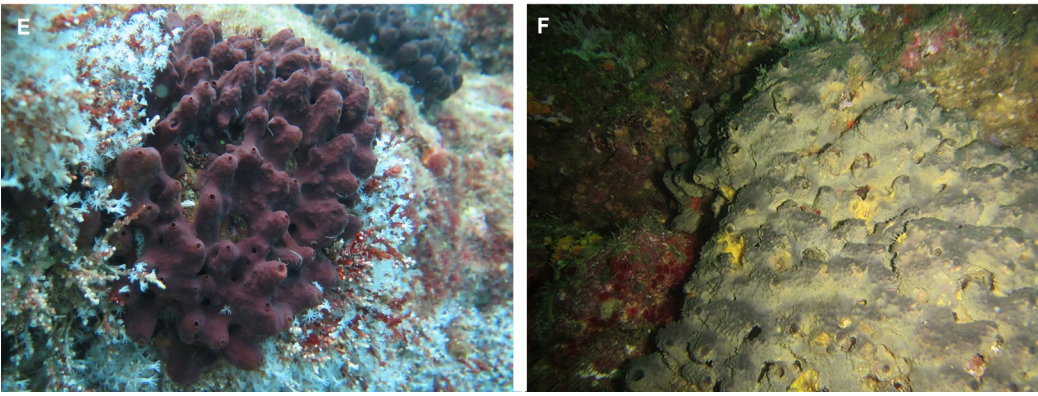
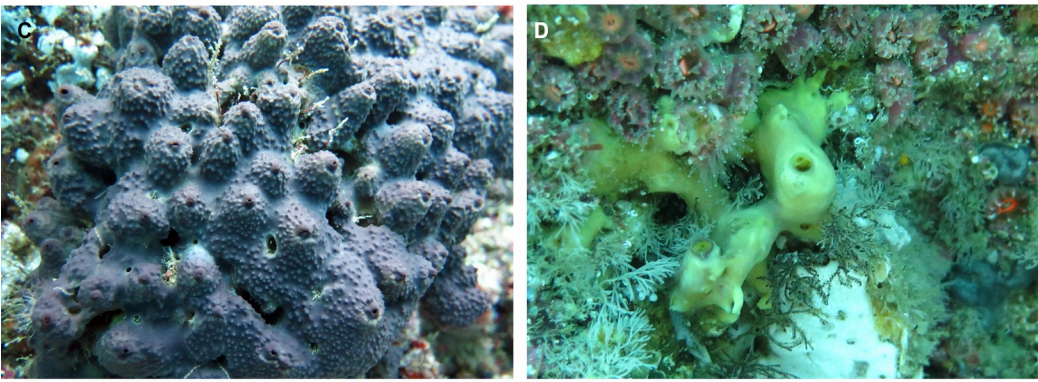
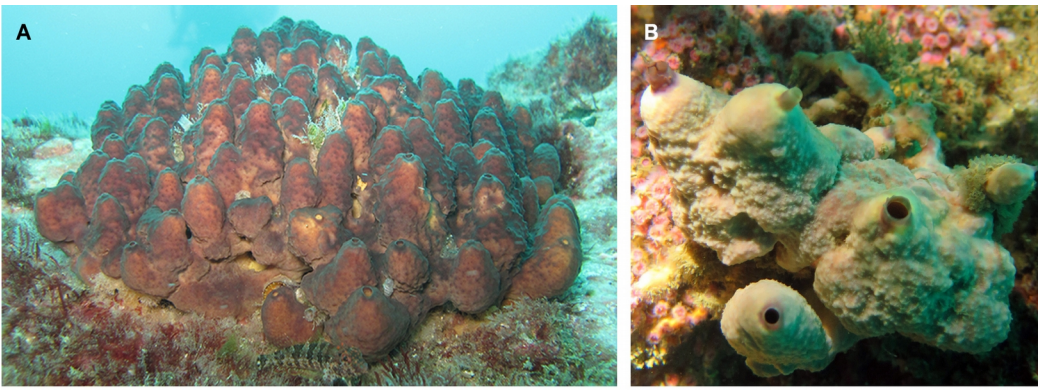
**PROYECTO** “Caracterización de la Biodiversidad Microbiológica y de Invertebrados de la Reserva Marina El Pelado a escala taxonómica, metabolómica y metagenómica para su uso en Salud Humana y Animal”

**CENAIM**



# PROYECTO “Caracterización de la Biodiversidad Microbiológica y de Invertebrados de la Reserva Marina El Pelado a escala taxonómica, metabolómica y metagenómica para su uso en Salud Humana y Animal”

**Objetivo:**  
Identificar Porifera

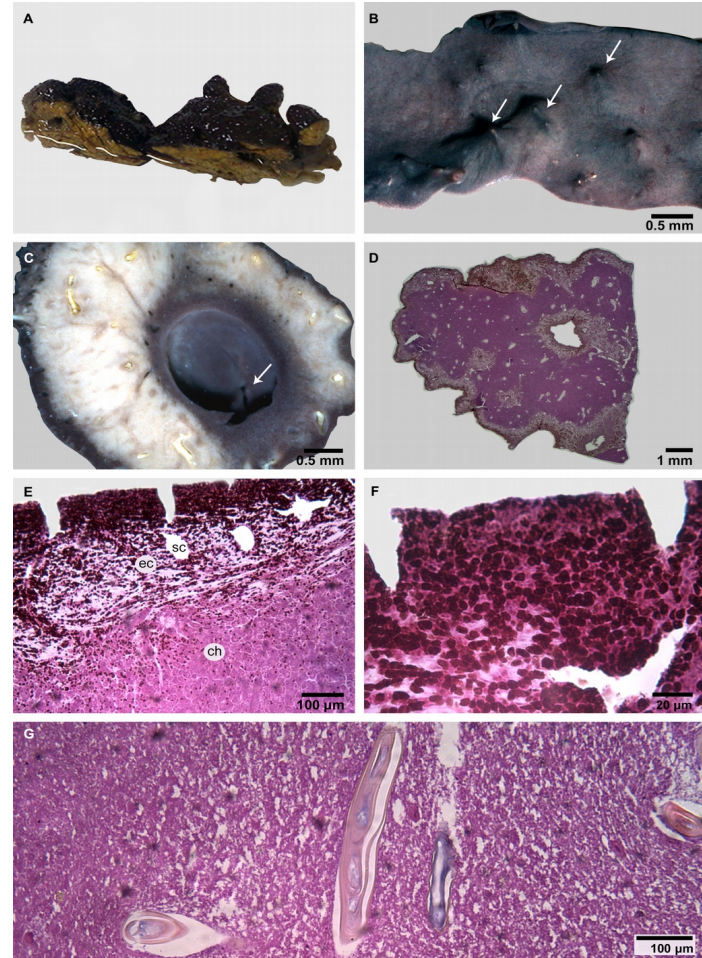
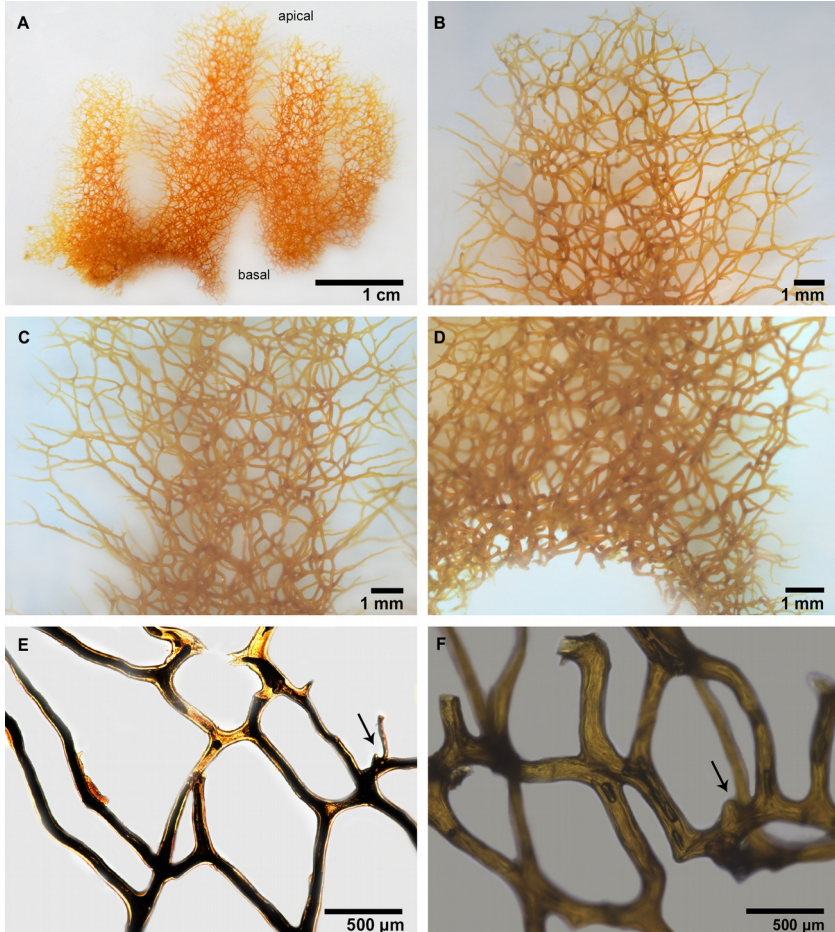


# Análisis morfológico

Superficie, número de ósculos, lóbulos, y cónulos.

Laminas de fibras: medidas

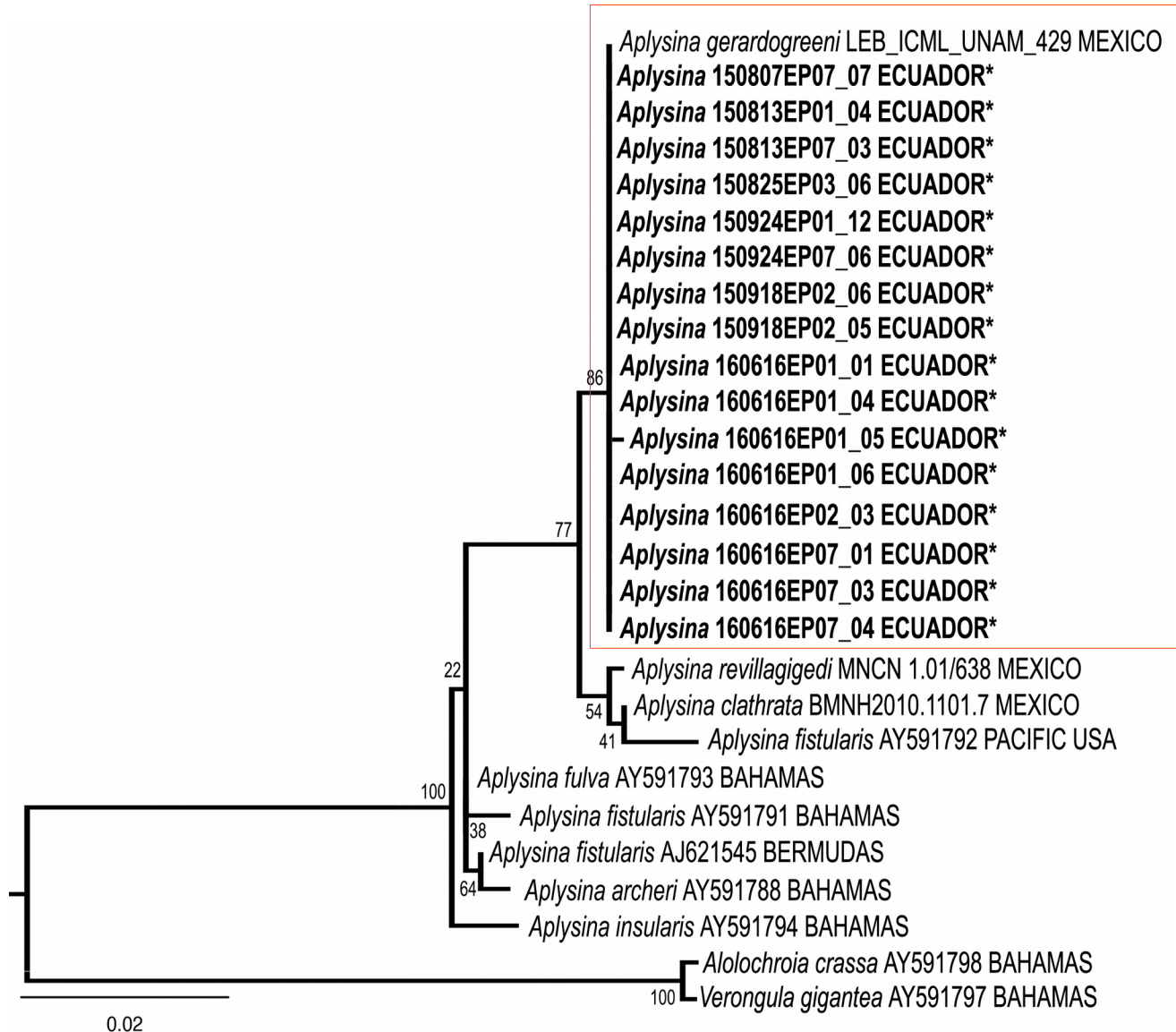
Cortes transversales: ectosoma y coanosoma



Esqueleto anastomosado y dendrítico?

Descripción original?

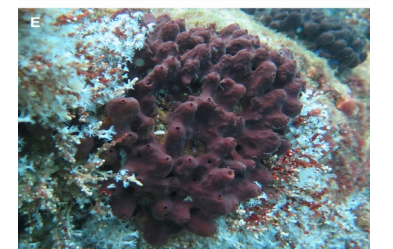
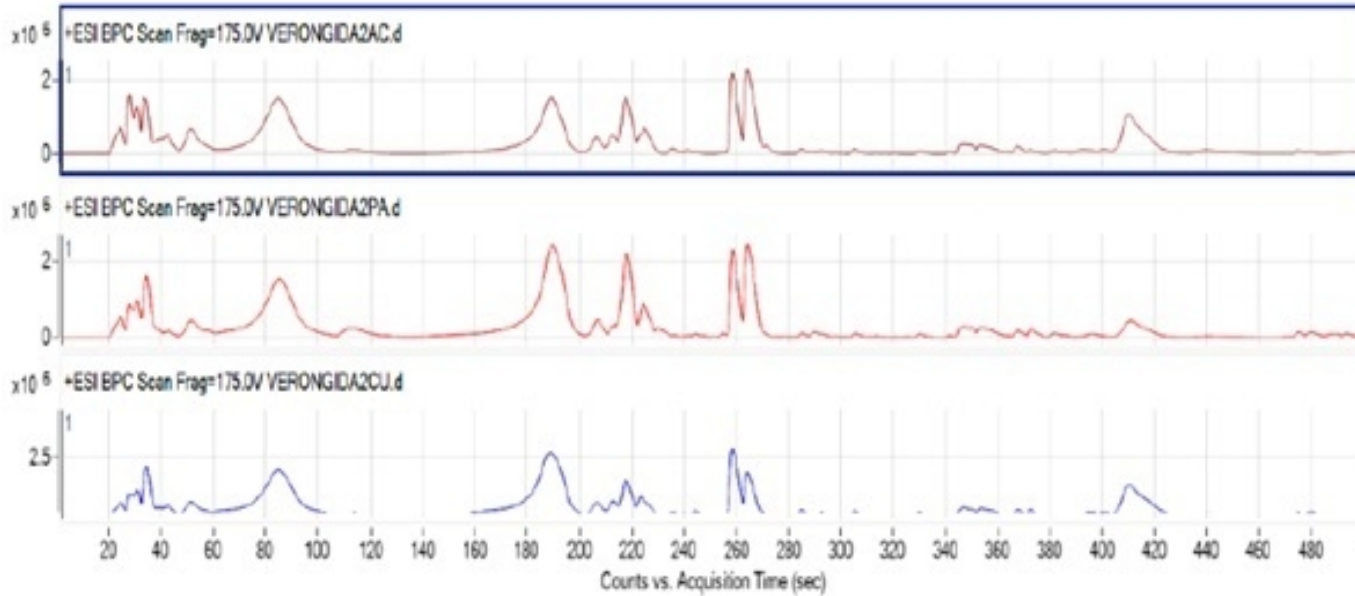
# Análisis genético



Máxima Verosimilitud, TN92, 1000 pseudorélicas.

Marcador ITS

# Análisis metabolómico

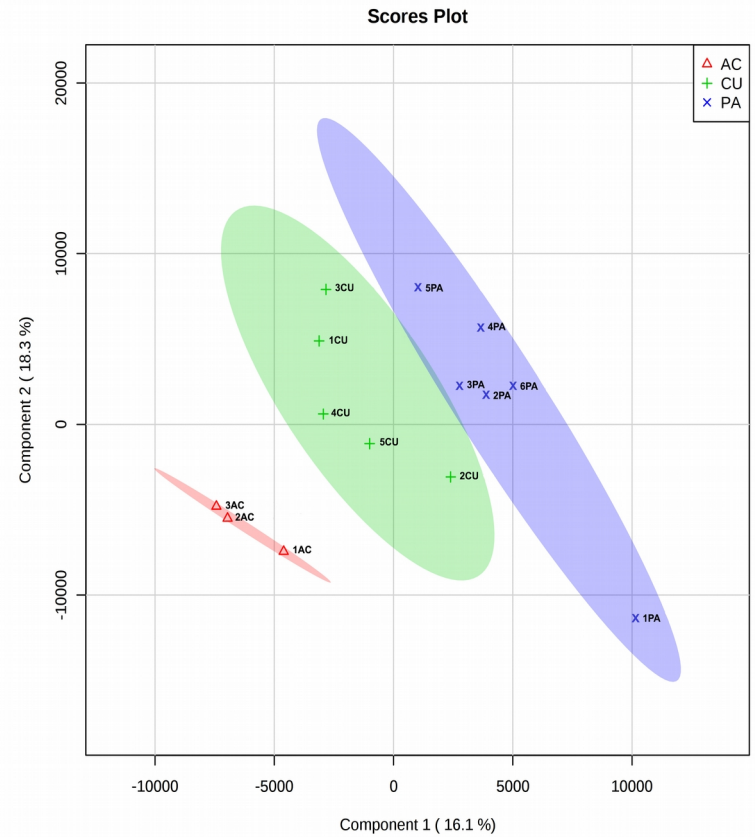
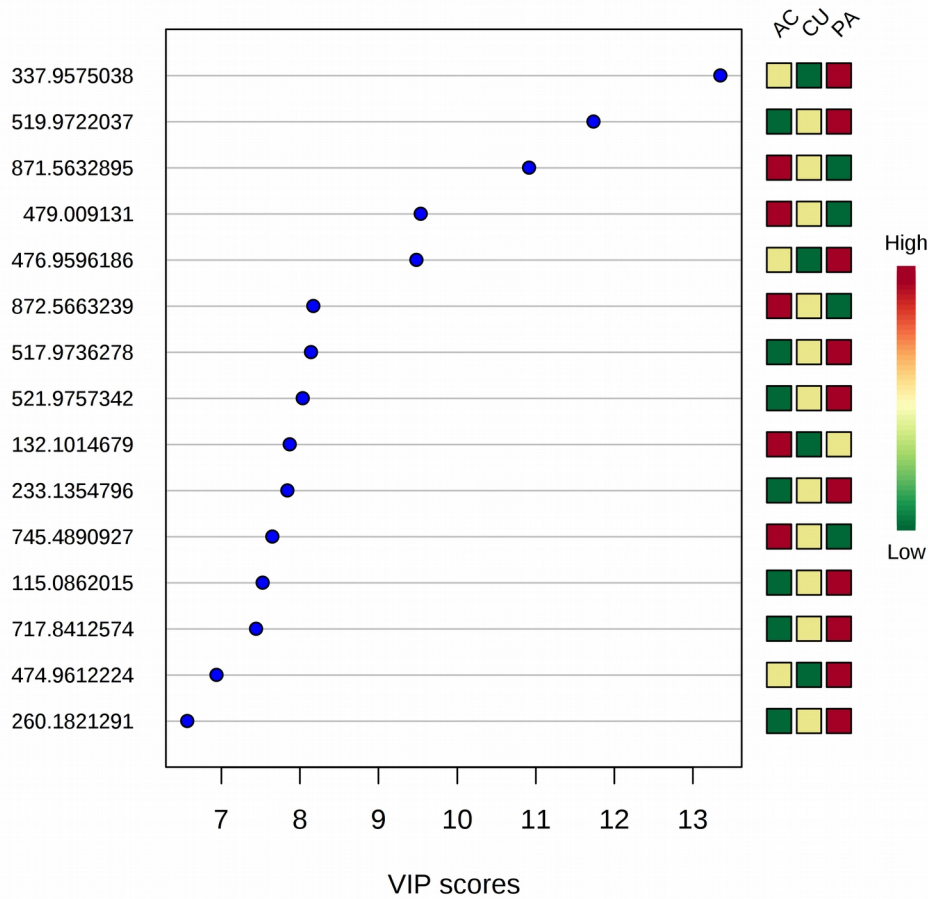


Extracción con MeOH/CH<sub>2</sub>Cl<sub>2</sub> 1:1

Análisis UHPLC–HRMS

Análisis de Componentes Principales – localidades

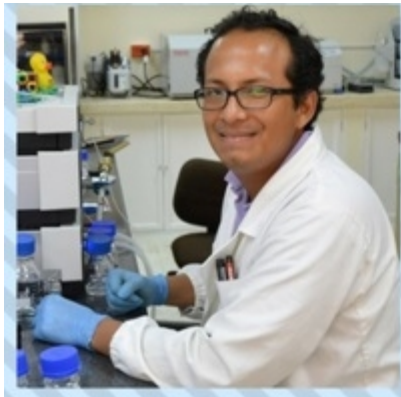
# Análisis metabólico





# Conclusión

- Rediagnosis *A. gerardogreeni*: esqueleto y morfotipos de colores.
- Ampliación de distribución geográfica de *A. gerardogreeni*.
- Validación de metabolómica como herramienta para taxonomía de *Aplysina*.



**Gracias por su atención**

