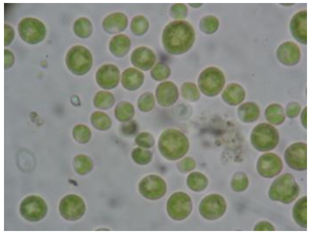
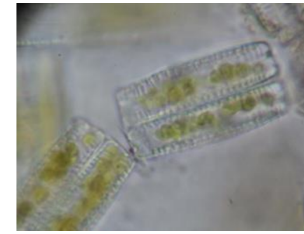


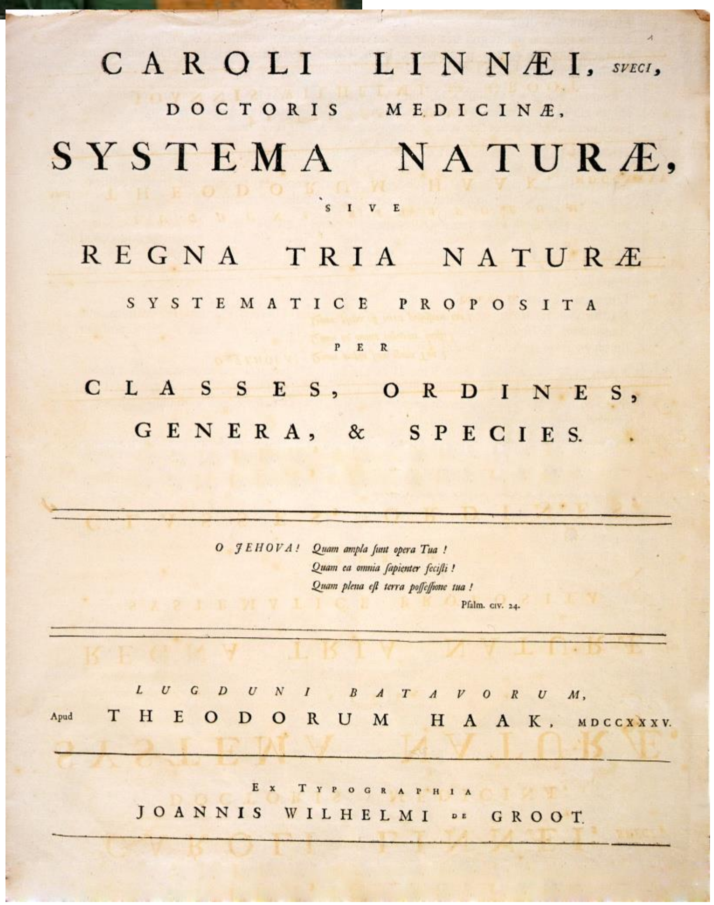






Clasificación de la diversidad biológica: Sistemática y taxonomía

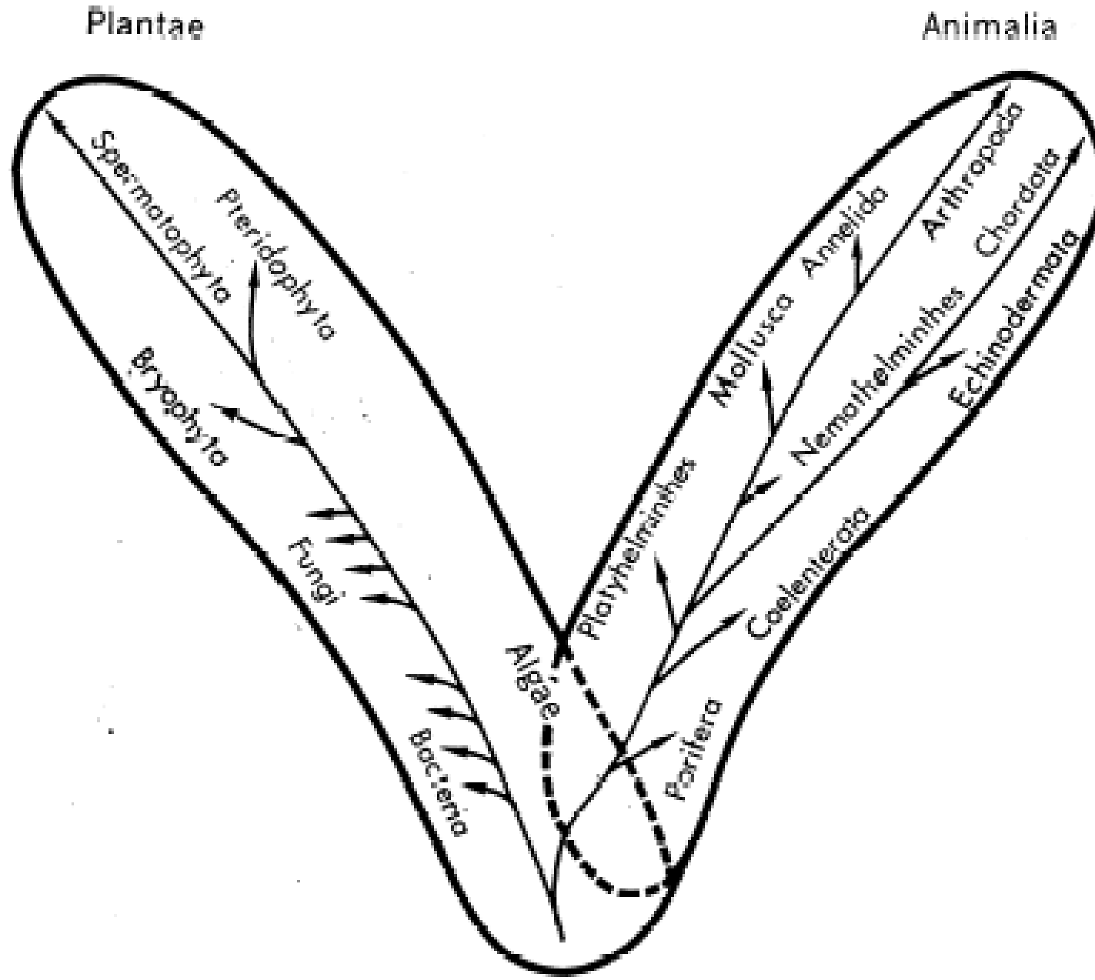
‘***Sistemática*** *es el estudio científico de las clases y la diversidad de los organismos y de sus interrelaciones; comprende la* ***clasificación****, la* ***taxonomía*** *y la* ***determinación***’ (Crisci & Lopez Armengol 1983)



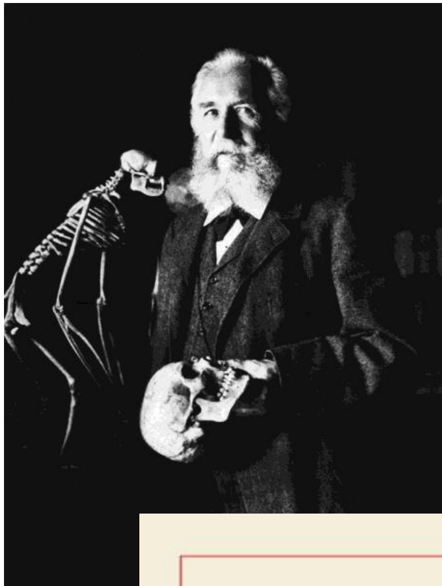
CAROLI LINNÆI, SVECI,
DOCTORIS MEDICINÆ,
SYSTEMA NATURÆ,
SIVE
REGNA TRIA NATURÆ
SYSTEMATICE PROPOSITA
PER
CLASSES, ORDINES,
GENERA, & SPECIES.

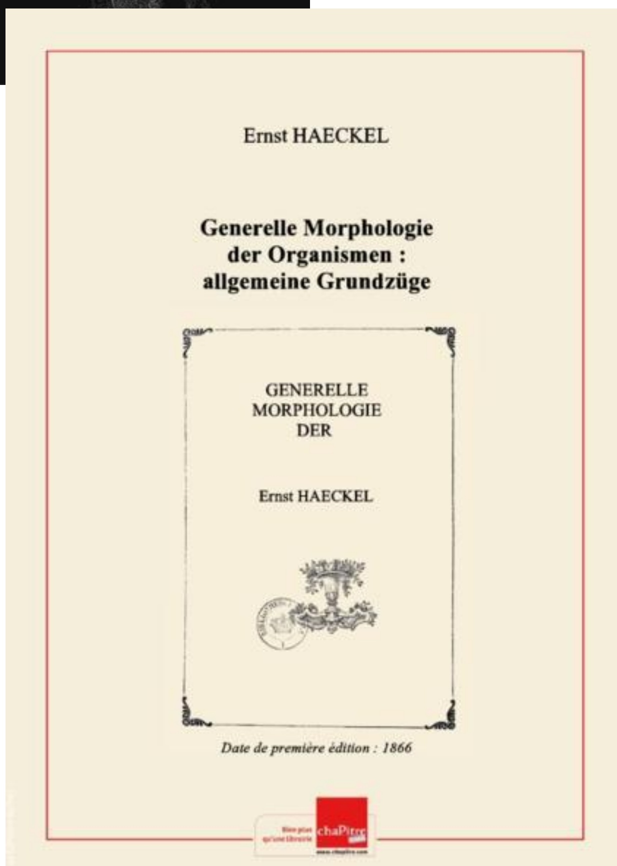
O JEHOVA! Quam ampla sunt opera Tua!
Quam ea omnia sapienter fecisti!
Quam plena est terra possessione tua!
Psalm. civ. 24.

LUGDUNI BATAVORUM,
Apud THEODORUM HAAK. MDCCXXXV.
Ex Typographia
JOANNIS WILHELMI DE GROOT.



Carl von Linneo, 1735





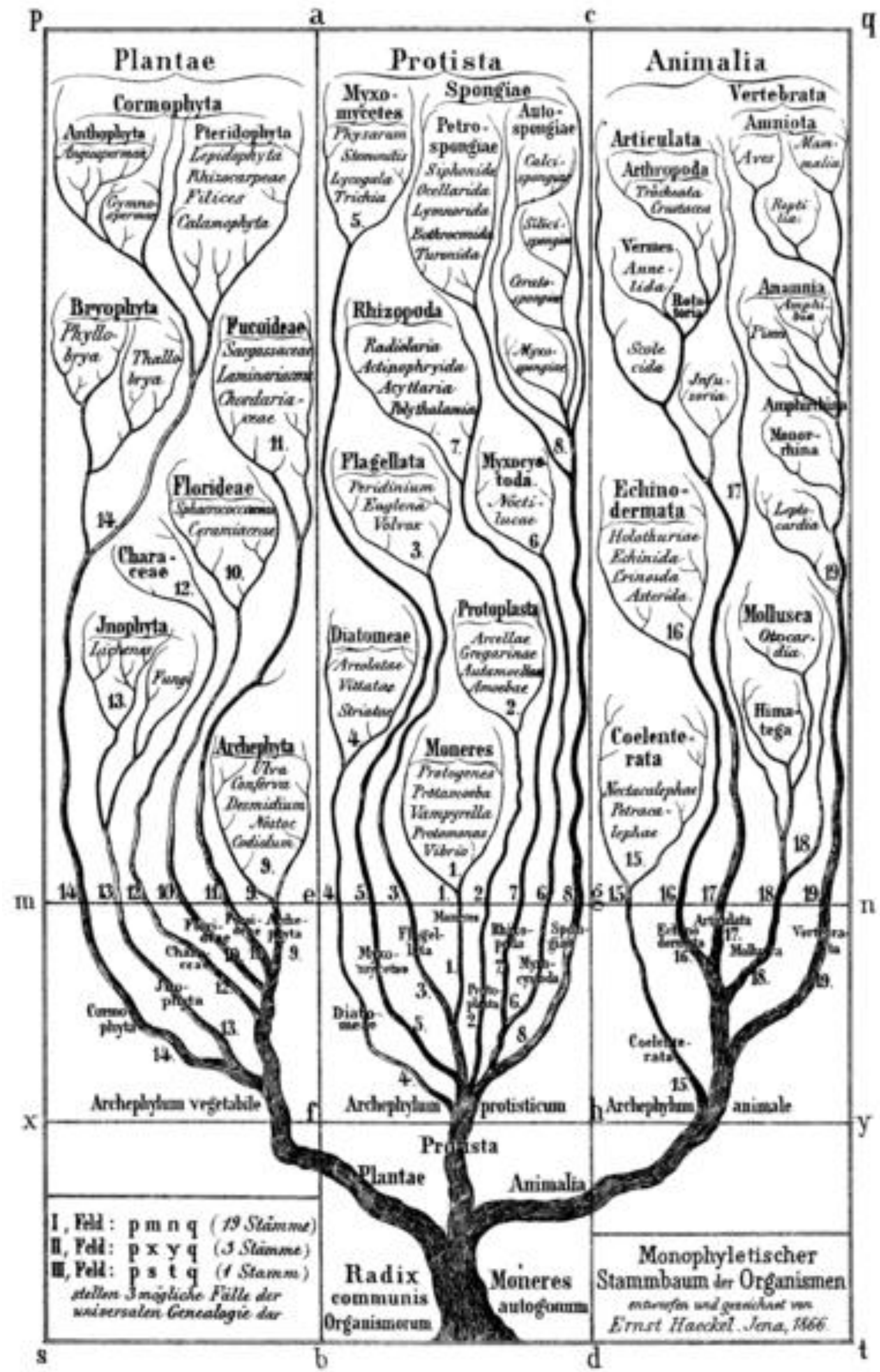
Ernst HAECKEL

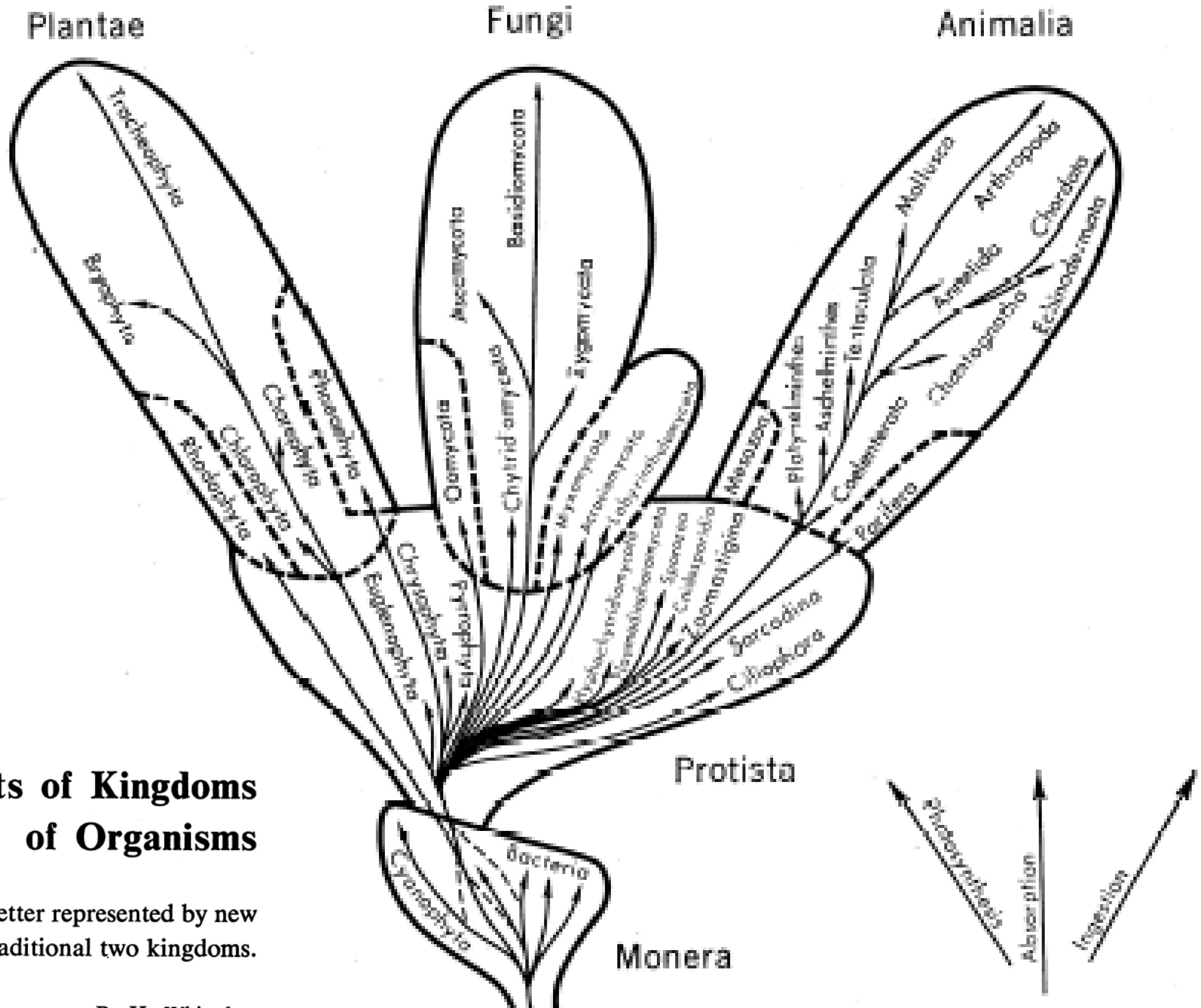
Generelle Morphologie der Organismen : allgemeine Grundzüge

GENERELLE
MORPHOLOGIE
DER

Ernst HAECKEL

Date de première édition : 1866

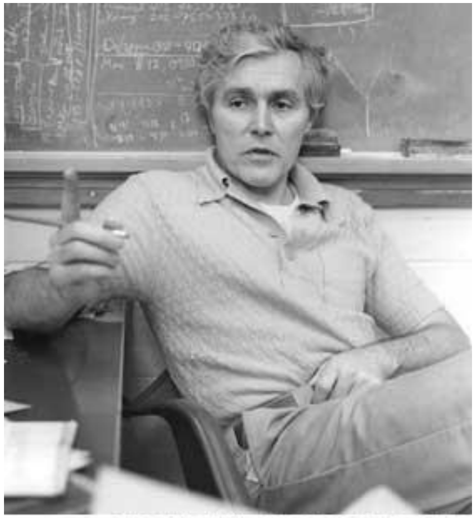




New Concepts of Kingdoms of Organisms

Evolutionary relations are better represented by new classifications than by the traditional two kingdoms.

R. H. Whittaker



NARA/U. of Illinois 306-PS-E-77—5743

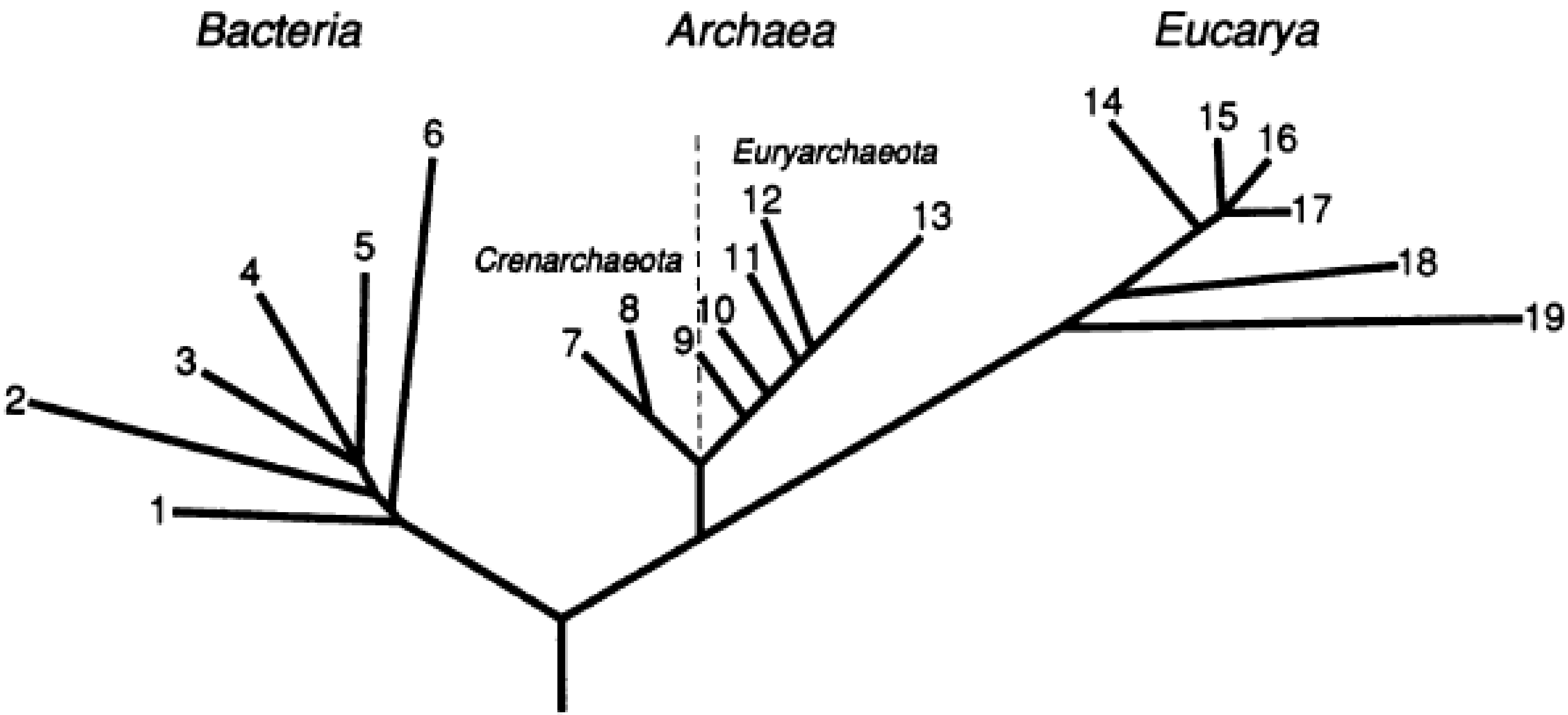
Proc. Natl. Acad. Sci. USA
Vol. 87, pp. 4576–4579, June 1990
Evolution

Towards a natural system of organisms: Proposal for the domains Archaea, Bacteria, and Eucarya

(Euryarchaeota/Crenarchaeota/kingdom/evolution)

CARL R. WOESE*†, OTTO KANDLER‡, AND MARK L. WHEELIS§

*Department of Microbiology, University of Illinois, 131 Burrill Hall, Urbana, IL 61801; ‡Botanisches Institut der Universität München, Menzinger Strasse 67, 8000 Munich 19, Federal Republic of Germany; and §Department of Microbiology, University of California, Davis, CA 95616



Sina Adl

Alastair Simpson

Cristopher Lane

Julius Lukeš

y 21 autores más

The Journal of
Eukaryotic Microbiology

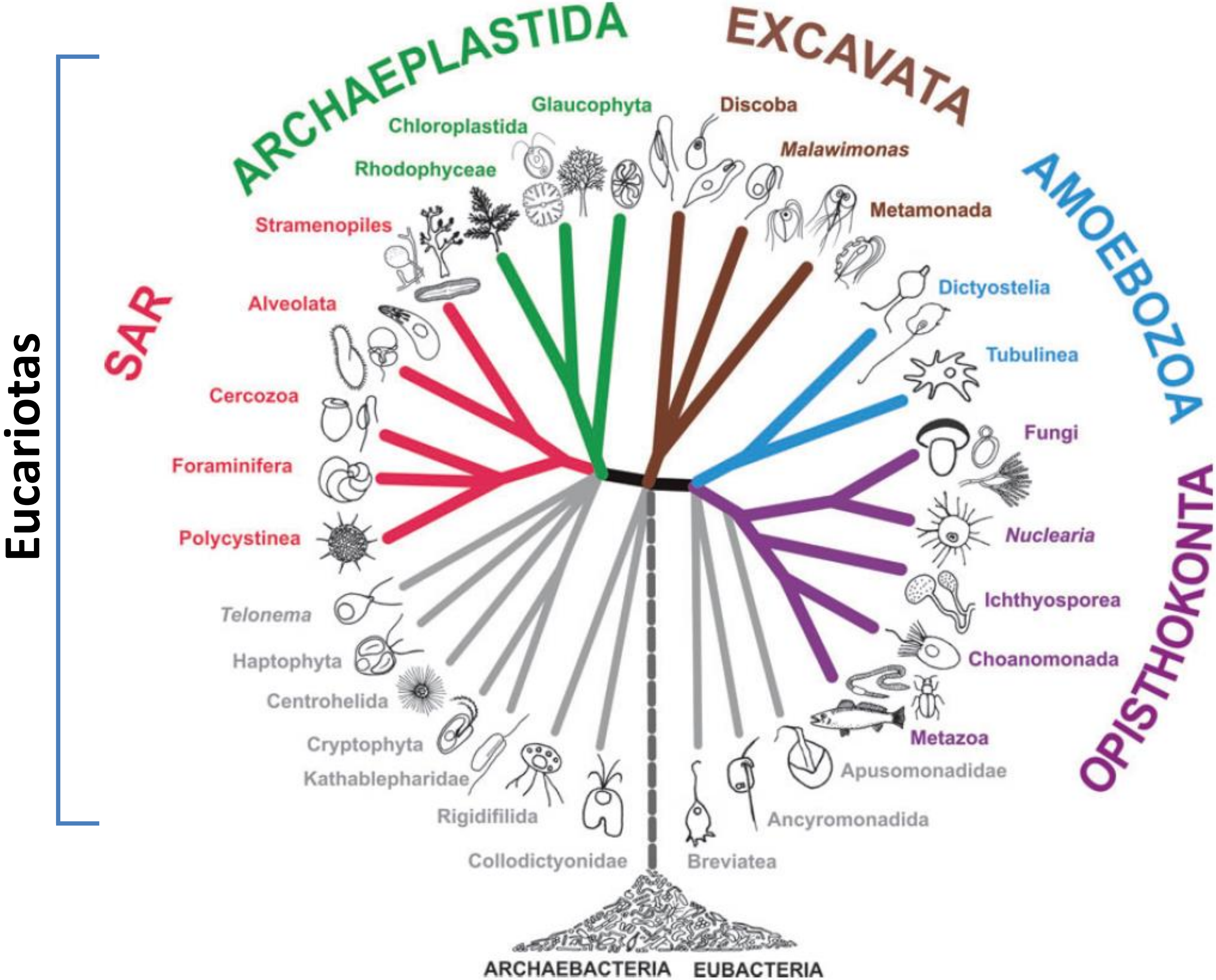
Published by the International Society of Protistologists

J. Eukaryot. Microbiol., 59(5), 2012 pp. 429–493

DOI: 10.1111/j.1550-7408.2012.00644.x

The Revised Classification of Eukaryotes

SINA M. ADL,[a,b] ALASTAIR G. B. SIMPSON,[b] CHRISTOPHER E. LANE,[c] JULIUS LUKEŠ,[d] DAVID BASS,[e] SAMUEL S. BOWSER,[f] MATTHEW W. BROWN,[g] FABIEN BURKI,[h] MICAH DUNTHORN,[i] VLADIMIR HAMPL,[j] AARON HEISS,[b] MONA HOPPENRATH,[k] ENRIQUE LARA,[l] LINE LE GALL,[m] DENIS H. LYNN,[n,1] HILARY MCMANUS,[o] EDWARD A. D. MITCHELL,[l] SHARON E. MOZLEY-STANRIDGE,[p] LAURA W. PARFREY,[q] JAN PAWLOWSKI,[r] SONJA RUECKERT,[s] LAURA SHADWICK,[t] CONRAD L. SCHOCH,[u] ALEXEY SMIRNOV[v] and FREDERICK W. SPIEGEL[t]

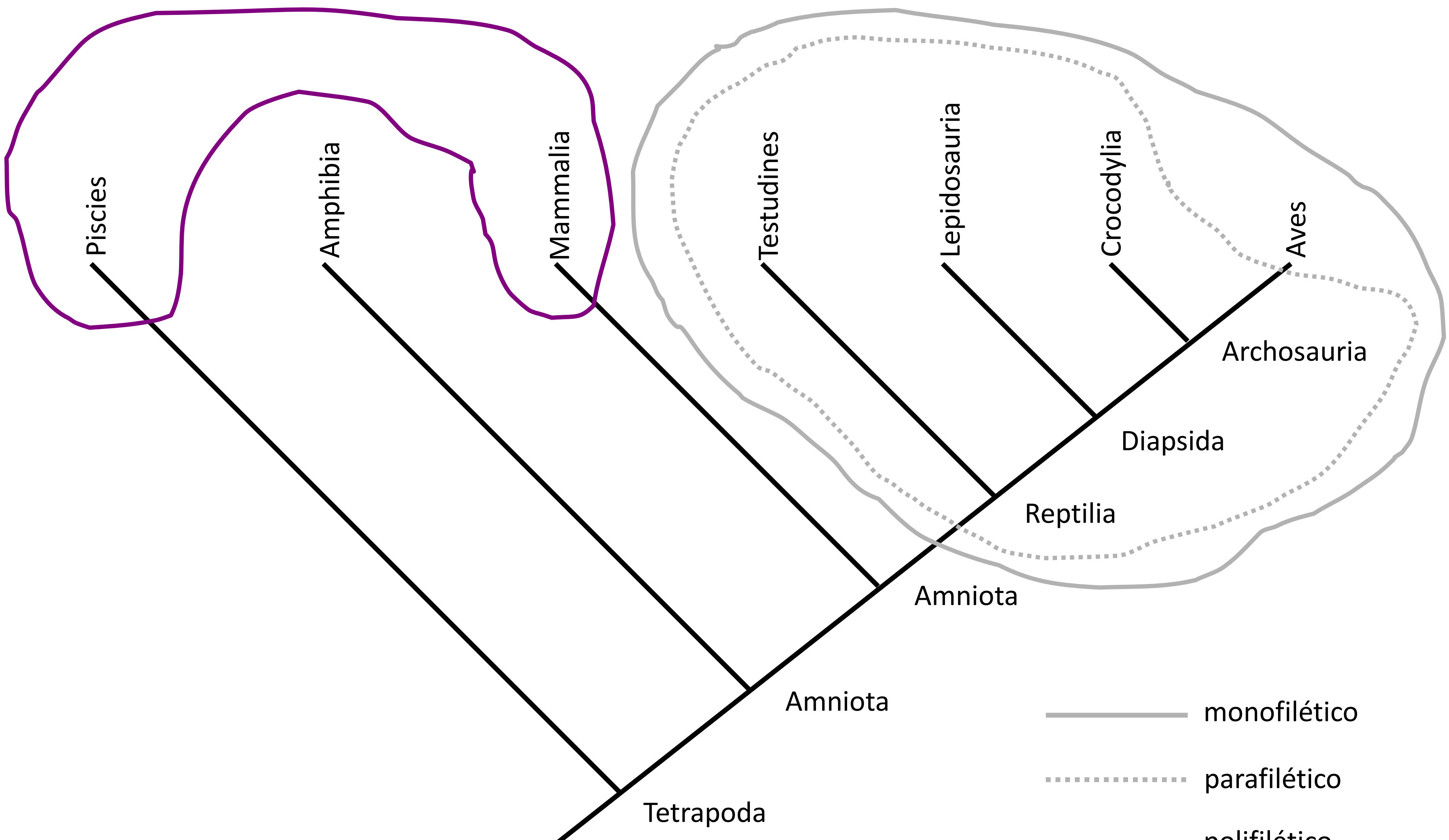

Eucariotas
ARCHAEPLASTIDA
EXCAVATA
AMOEBOZOA
OPISTHOKONTA
SAR
Glaucophyta
Chloroplastida
Rhodophyceae
Discoba
Malawimonas
Metamonada
Stramenopiles
Alveolata
Cercozoa
Foraminifera
Polycystinea
Dictyostelia
Tubulinea
Fungi
Nuclearia
Ichthyosporea
Choanomonada
Metazoa
Telonema
Haptophyta
Centrohelida
Cryptophyta
Kathablepharidae
Rigidifilida
Collodictyonidae
Breviatea
Ancyromonadida
Apusomonadidae
ARCHAEBACTERIA
EUBACTERIA

¿Porqué cambian los sistemas de clasificación?

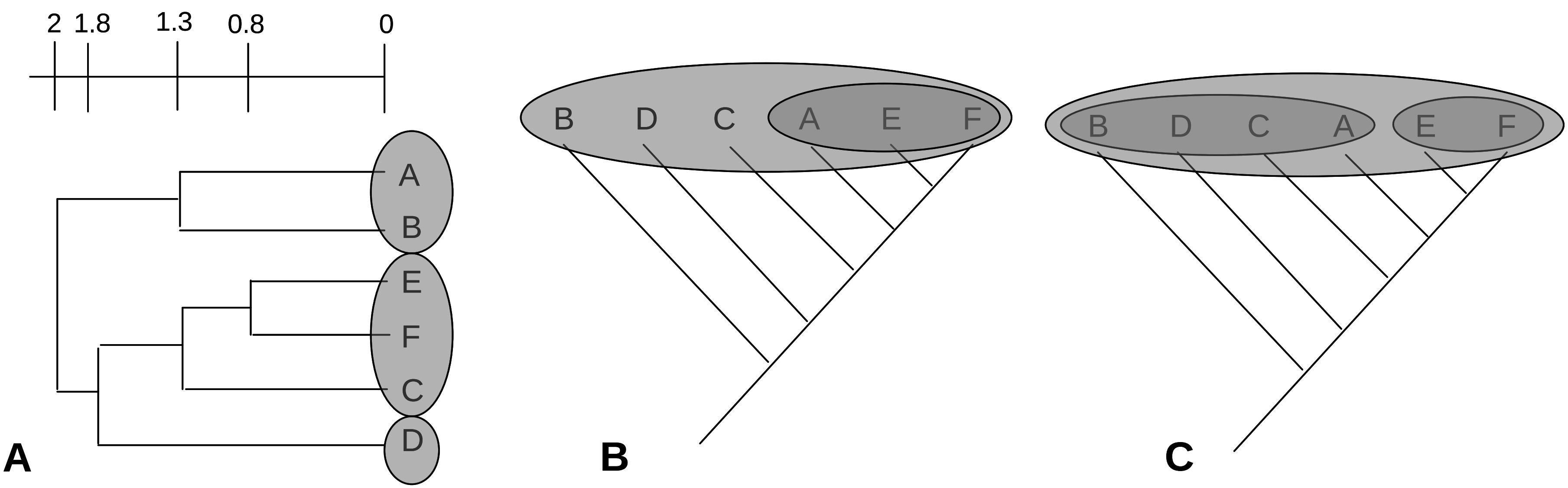
1. Los fundamentos del sistema -distintas escuelas-

2. Las herramientas utilizadas

Algunos conceptos básicos en la sistemática biológica



Escuelas



Fenética

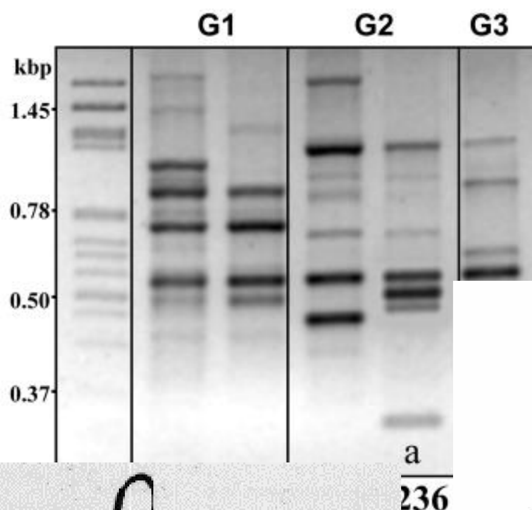
Filogenética o cladística

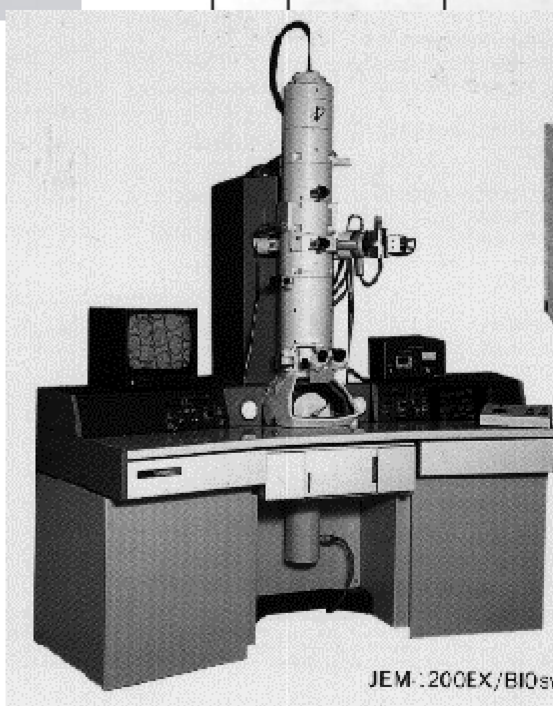
Evolutiva

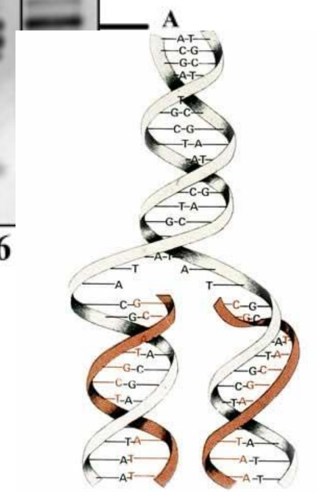
Herramientas

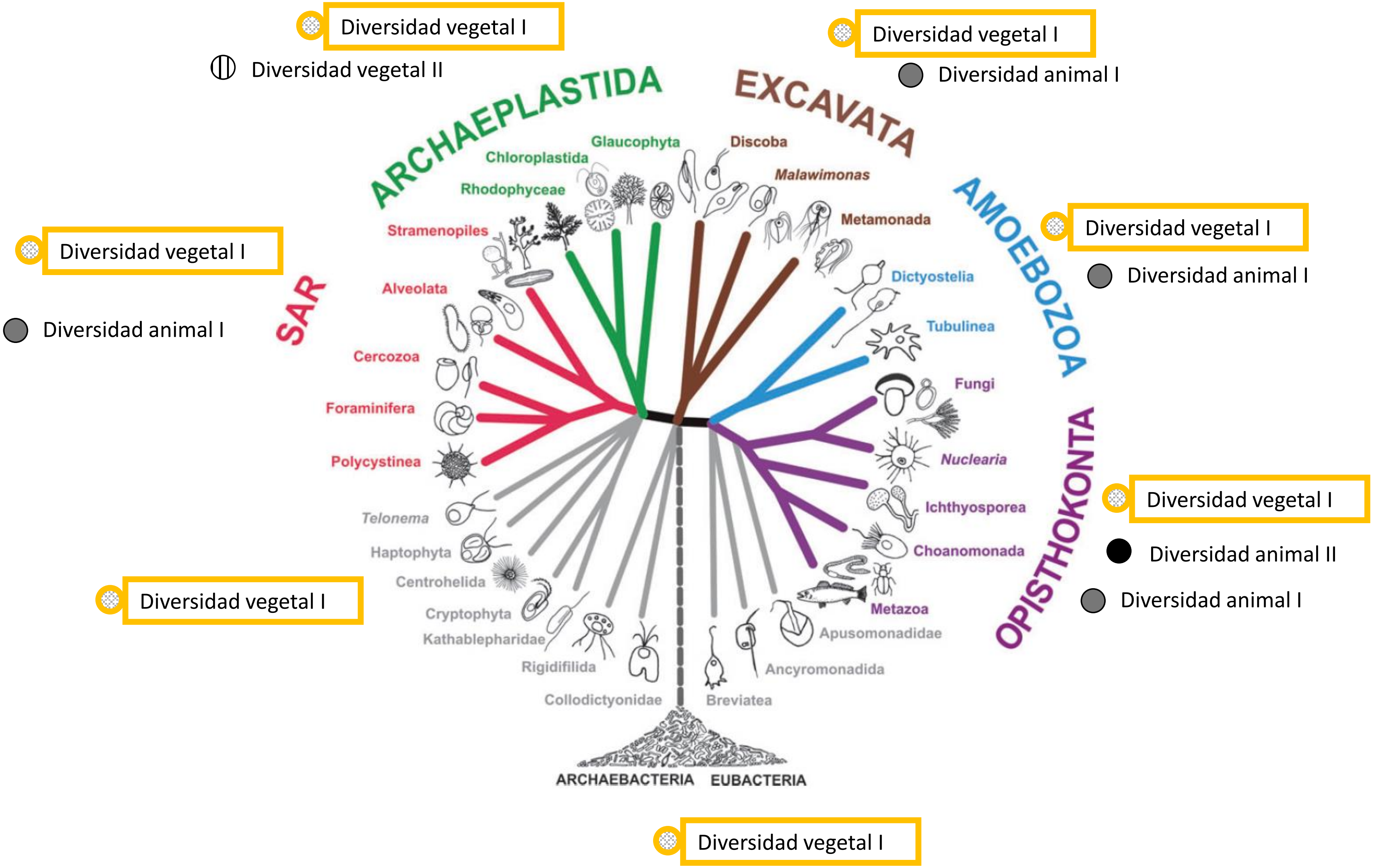
-Morfoanatomía
-Citología
-Metabolismo
-Ácidos nucleicos

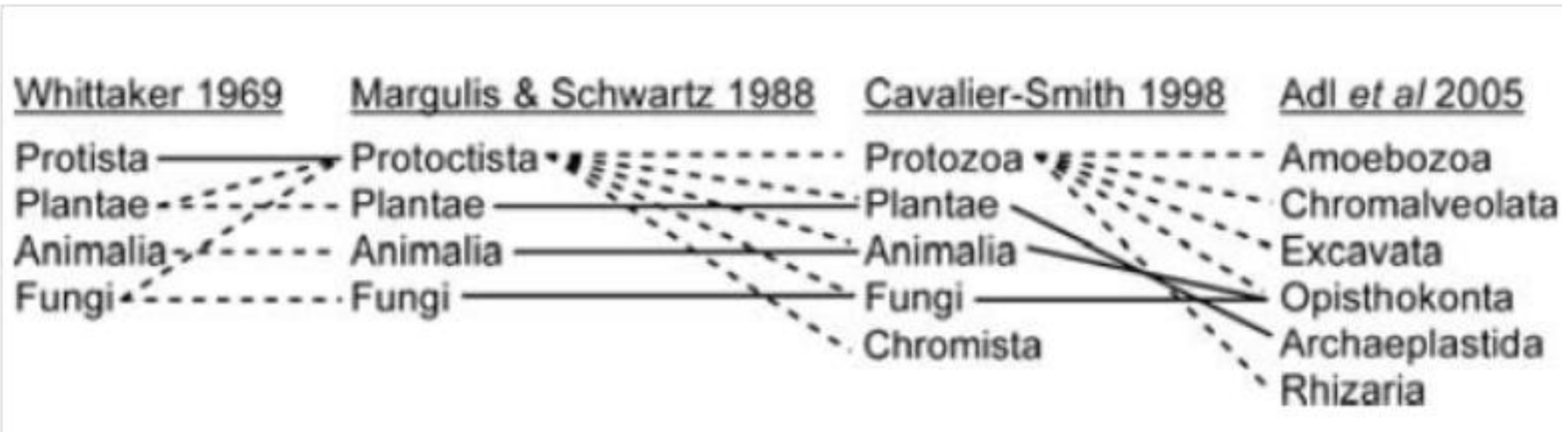
Herramientas








Diversidad vegetal I
Diversidad vegetal II
Diversidad vegetal I
Diversidad animal I
Diversidad vegetal I
Diversidad animal I
Diversidad vegetal I
Diversidad animal I
Diversidad vegetal I
Diversidad animal II
Diversidad animal I
Diversidad vegetal I
Diversidad vegetal I
ARCHAEPLASTIDA
EXCAVATA
AMOEBOZOA
OPISTHOKONTA
SAR
Glaucophyta
Chloroplastida
Rhodophyceae
Stramenopiles
Alveolata
Cercozoa
Foraminifera
Polycystinea
Telonema
Haptophyta
Centrohelida
Cryptophyta
Kathablepharidae
Rigidifilida
Collodictyonidae
Discoba
Malawimonas
Metamonada
Dictyostelia
Tubulinea
Fungi
Nuclearia
Ichthyosporea
Choanomonada
Metazoa
Apusomonadidae
Ancyromonadida
Breviatea
ARCHAEBACTERIA
EUBACTERIA


Whittaker 1969
Margulis & Schwartz 1988
Cavalier-Smith 1998
Adl et al 2005
Protista
Plantae
Animalia
Fungi
Protoctista
Plantae
Animalia
Fungi
Protozoa
Plantae
Animalia
Fungi
Chromista
Amoebozoa
Chromalveolata
Excavata
Opisthokonta
Archaeplastida
Rhizaria

Rangos taxonómicos tradicionales

-Reino

-Phylum	- División
-mycota	*-phyta*

-Clase

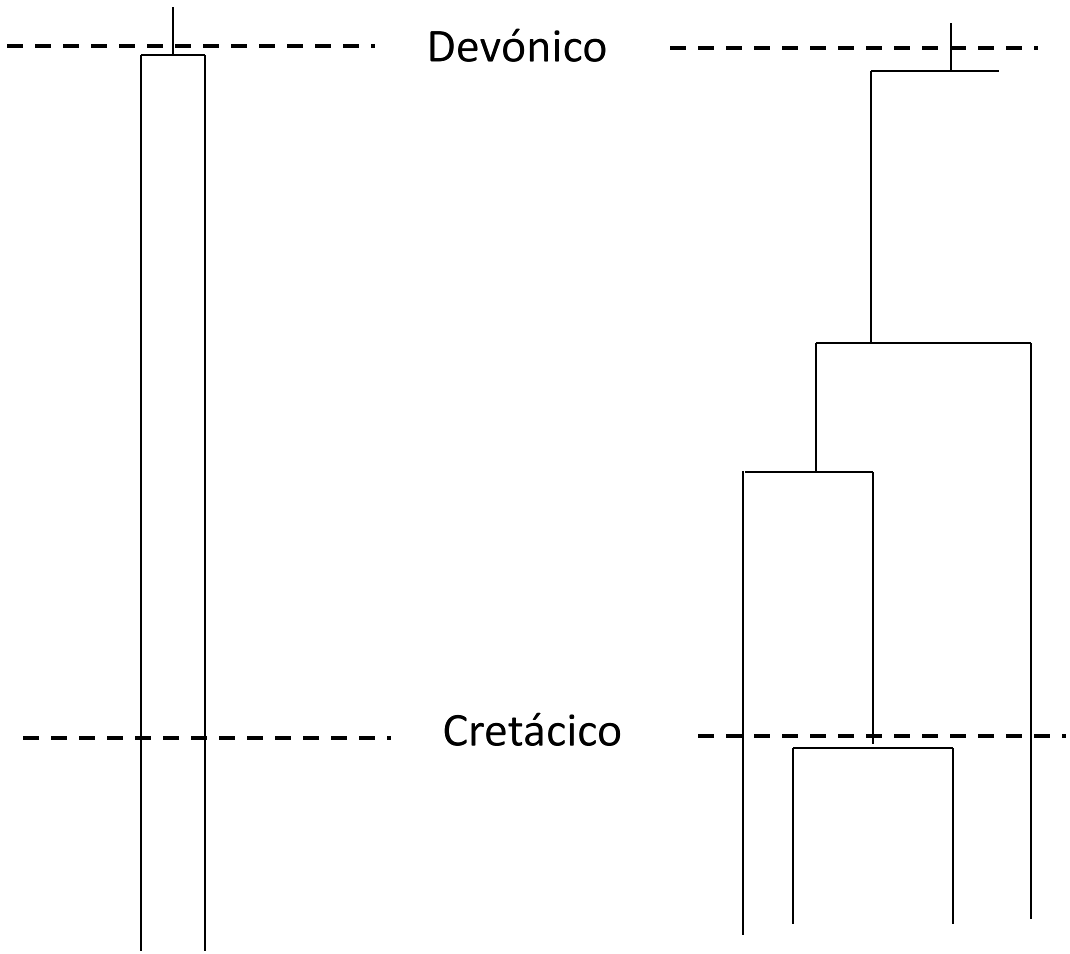
-mycetes	*-phyceae*

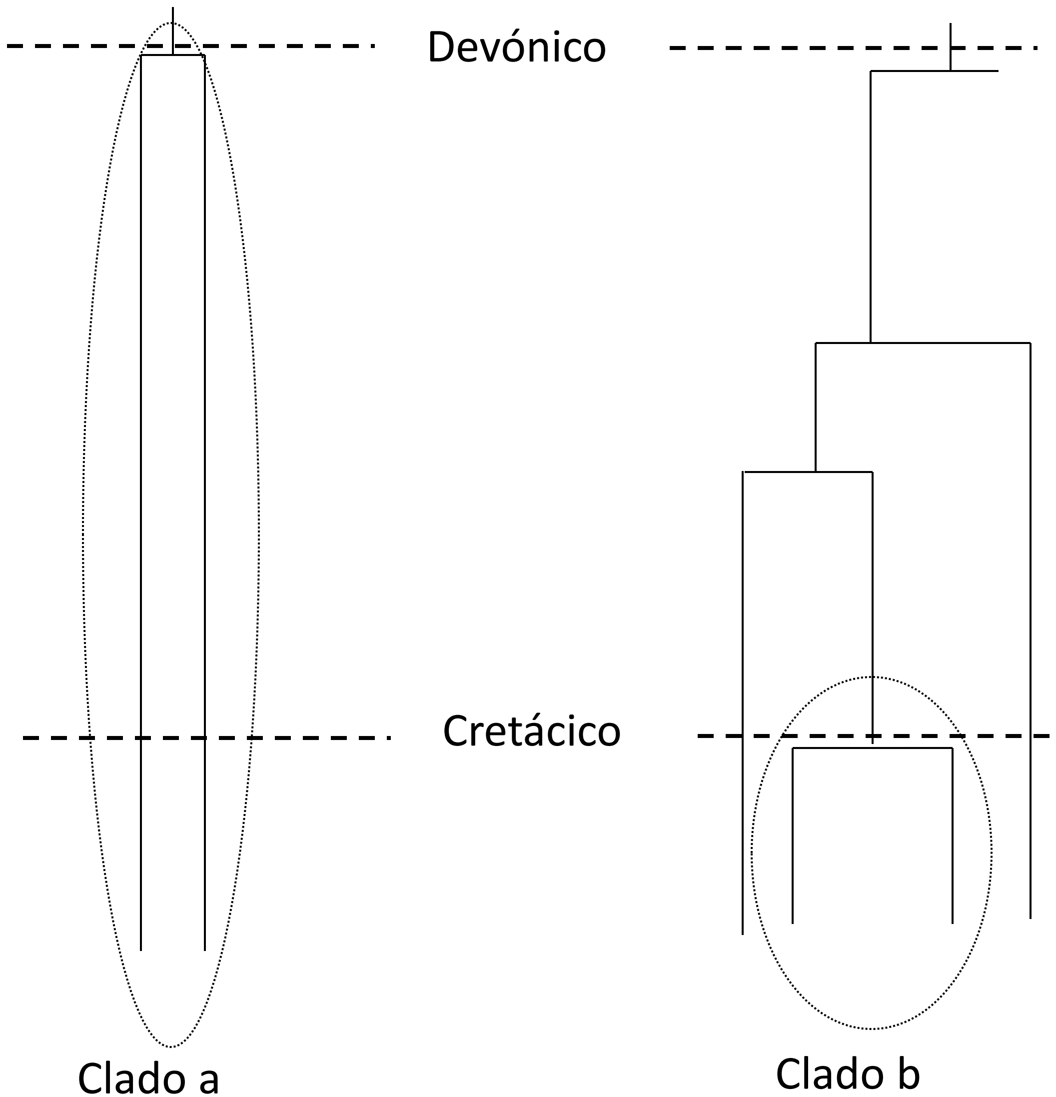
-Orden
-ales

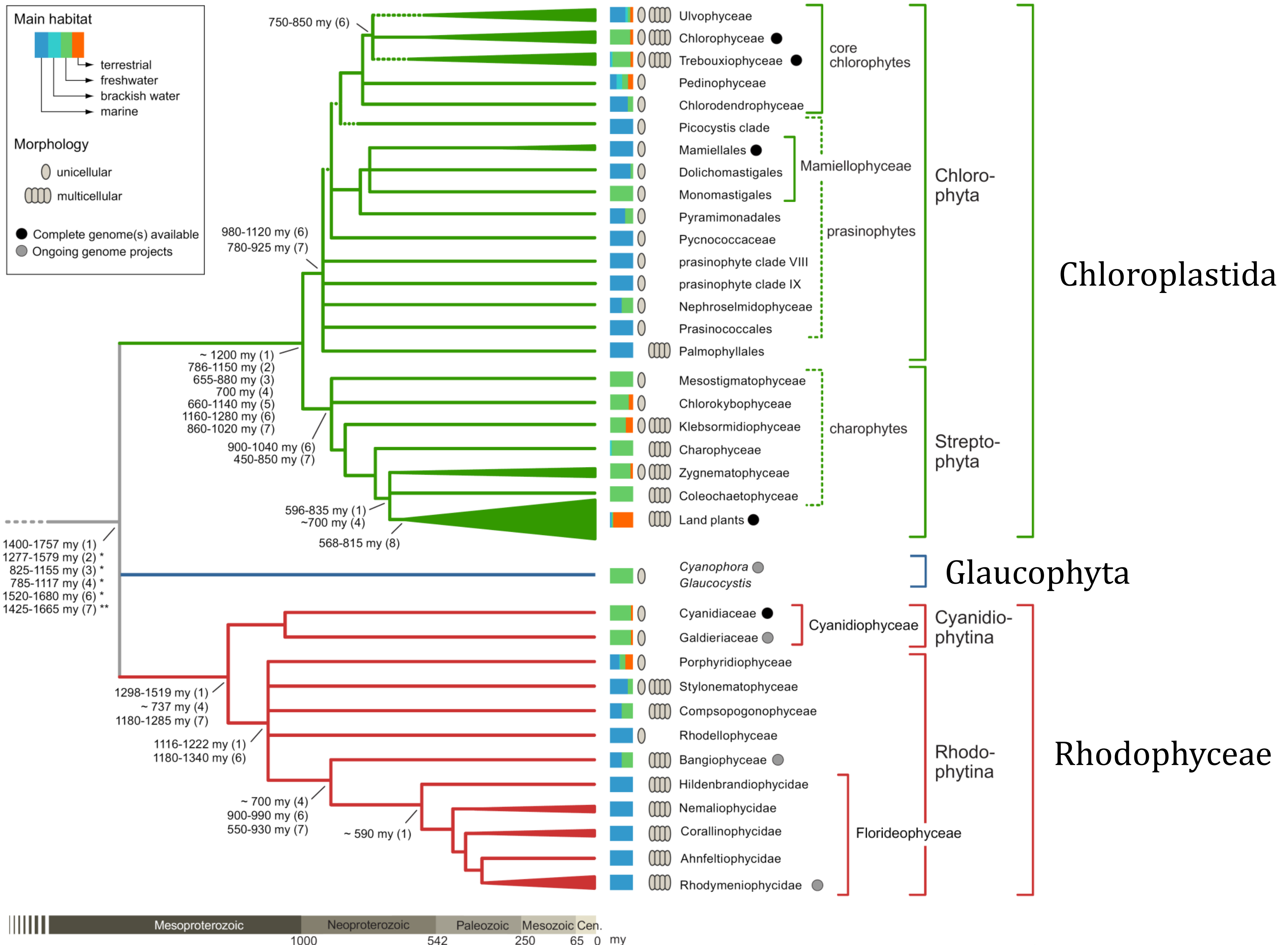
-Familia
-aceae

-Género

Artificial - Cambios en cascada


Devónico
Cretácico


Devónico
Cretácico
Clado a
Clado b



Modificado de De Clerck et al. 2012

Table **1.** The classification of eukaryotes at the highest ranks.

		Super-groups	Examples
Eukaryota	Amorphea	Amoebozoa	Tubulinea Mycetozoa
		Opisthokonta	Fungi Choanomonada Metazoa
			Apusomonada
			Breviata
		Excavata	Metamonada Malawimonas Discoba
	Diaphoretickes		Cryptophyceae
			Centrohelida
			Telonemia
			Haptophyta
		Sar	Cercozoa Foraminifera "Radiolaria"
			Alveolata Stramenopiles
		Archaeplastida	Glaucophyta Rhodophyceae Chloroplastida
	Incertae sedis Eukaryota		Incertae sedis, and table 3

Adl et al 2012

•• Charophyta Migula 1897, emend. Karol et al. 2009 [Charophyceae Smith 1938, Mattox & Stewart 1984]
Asymmetric motile cells, when present, with pair of cilia without mastigonemes; basal bodies with distinctive multilayered structure of microtubular rootlet and cytoskeletal anchor; thylakoids stacked; plastid with two membranes without periplastid endoplasmic reticulum; starch inside plastid; open mitosis; usually with phycoplast, but some with phragmoplast and cell plate; with primary plasmodesmata between adjacent cells in filamentous forms; filaments branching or nonbranching; with nonmotile vegetative phase; some with multinucleate cells; with or without sexual reproduction; sexual species with haplobiontic life cycle; with desiccation-resistant cysts (zygospores); glycolate oxidase in peroxisomes; Cu/Zn superoxide dismutase; ciliary peroxisome.

••• *Chlorokybus* Geitler 1942 [Chlorokybophyceae Lewis & McCourt 2004] (M)
Sarcinoid packets of cells; subaerial; biciliated zoospores; cilia with hairs; multi-layered structure (MLS) at ciliary root. *Chlorokybus atmophyticus*.

••• *Mesostigma* Lauterborn 1894 [Mesostigmatophyceae Marin & Melkonian 1999, emend. Lewis & McCourt 2004; Mesostigmata Turmel et al. 2002] (M)
Asymmetrical cell with pair of lateral cilia without mastigonemes, emerging from a pit; basal body transition region with similarity to Streptophyta multilayered structure anchor associated with basal body; with chlorophylls *a* and *b*; plastid with two membranes without periplastid endoplasmic reticulum; starch inside plastid; with glycolate oxidase; flagellar peroxisome present; cell wall of cellulose; organic scales cover cell wall and flagella. *Mesostigma viride*.

••• Klebsormidiophyceae van den Hoek et al. 1995
Coccoid or unbranched filaments; one or two chloroplasts with one pyrenoid; most chloroplasts parietal; cleavage furrow during cell division but no cell plate or phragmoplast; sexual reproduction unknown. *Entransia, Interfilum, Klebsormidium*.

••• Phragmoplastophyta Lecointre & Guyander 2006
Cell division by way of some form of phragmoplast; some oogamous, others anisogamous with nonmotile female gamete and motile male gamete.

•••• Zygnematophyceae van den Hoek et al. 1995, emend. Hall et al. 2009
Without ciliated stages; sexual reproduction via conjugation; thalli unicellular or filamentous; no centrioles. *Spirogyra, Staurastrum*.

•••• Coleochaetophyceae Jeffrey 1982
Thalli discs of cells or branched filaments; sheathed hairs as extensions of the cell wall. *Coleochaete, Chaetosphaeridium*.

•••• Streptophyta Jeffrey 1967
Twisted or spiralled ciliated motile cells.

••••• Charophyceae Smith 1938, emend. Karol et al. 2009 [Charales Lindley 1836; Charophytae Engler 1887]
Thallus attached to substrate with rhizoids; thallus a central axis of multinucleate internodal cells, with whorls of branchlets radiating from mononucleate cells at nodes; calcium carbonate accumulates in cell wall of many species; haplobiontic life cycle; sexual reproduction oogamous with sperm cells; differentiated sperm and egg producing organs; antheridium with several shield cells and a manubrium that gives rise to spermatogenous filaments. *Chara*, *Nitella*, *Tolypella*.

••••• Embryophyta Engler 1886, emend. Lewis & McCourt 2004 [Cormophyta Endlicher 1836; Plantae Haeckel 1866]
Ciliated basal bodies, when present, with distinctive multilayered structure of microtubules and cytoskeletal anchor; open mitosis with phragmoplast at cytokinesis; plasmodesmata and other characteristic cell-cell junctions; diplobiontic life cycle, with vegetative propagation possible in many; alternation of generations,

Adl et al 2012

¿Qué es una especie?

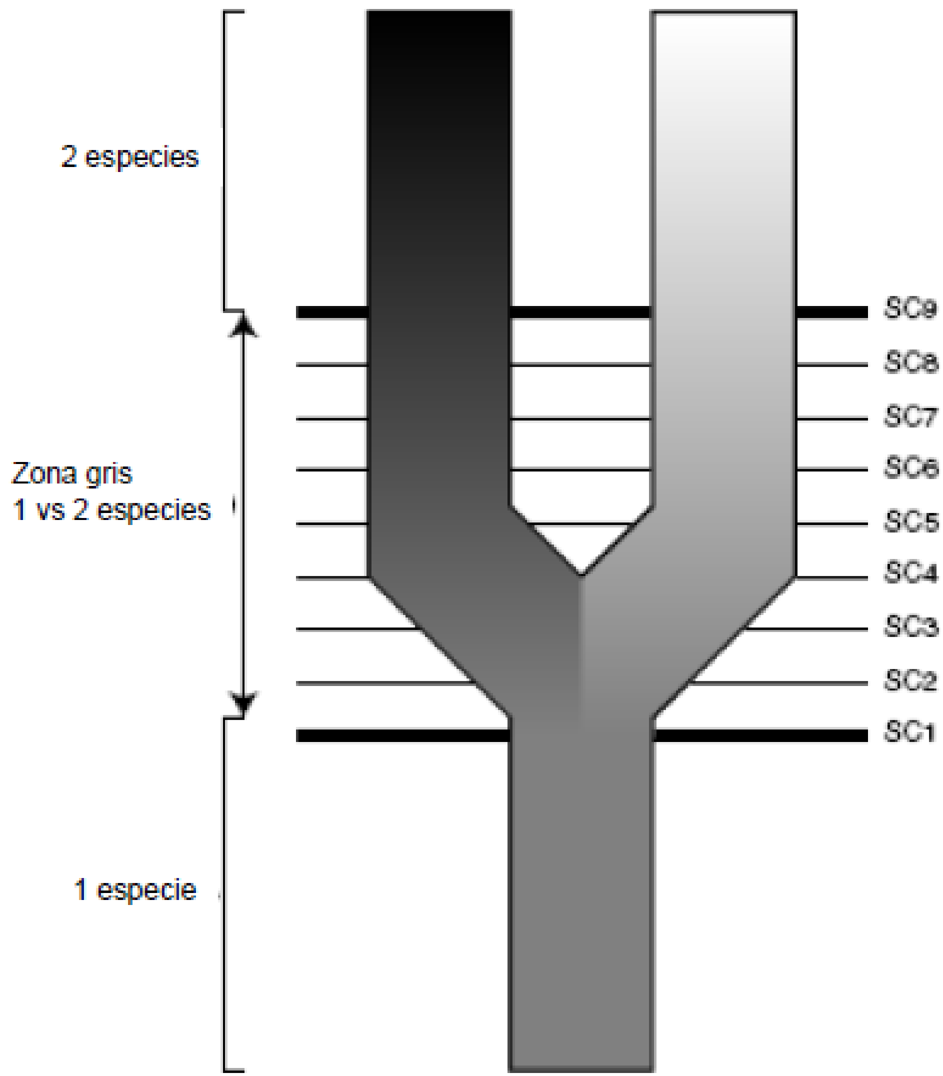
Especie. (Del lat. species). Bot. y Zool. Cada uno de los grupos en que se dividen los géneros y que se componen de individuos que, además de los caracteres genéricos, tienen en común otros caracteres por los cuales se asemejan entre sí y se distinguen de los de las demás especies. La especie se subdivide a veces en variedades o razas.

(Diccionario de la Real Academia Española)

¿Qué es una especie?

‘Son linajes metapoblacionales que evolucionan separadamente, o más específicamente, segmentos de tales linajes’

El término **linaje** se refiere a la **serie ancestro-descendiente** mientras que la **metapoblación** se refiere a la población inclusiva constituida por **subpoblaciones conectadas**. Vale aclarar que aquí especie no es el linaje metapoblacional entero sino un segmento del mismo que las especies dan origen a otras especies formando linajes a escala específica. Cualquier especie dada es uno de los tantos segmentos que constituyen ese linaje a escala específica (De Queiroz 2007).


2 especies
Zona gris
1 vs 2 especies
1 especie
SC9
SC8
SC7
SC6
SC5
SC4
SC3
SC2
SC1

Tenemos un concepto de especie pero distintos criterios de delimitación de acuerdo a los diferentes grupos de organismos biológicos.

¿Cómo se describen (y delimitan) las especies en los distintos grupos biológicos de esta materia?

Nombre genérico Epíteto específico Sigla

Amanita muscaria (L.) Lam.

***Amanita muscaria* (L.) Lam.**, *Encycl. Méth. Bot.* (Paris) **1**(1): 111 (1783)

Basónimo:

Agaricus muscarius L. 1753

Mycologia, 99(6), 2007, pp. 833–841.

Fomitopsis incarnatus sp. nov. based on generic evaluation of *Fomitopsis* and *Rhodofomes*

Kyung Mo Kim
Jin Sung Lee[1]
Hack Sung Jung[2]
Department of Biological Sciences, College of Natural Sciences, Seoul National University, San 56-1 Shillim-9-dong, Kwanak-gu, Seoul 151-747, Korea

Abstract: A new polypore in the genus *Fomitopsis* was discovered in Kangwon Province, Korea. The species was morphologically similar to *Fomitopsis rosea* and *F. cajanderi*, but the pinkish white pore surface, the size and shape of the pores and the number of sterigmata were different enough for it to be distinguished from the recorded species of *Fomitopsis*. Based on the results of morphological and phylogenetic analyses, this new polypore is proposed as *Fomitopsis incarnatus* sp. nov.

Key words: *Fomitopsis cajanderi*, *Fomitopsis rosea*, internal transcribed spacer, mitochondrial small subunit rDNA, phylogeny, second largest subunit of RNA polymerase II

INTRODUCTION

Fomitopsis P. Karst. is a cosmopolitan genus (Polyporaceae, Aphyllophorales, Hymenomycetes, Basidiomycota), and most of its species occur in boreal and temperate zones (Ryvarden 1991, Ryvarden and Gilbertson 1993). The generic concept of *Fomitopsis* has been controversial among mycologists (Carranza-Morse and Gilbertson 1986, Kotlaba and Pouzar 1990, Ryvarden 1991, Ryvarden and Gilbertson 1993, Kotlaba and Pouzar 1998). Kotlaba and Pouzar (1990, 1998) suggested a narrow generic concept for *Fomitopsis*, emphasizing the wall thickness of basidiospores. *Fomitopsis pinicola* (Sw.) P. Karst. (the type species of *Fomitopsis*) has thick-walled basidiospores and a resinous substance on the upper surface of basidiocarps, while *F. rosea* is characterized by thin-walled spores, the rose context and the absence of a resinous crust on the pileal surface (Kotlaba and Pouzar 1998). Based on such morphological differences, a monotypic genus, *Rhodofomes* Kotl. & Pouzar typified by *R. roseus* (Alb. & Schwein.) Vlasak (= *F. rosea*), was segregated from *Fomitopsis* into a new genus (Kotlaba and Pouzar 1990). However Ryvarden (1991) and Ryvarden and Gilbertson (1993) argued that the rose-colored context is not of sufficient taxonomic importance to warrant segregation into a new genus.

Many genetic markers recently have been applied to resolve fungal phylogenetic relationships. Internal transcribed spacers of nuclear rDNA (nuclear ITS), the small subunit mitochondrial rDNA (mt-SSU) and the genes encoding the second largest subunit of RNA polymerase II (RPB2) have become especially useful to classify fungal taxa at the species and genus levels (Ko and Jung 1999, 2002, Lim and Jung 2003, Desjardin et al 2004, Hong and Jung 2004, Matheny

RESULTS

Fomitopsis incarnatus K.M. Kim, J.S. Lee & H.S. Jung, sp. nov. FIG. 1

Basidiocarpus perennis, sessilis, effuso-reflexus ad ungulatum, proximo 13 × 6 × 7 cm; superficies cum concentrico protuberatione, brunneolus canus ad cinerascentem nigrum; pororum subroseus-albidus ad roseus, pori rotundi, 6–8 per mm; hymenium tubiformis, proximo 1–1.2 cm crassus; contextus brunneolus luteus, proximo 3–5 mm crassus; systema hypharum trimiticum; hyphae generatoriae fibulatae, 2.3–3 µm latae; hyphae skeletaleae brunneolus luteus in KOH, aseptatae, 2.3–4 µm latae; hyphae ligativae ramificatae, brunneolus luteus in KOH, aseptatae, 1.8–3.4 µm latae; basidia clavata, 2-sterigmata, 15–19 × 4–6.3 µm; basidiosporae ellipsoidae, curvae, parietae tenuae, hyalinae, laeves, 4.5–6.3 × 2.2–2.9 µm.

HOLOTYPE: KOREA. Mount Chiak, Kangwon Province, ca. 37°24′N, 128°3′E, ca. 400 m a.s.l., on the base of *Fraxinus mandshurica*, 25 Jul 2005, *J. S. Lee* and *K. M. Kim* SNU m-05072501 (culture ex-holotype SNU m-05072501 = SFCC m-05072501).

Basidiocarps perennial, sessile, semicircular and broadly attached, effused-reflexed to ungulate, up to 13 × 6 × 7 cm; upper surface with broad concentric bulges, frequently fissured, brownish gray (10F2) to

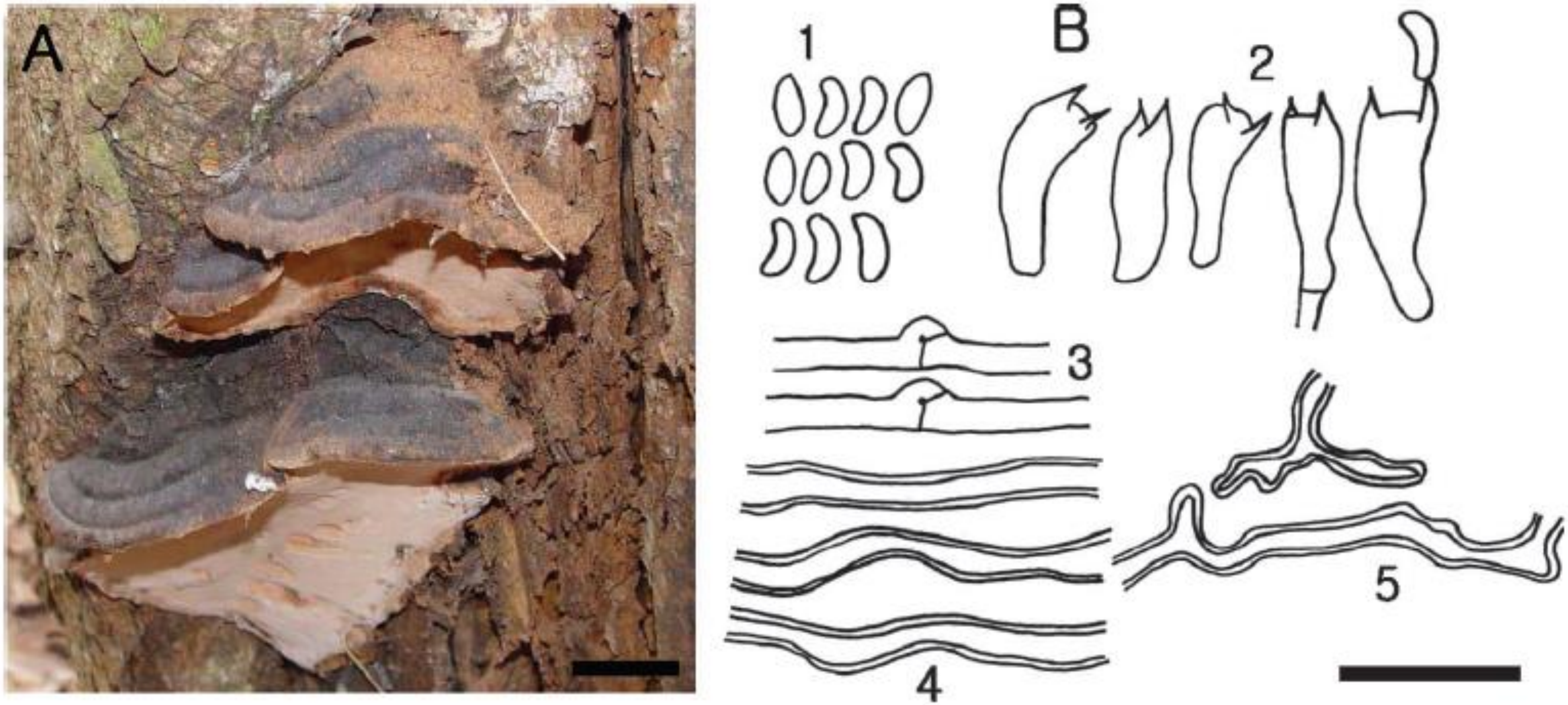


FIG. 1. Basidiocarps (A) and microscopic characters (B) of *F. incarnatus* (holotype). 1. basidiospores; 2. basidia; 3. generative hyphae; 4. skeletal hyphae; 5. binding hyphae. Bars: A = 2 cm; B = 15 µm.

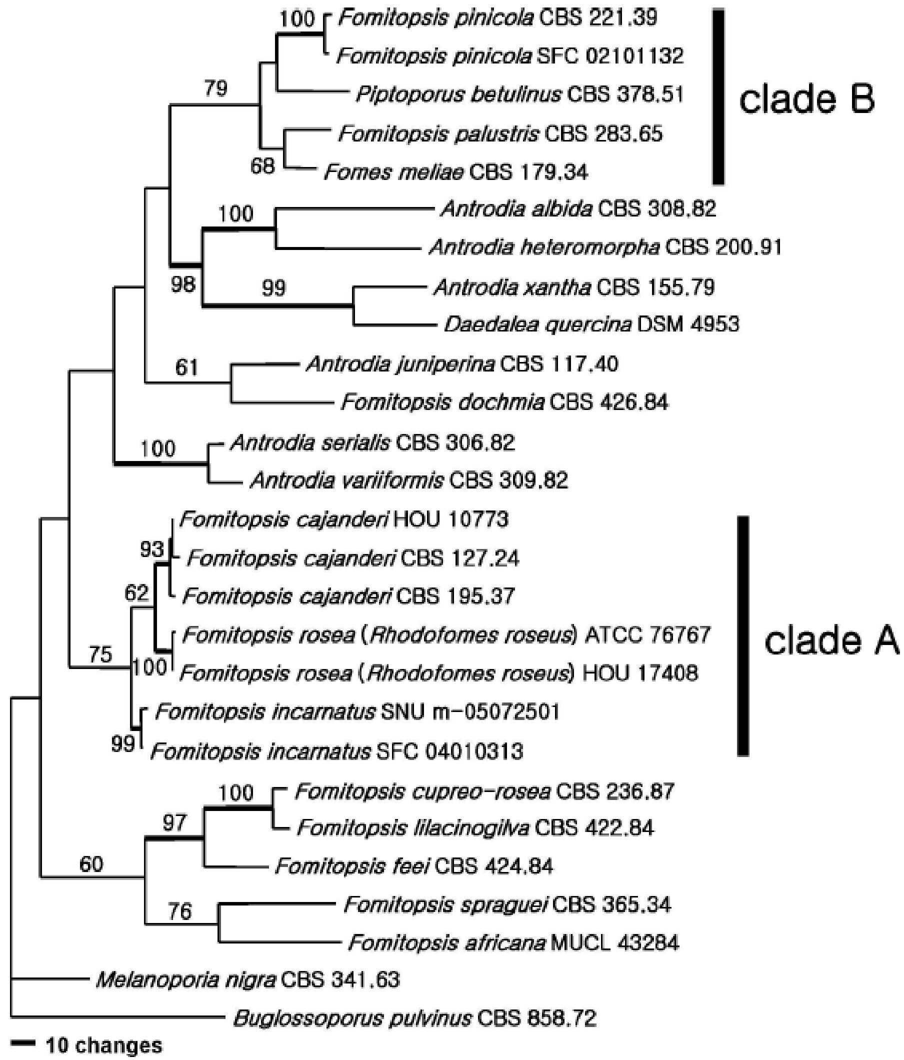


FIG. 2. One of the five most parsimonious trees inferred from the nuclear ITS sequences (666 bp; tree length = 949, CI = 0.530, RI = 0.575). *Buglossoporus pulvinus* was used as outgroup to root the tree. Nonparametric bootstrap values were shown above branches supported by more than 50% from 1000 replications; bold lines were used where branches were supported by more than 90%.

J. Phycol. 45, 251–263 (2009)

DOI: 10.1111/j.1529-8817.2008.00621.x

SYMBIODINIUM NATANS SP. NOV.: A ''FREE-LIVING'' DINOFLAGELLATE FROM TENERIFE (NORTHEAST-ATLANTIC OCEAN)[1]

Gert Hansen[2] *and Niels Daugbjerg*

Department of Biology, Phycology Laboratory, University of Copenhagen, Øster Farimagsgade 2D, DK-1353 Copenhagen K., Denmark

We examined a free-living *Symbiodinium* species by light and electron microscopy and nuclear-encoded partial LSU rDNA sequence data. The strain was isolated from a net plankton sample collected in near-shore waters at Tenerife, the Canary Islands. Comparing the thecal plate tabulation of the free-living *Symbiodinium* to that of *S. microadriaticum* Freud., it became clear that a few but significant differences could be noted. The isolate possessed two rather than three antapical plates, six rather than seven to eight postcingular plates, and finally four rather than five apical plates. The electron microscopic study also revealed the presence of an eyespot with brick-shaped contents in the sulcal region and a narrow anterior plate with small knob-like structures. Bayesian analysis revealed the free-living *Symbiodinium* to be a member of the earliest diverging clade A. However, it did not group within subclade A_I (=temperate A) or any other subclades within clade A. Rather, it occupied an isolated position, and this was also supported by sequence divergence estimates. On the basis of comparative analysis of the thecal plate tabulation and the inferred phylogeny, we propose that the *Symbiodinium* isolate from Tenerife is a new species (viz. *S. natans*). To elucidate further the species diversity of *Symbiodinium*, particularly those inhabiting coral reefs, we suggest combining morphological features of the thecal plate pattern with gene sequence data. Indeed, future examination of motile stages originating from symbiont isolates will demonstrate if this proves a feasible way to identify and characterize

verse basal body; TMRE, transverse microtubular root extension; TSC, transverse striated collar; vc, ventral connective

The term zooxanthellae refers to the golden-brown-colored algae living in mutualistic symbiosis with various invertebrate and protist hosts. Although they may include cryptophytes and diatoms, dinoflagellates constitute by far the most common group (Trench and Blank 1987, Rowan 1998). Earlier studies suggested that the endosymbionts represented a single pandemic dinoflagellate species, *Symbiodinium microadriaticum* (McLaughlin and Zahl 1966), but the advent of ultrastructural, biochemical, and later molecular systematics suggested the presence of different *Symbiodinium* species, and even dinoflagellate species from other genera, for example, *Amphidinium, Aureodinium, Gloeodinium, Gymnodinium,* and *Scrippsiella* (Trench 1987, Wakefield et al. 2000). Still, species of *Symbiodinium* are the most widespread types of endosymbionts and have been found, besides cnidarians, in such diverse groups as foraminiferans, radiolarians, ciliates, mollusks, and sponges (Baker 2003). The genus comprises four validly described species (*S. microadriaticum, S. pilosum* Trench et R. J. Blank ex. Trench, *S. kawagutii* Trench et R. J. Blank ex. Trench, and *S. goreauii* Trench et R. J. Blank ex. Trench) and seven species without a formal description (*S. bermudense, S. californicum,*

RESULTS

Symbiodinium natans sp. nov. Gert Hansen et Daugbjerg.

Description. Cellulae mobiles circiter 10 μm longae (9.5–11.5 μm) et 8 μm latae (7.4–9 μm). Epitheca leviter latior quam hypotheca. Apicalis theca angusta elongataque plurimis cum tuberibus in apice sita. Cingulum cinguli unius latitudine dispositum. Ex duabus lineis thecarum pentagonalium constat. Thecae formula x, EAV, 4′, 5a, 8″, ?s, ?c, 6t′, 2‴′. Praesentia unius pyrenoidis duplici calamo in media cellula siti. Nucleus in epitheca situs. Stigma ex plurimis vesiculis latericii forma in sulco. Pedunculus unus praesens. GenBank accessus numerus EU315917.

Motile cells are ~10 μm long (range 9.5–11.5 μm) and 8 μm wide (range 7.4–9 μm). The episome is slightly larger than the hyposome. An apical narrow elongated amphiesmal vesicle (EAV) with numerous knobs is located at the apex. The cingulum is displaced one cingular width and consists of two rows of pentagonal plates. Plate formula: x, EAV, 4′, 5a, 8″, ?s, ?c, 6t′, 2‴′. One two-stalked pyrenoid is situated in median part of the cell. The nucleus is located in the episome. An eyespot, consisting of numerous brick-containing vesicles, is present in the sulcus. A peduncle is present. GenBank accession number: EU315917.

Etymology: natans referring to the free-swimming cells of this species.

Holotype: A SEM stub of the clonal culture used in this study has been deposited at the Botanical Museum, University of Copenhagen, accession number CAT2393. Figure 3, A–C, has been chosen to represent the type in accordance to fulfill article 39.1 of the International Code of Botanical Nomenclature (ICBN).

Type locality: Callao Salvaje, Tenerife.

LM. The typical motile cell had a slightly longer epi- than hyposome (Fig. 1A), although some variations were noted from very pronounced ''mushroom-shaped'' (not shown) to an almost equally sized epi- and hyposome (Fig. 1C). Brownish chloroplast(s) were situated along the cell periphery, and a distinct pyrenoid surrounded by a starch layer was located just below the nucleus (Fig. 1C). A darker brownish body, assumed to be the eyespot, was present in the sulcal area (Fig. 1, A and B). A majority of cells in the log phase were in the motile phase and had a very characteristic ''spinning'' movement, staying at the same place as if attached to the bottom of the culture flask, only occasionally swimming for a short distance.

The immotile cells measured ~13 μm in diameter and were often packed with storage products, particularly in old cultures (Fig. 1E). Scattered two-celled division stages were occasionally observed on the bottom of the culture flask, but four-celled stages were never recognized (Fig. 1D).

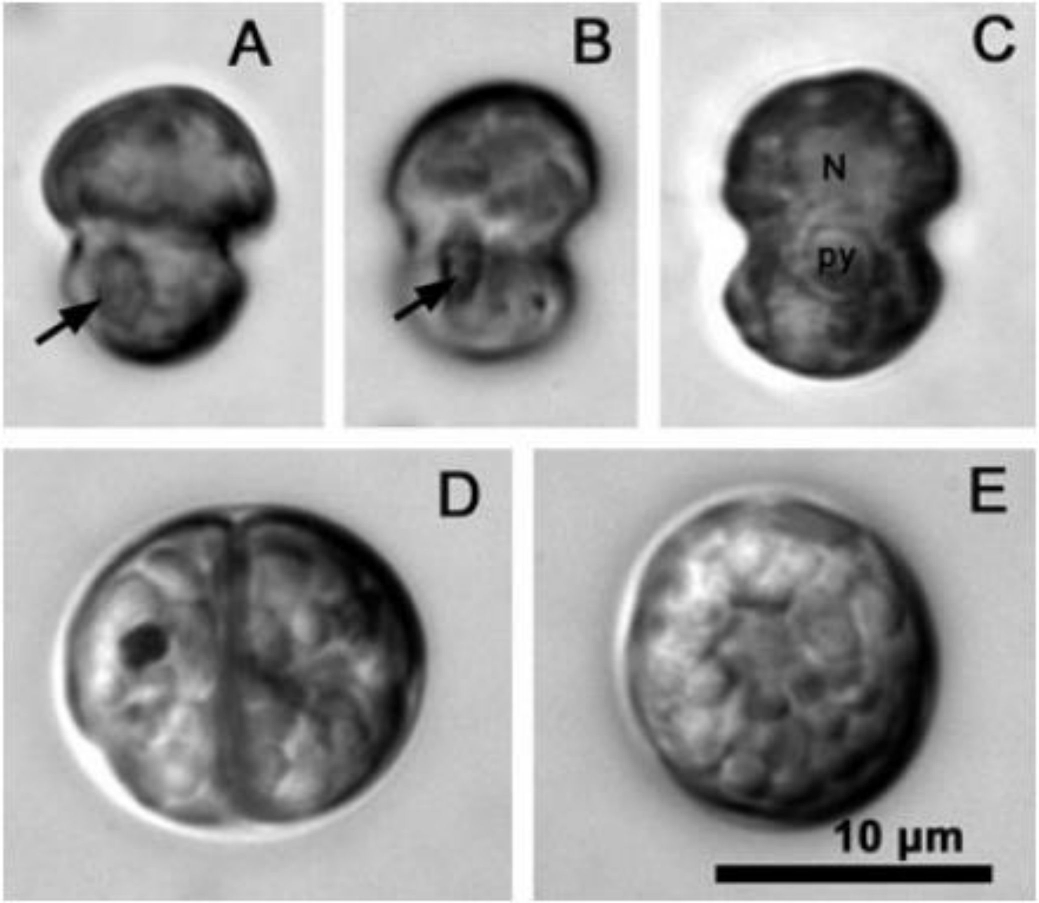


FIG. 1. *Symbiodinium natans* sp. nov., DIC LM. (A–C) Motile cells showing the putative eyespot (arrow), the nucleus (N), and the pyrenoid (py). Notice focal plane is in the cell. (D) Two-celled division cyst. (E) Immotile predivision cyst.

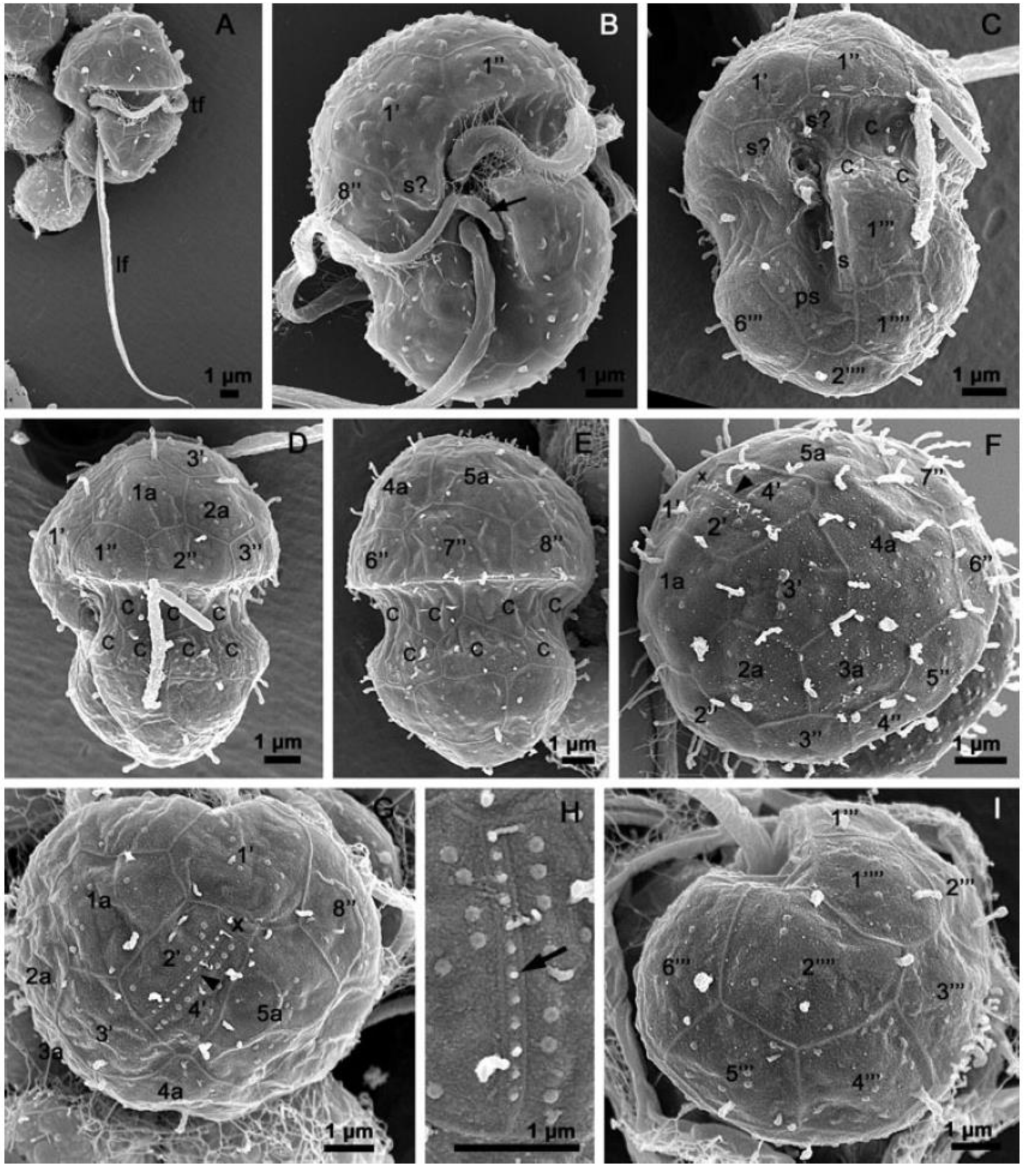


FIG. 2. *Symbiodinium natans* sp. nov., SEM, motile cells. (A) Cell displaying the transverse (tf) and longitudinal flagella (lf). (B) Cell in ventral view with intact flagella and a partly protruded peduncle (arrow). Some of the visible plates have been labeled. (C) Cell with discarded flagella and more clear plate pattern (ventral view). (D, E) Cells seen in left and right lateral views, respectively. (F) Episome seen in dorsal view; EAV-plate (arrowhead). (G) Episome seen in apical view. (H) The EAV plate in higher magnification. Notice the small knobs (arrow). (I) Antapical view of the hyposome.

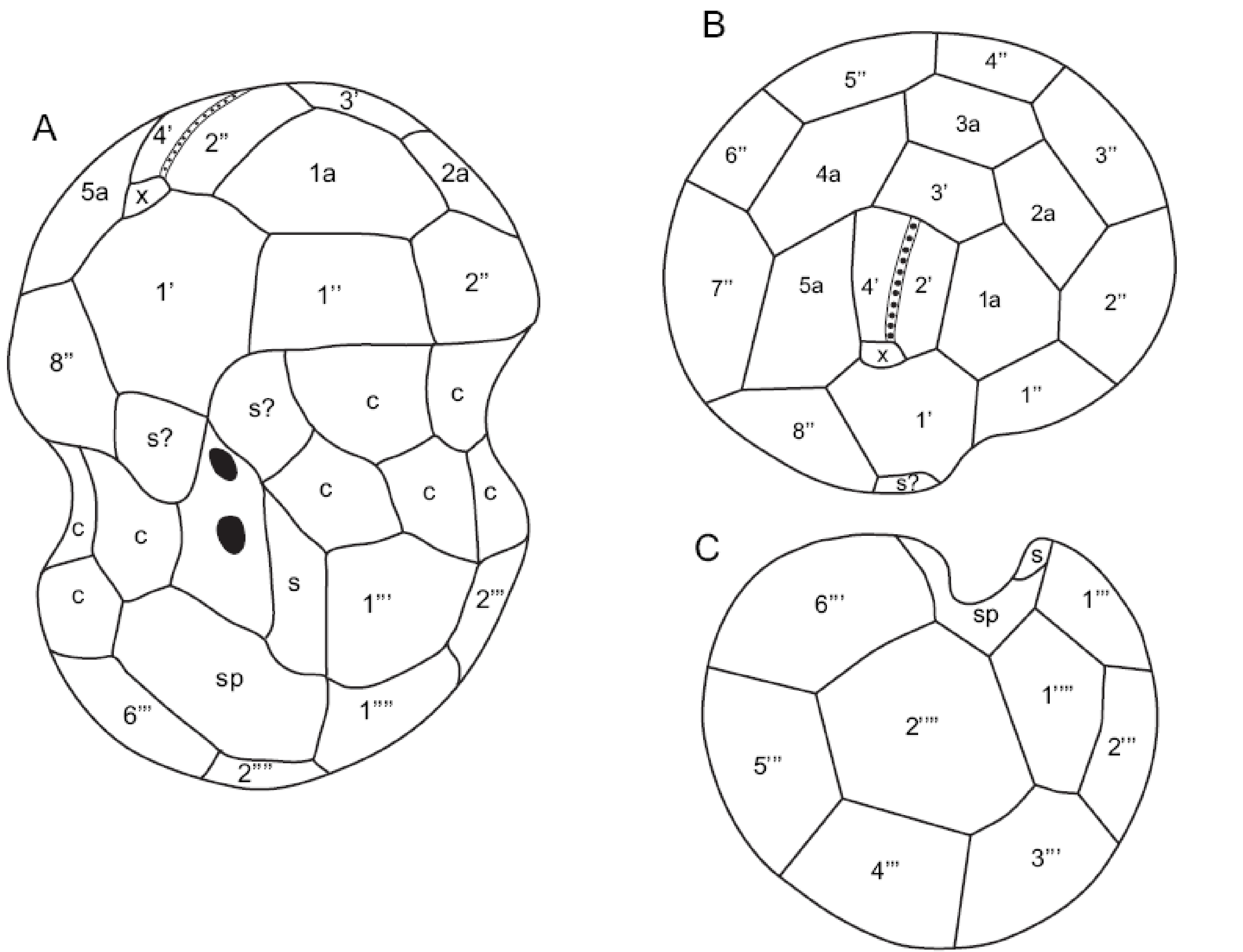


FIG. 3. The thecal plate pattern of *Symbiodinium natans* sp. nov. based on a compilation of SEM micrographs. (A) Ventral view. (B) Apical view. (C) Antapical view.

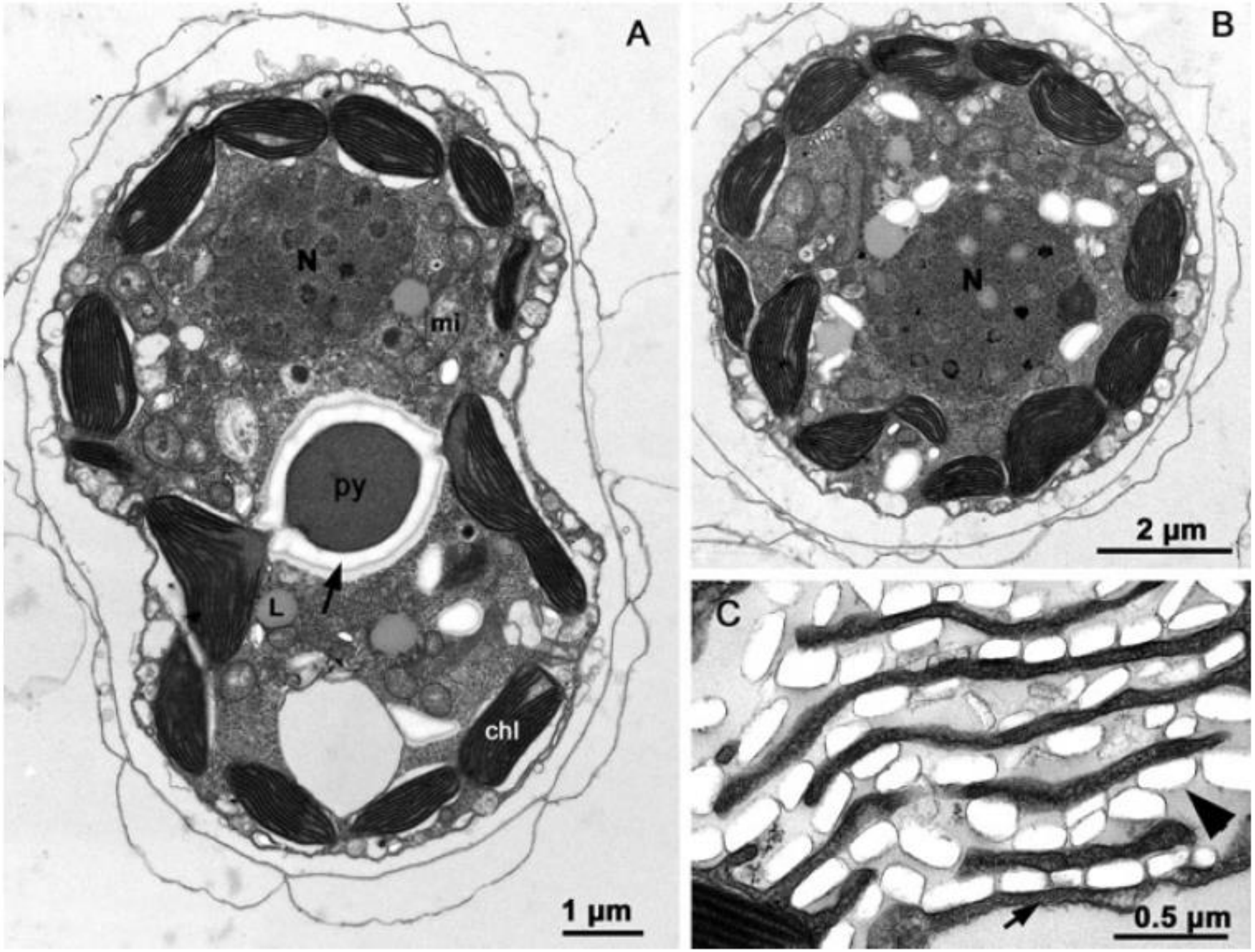
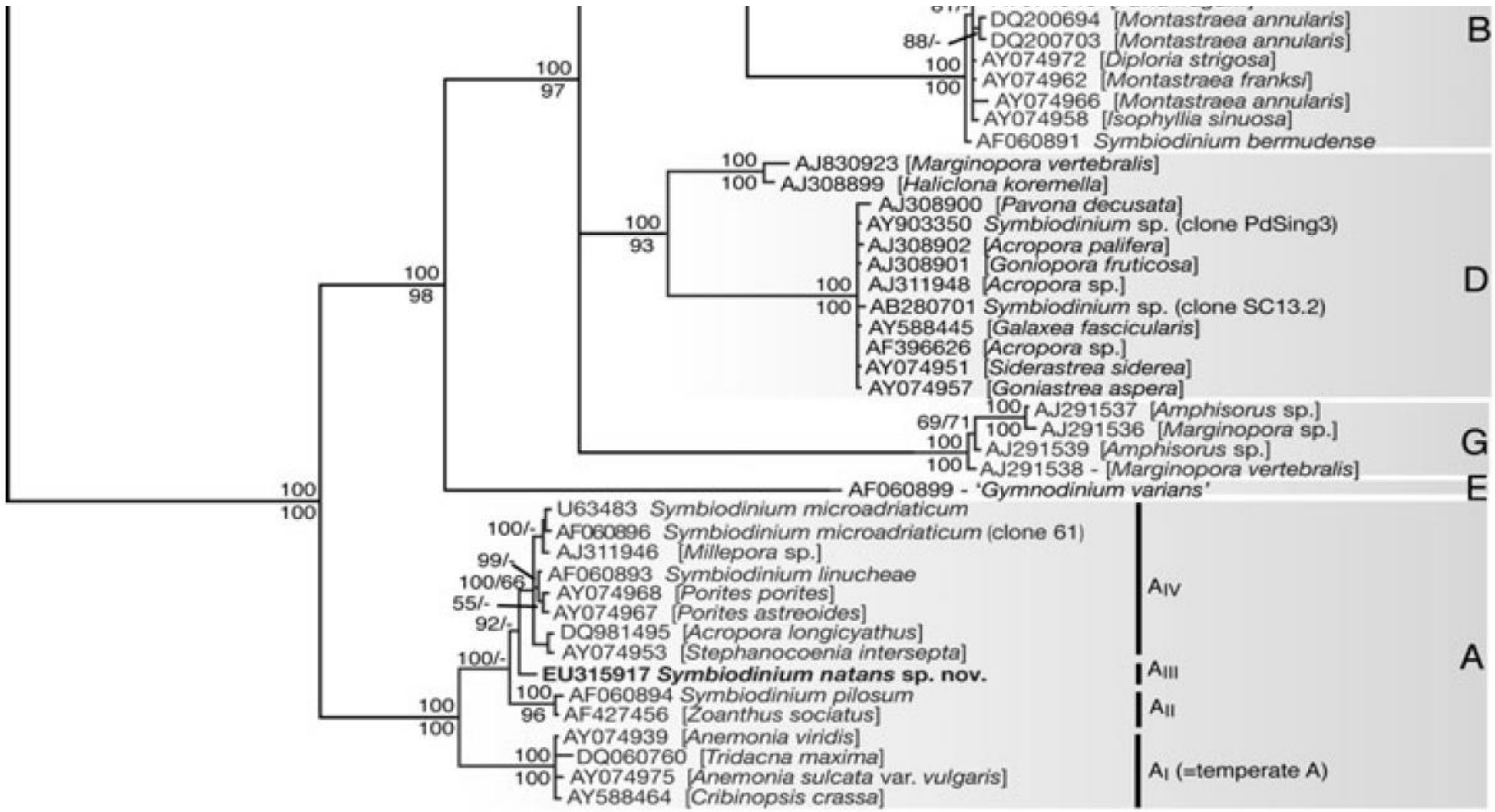


FIG. 4. *Symbiodinium natans* sp. nov., TEM, general ultrastructure. (A) Longitudinal section. N, nucleus; chl, chloroplast; py, pyrenoid mi, mitochondrion; L, lipid droplet. Notice starch cap around the pyrenoid (arrow). (B) Transverse section. Notice peripheral location o chloroplasts. (C) The eyespot consisting of brick-containing cisternae (arrowhead). Notice microtubular strand (arrow).



DQ200694 [Montastraea annularis]
DQ200703 [Montastraea annularis]
AY074972 [Diploria strigosa]
AY074962 [Montastraea franksi]
AY074966 [Montastraea annularis]
AY074958 [Isophyllia sinuosa]
AF060891 Symbiodinium bermudense
B
AJ830923 [Marginopora vertebralis]
AJ308899 [Haliclona koremella]
AJ308900 [Pavona decusata]
AY903350 Symbiodinium sp. (clone PdSing3)
AJ308902 [Acropora palifera]
AJ308901 [Goniopora fruticosa]
AJ311948 [Acropora sp.]
AB280701 Symbiodinium sp. (clone SC13.2)
AY588445 [Galaxea fascicularis]
AF396626 [Acropora sp.]
AY074951 [Siderastrea siderea]
AY074957 [Goniastrea aspera]
D
AJ291537 [Amphisorus sp.]
AJ291536 [Marginopora sp.]
AJ291539 [Amphisorus sp.]
AJ291538 - [Marginopora vertebralis]
G
AF060899 - 'Gymnodinium varians'
E
U63483 Symbiodinium microadriaticum
AF060896 Symbiodinium microadriaticum (clone 61)
AJ311946 [Millepora sp.]
AF060893 Symbiodinium linucheae
AY074968 [Porites porites]
AY074967 [Porites astreoides]
DQ981495 [Acropora longicyathus]
AY074953 [Stephanocoenia intersepta]
AIV
EU315917 Symbiodinium natans sp. nov.
AIII
AF060894 Symbiodinium pilosum
AF427456 [Zoanthus sociatus]
AII
AY074939 [Anemonia viridis]
DQ060760 [Tridacna maxima]
AY074975 [Anemonia sulcata var. vulgaris]
AY588464 [Cribinopsis crassa]
AI (=temperate A)
A
88/-
100
100
97
93
98
69/71
100/-
99/-
100/66
55/-
92/-
100/-
96

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LAURENCIA MARILZAE SP. NOV. (CERAMIALES, RHODOPHYTA) FROM THE CANARY ISLANDS, SPAIN, BASED ON MORPHOLOGICAL AND MOLECULAR EVIDENCE[1]

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Laurencia marilzae Gil-Rodríguez, Sentíes et M.T. Fujii sp. nov. is described based on specimens that have been collected from the Canary Islands. This new species is characterized by distinctive yellow–orange as its natural habitat color, a terete thallus, four pericentral cells per vegetative axial segment, presence of secondary pit-connections between adjacent cortical cells, markedly projecting cortical cells, and also by the presence of _corps en cerise_ (one per cell) present in all cells of the thallus (cortical, medullary, including pericentral and axial cells, and trichoblasts). It also has a procarp-bearing segment with five pericentral cells and tetrasporangia that are produced from the third and fourth pericentral cells, which are arranged in a parallel manner in relation to fertile branchlets. The phylogenetic position of this taxon was inferred based on chloroplast-encoded _rbc_L gene sequence analyses. Within the _Laurencia_ assemblage, _L. marilzae_ formed a distinctive lineage sister to all other _Laurencia_ species analyzed. Previously, a large number of unique diterpenes dactylomelane derivatives were isolated and identified from this taxon. _L. marilzae_ is morphologically, genetically, and chemically distinct from all other related species of the _Laurencia_ complex described.

The taxonomy of the *Laurencia* J. V. Lamour. complex has undergone several major changes, and currently four genera are assigned to this complex. These changes have led to the resurrection of the genus *Osmundea* (Nam et al. 1994), the elevation of subgenus *Chondrophycus* (in Saito 1967) to generic rank (Garbary and Harper 1998) with generic features as defined by Nam (1999), and recently the genus *Palisada* based on Yamada's (1931) section *Palisadae* (Nam 2006, 2007). Eighteen species of the *Laurencia* complex have been recorded from the Canary Islands (Gil-Rodríguez and Haroun 1993, Haroun et al. 2002), representing 72% of the species described from the east Atlantic Ocean coast (Lawson and John 1982, Maggs and Hommersand 1993, Nam et al. 2000, Gil-Rodríguez and Haroun 2002, Neto et al. 2005).

The *Laurencia* complex in the Canary Islands has been studied taxonomically since the beginning of the 19th century (Bory de Saint-Vincent 1803, Montagne 1840, Børgesen 1930, Gil-Rodríguez and Haroun 1992, 1993, Hernández-González and Gil-Rodríguez 1994, Masuda et al. 1998, Schnetter et al. 2000, Gil-Rodríguez et al. 2003). Ecological and biogeographical aspects of this

RESULTS

Laurencia marilzae sp. nov.

Diagnosis: Alga, colore flavo aurantiaco, in naturali habitatione caespites 7 cm altos forman. Axes cylindrici usque ad 1.5 mm in diametro affixi ad substratum basali disco, quamquam etiam adsint parvae auxiliares adhaerentiae, quae oriuntur ex ramis basalibus; thalli cartilaginea structura atque irregulariter pyramidali ambitu; ramificatio irregulatim alterna et spiraliter disposita, generatim usque ad 2–3 (4) ordines ramificationis; ultimis rami cylindrici ad clavatos; unum ''corps en cerise'' in omnibus thalli cellulis, et in cellulis axialis segmenti et in medullosis cellulis; corticalium cellularum parietes valde projectae sunt; in transversali sectione corticales cellulae numquam radiatim elongatae nec paliformes nec cum secundariis conexionibus; medullosae cellulae cum incrassatis uniformiter parietibus, sed sine lenticularibus crassitudinibus; quattuor pericentrales cellulae per vegetativum segmentum axiale; prima cellula pericentralis sub cellula basali trichoblastorum exoriens; segmentum, ferens procarpium, quinque pericentralibus cellulis, quarum quinta sustinens est; cystocarpium maturum forma subconicali cum prominente ostiolo; tetrasporangia in tertia quartaque pericentrali cellul facta, dispositione parallela ramorum fertilium axe. Habitatio: frequens in locis valde expositis fluctibus.

Plants yellow–orange color in natural habitat forming tufts up to 7 cm high; terete axes up to 1.5 mm in diameter, arising from a discoid holdfast; smaller auxiliary holdfasts present formed from descending basal branches; thalli cartilaginous in texture, irregularly pyramidal in outline; branching irregularly alternate and spirally arranged, usually with 2–3 (4) orders of branches; ultimate branchlets are cylindrical-clavate; *corps en cerise*, one per cell, present in almost all cells of the thalli, including axial segment and other medullary cells; cortical cell walls markedly projecting; in transverse section, cortical cells neither elongated radially nor arranged as a palisade with secondary pit connections; medullary cells with walls uniformly thickened, but lenticular thickenings are absent; four pericentral cells per vegetative axial segment; procarp-bearing segment with five pericentral cells, the fifth becoming the supporting cell; mature cystocarps subconical without protuberant ostiole; tetrasporangia are produced from third and fourth pericentral cells, in parallel arrangement in relation to fertile branchlets.

Morphology: Plants forming yellow–orange tufts up to 7 cm high (Fig. 1a), with terete axes, cartilaginous in texture, irregularly pyramidal in outline, not adhering to herbarium paper when dried. Thalli attached to the substratum by a discoid holdfast and from descending branches formed from the lower portion of axes, which may attach the thalli secondarily by smaller holdfasts (Fig. 1b). Erect

FIG. 5. *Laurencia marilzae* sp. nov. thalli in natural habitat growing in the lower intertidal zone, intermingled with other macroalgae.

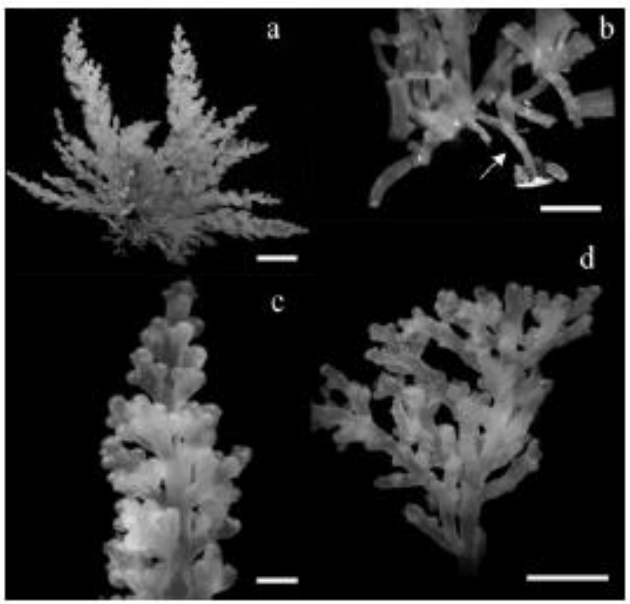

FIG. 1. *Laurencia marilzae* sp. nov. (a) Habit of a plant. Scale bar, 1 cm. (b) Detail of basal portion of the thallus (arrow). Scale bar, 1 mm. (c) Tetrasporangial branches. Scale bar, 2 mm. (d) Female branches. Scale bar, 2 mm.

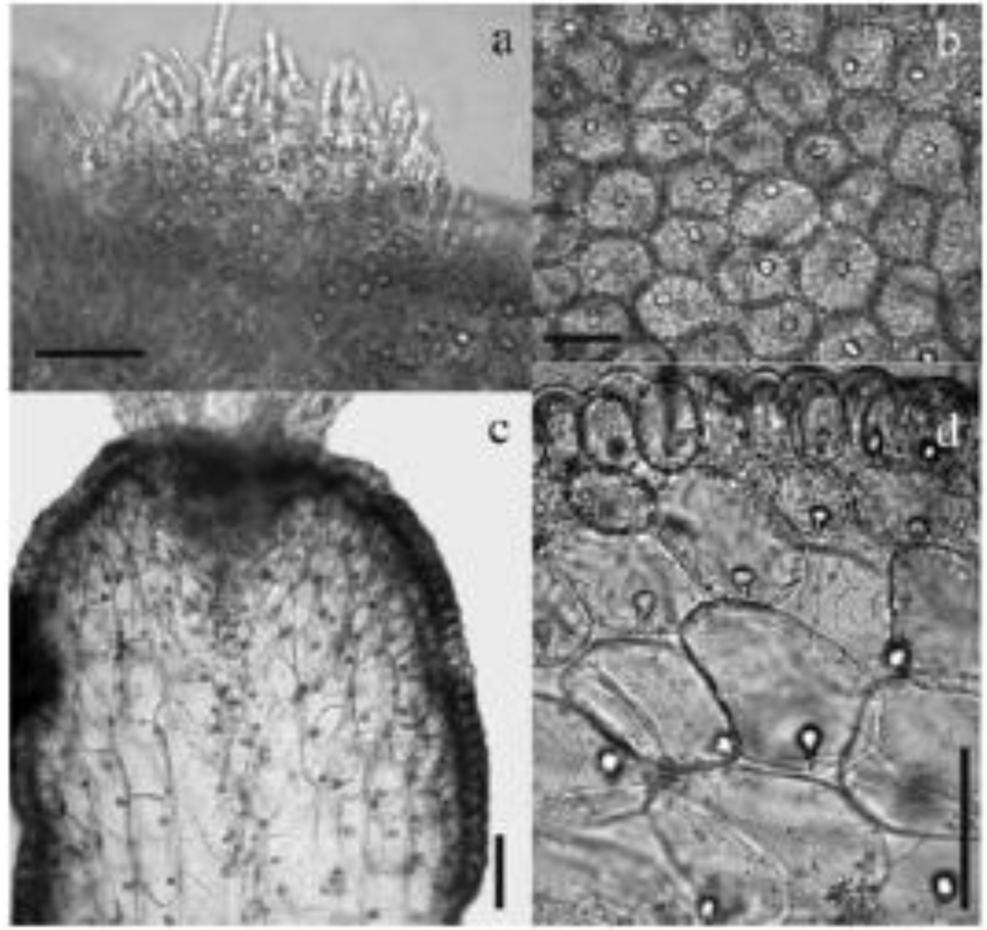

FIG. 2. *Laurencia marilzae* sp. nov. showing a single *corp en cerise* present in all cells of the thallus. (a) Apical region of the branch with abundant trichoblasts; each cell of trichoblast bearing a *corp en cerise*. Scale bar, 20 µm. (b) Cortical cells in superficial view. Scale bar, 50 µm. (c) Longitudinal section of a branch showing *corps en cerise* in cortical and medullary cells. Scale bar, 100 µm. (d) Longitudinal section in detail showing *corps en cerise* in medullary cells. Scale bar, 50 µm.

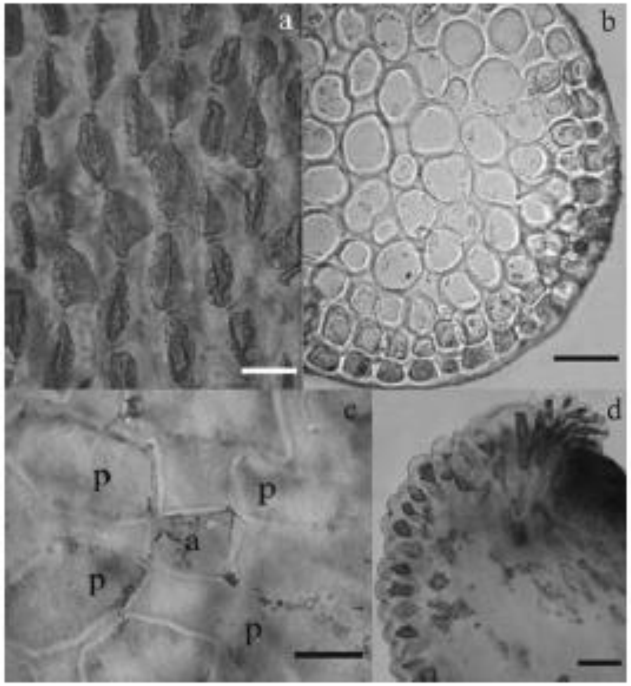

FIG. 3. *Laurencia marilzae* sp. nov. (a) Cortical cells of the middle portion of the thallus in surface view showing secondary pit connections. Scale bar, 20 µm. (b) Transverse section of the thallus. Scale bar, 50 µm. (c) Transverse section of the upper portion of a branch showing an axial cell (a) with four pericentral cells (p). Scale bar, 25 µm. (d) Longitudinal section of a branch showing projecting cortical cells. Scale bar, 40 µm.

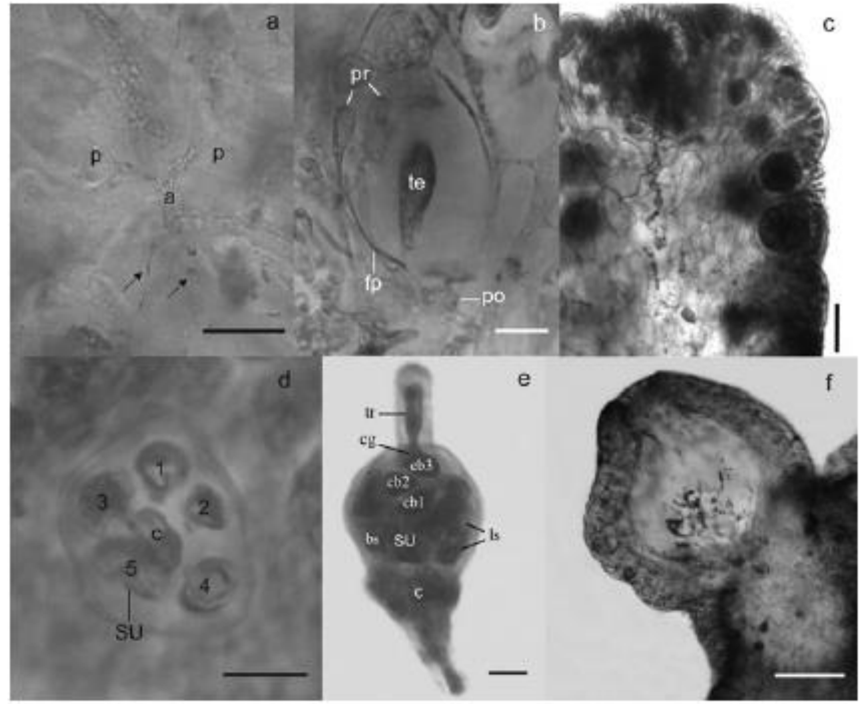

FIG. 4. *Laurencia marilzae* sp. nov. (a) Transverse section near the apex of branchlet showing tetrasporangial axial segment; axial cell (a) with two vegetative pericentral cells (p) and two fertile pericentral cells (arrows). Scale bar, 25 µm. (b) Detail of a fertile pericentral cell (fp) with two presporangial cover cells (pr), the tetrasporangial initial (te), and one postsporangial cover cell (po). Scale bar, 25 µm. (c) Longitudinal section through a tetrasporangial branchlet showing parallel arrangement of the tetrasporangia. Scale bar, 100 µm. (d) Procarp-bearing segment with five pericentral cells, the fourth becoming the supporting cell (su); central cell of procarp-bearing segment (c). Scale, 10 µm. (e) Procarp before fertilization with four-celled carpogonial branch (cb), lateral sterile group (ls), and basal sterile group (bs); carpogonium (cg), trichogyne (tr), supporting cell (su), central cell of procarp-bearing segment (c). Scale bar, 10 µm. (f) Longitudinal section through cystocarp. Scale bar, 200 µm.

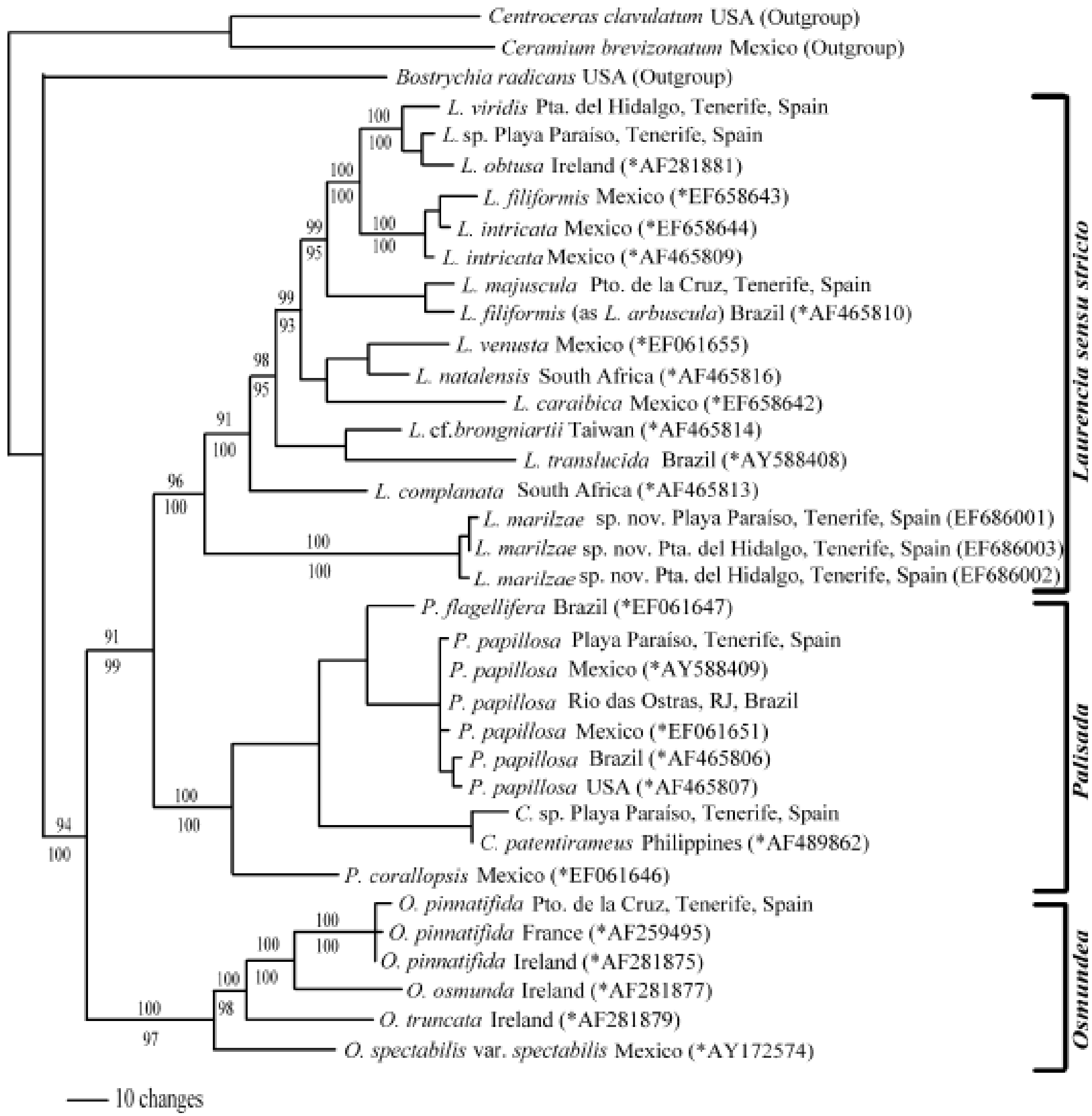

Fig. 6. Phylogenetic relationships of the *Laurencia* complex based on Bayesian analysis of *rbc*L DNA sequences. Fifty percent majority-rule consensus tree sampled after the run reached stationarity at generation 15,800 (total number of generations ran = 3.0×10^6). Evolutionary model used in the Bayesian analysis was the GTR+I+G, selected by a maximum-likelihood ratio test. Bootstrap (above) and Bayesian posterior probabilities (below) values are indicated at the nodes. (*) GenBank sequences.

Síntesis

“tienen en común otros caracteres por los cuales se asemejan entre sí y se distinguen de los de las demás especies” – **resulta insuficiente**

Concepto de especie

Criterios de delimitación