

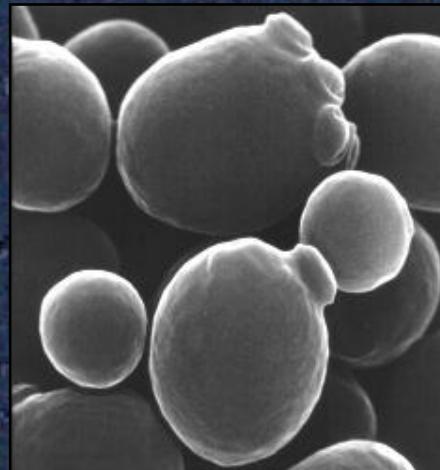


South America: an Invaluable Source of Yeast Diversity Lacking a Specialized Culture Collection



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Presentation overview



Survey of Yeast-preserving Culture Collections in South America



Contributions from Patagonia (Argentina) to yeast...

- Biodiversity
- Taxonomy 
- Biogeography 
- Ecology - photobiology
- Biotechnology



Mapa Político de America del Sur



Survey: Yeast-preserving Culture Collections in South America



World Federation for Culture Collections (WFCC) database



Latinoamerican Federation for Culture Collections (FELACC)

2009 Survey Organized by the Argentinean Association for Microbiology (AAM)



COUNTRY	N° CC	With yeasts
Brazil	60	6
Argentina	11	3
Venezuela	3	ni
Colombia	2	1
Chile	1	ni
TOTAL	77	10

ni: no information available

AAM 2009 Survey

COUNTRY	N° CC	With yeasts
Argentina	18	6
Brazil	5	1
Venezuela	1	0
Uruguay	2	1
Ecuador	1	1
TOTAL	27	9

Results from both databases differ considerably

Survey: Yeast-preserving Culture Collections in South America



Country	Collection	Origin	Nº Yeast strains	% Yeast
Brazil	UFMG, Belo Horizonte	Environ., industrial, other	15000	70
Argentina	CRUB, INIBIOMA-UNCo	Environ., Type strains	3000	100
Ecuador	CLQCA, CNIB	Environ., Other	1800	100
Brazil	URM, Recife	Various	1600	18
Argentina	IMR-M	Clinic, environ.	1426	57
Argentina	EEA, INTA	Wine, other	1330	100
Argentina	IDEPA-UNCo	Wine, cider industries, other	1098	100
Argentina	Dmic, Malbran	Clinic, environ.	425	23
Argentina	CCCE, CEREMIC	Clinic, other	402	28
Brazil	INCQS, Fiocruz	Various	277	28
Argentina	CCMFCA	Wine industries	211	33
Ecuador	Hospital Vozantes	Clinic	120	9
Brazil	CBMAI Altern. Research Collect.	Environ., various	100	5
Brazil	UFPEDA; Pernambuco	Various	75	13
Argentina	LPSC, Spegazzini Inst.	International collections	50	5
Brazil	IGESALQ, U. Sao Paulo	Various	50	6
Brazil	IPT, S.P.	Various	34	8
Brazil	CBMAI	Various	30	2.5
Argentina	CCM-A, UBA	n.a.	21	2
Colombia	CMPUJ, Univ. Javeriana	Clinic	20	1
Argentina	BNM, BsAs	various	2	0.5

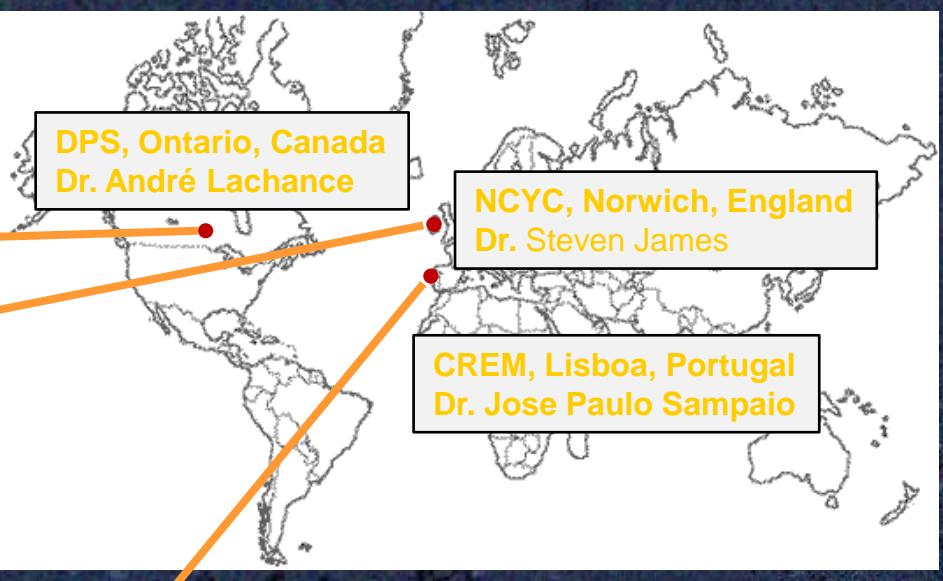
Sources: 2009 AAM survey/ WFCC database/ Collection's official web site / curator's personal communication

Survey: Yeast-preserving Culture Collections in South America

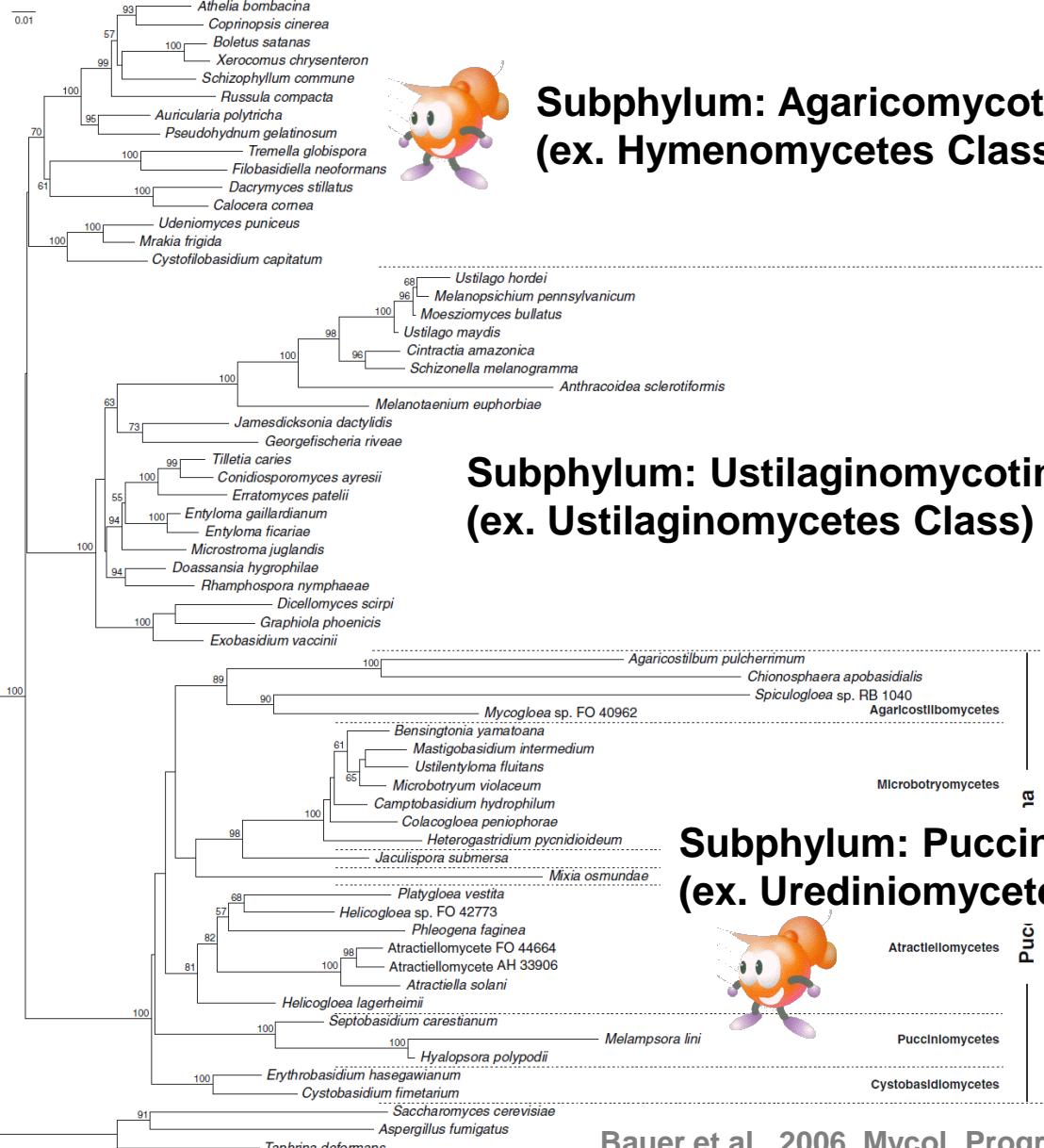
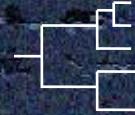


Country	Collection	Nº Yeast strains	Year	Described sp. nov.	Not yet described sp. nov.	TOTAL sp. nov.
Brasil	UFMG, Belo Horizonte	15000	1994	35	50	85
Argentina	CRUB, INIBIOMA, Bche.	3000	2002	12	20	32
Ecuador	CLQCA, CNIB, Quito http://www.cnib.com.ec/CLQCA	1800	2006	1	15	16
	TOTAL	19800 (30-40% ID)		48	85	133

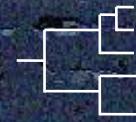
South America



Contributions from Patagonia to yeast... taxonomy (Basidiomycota)

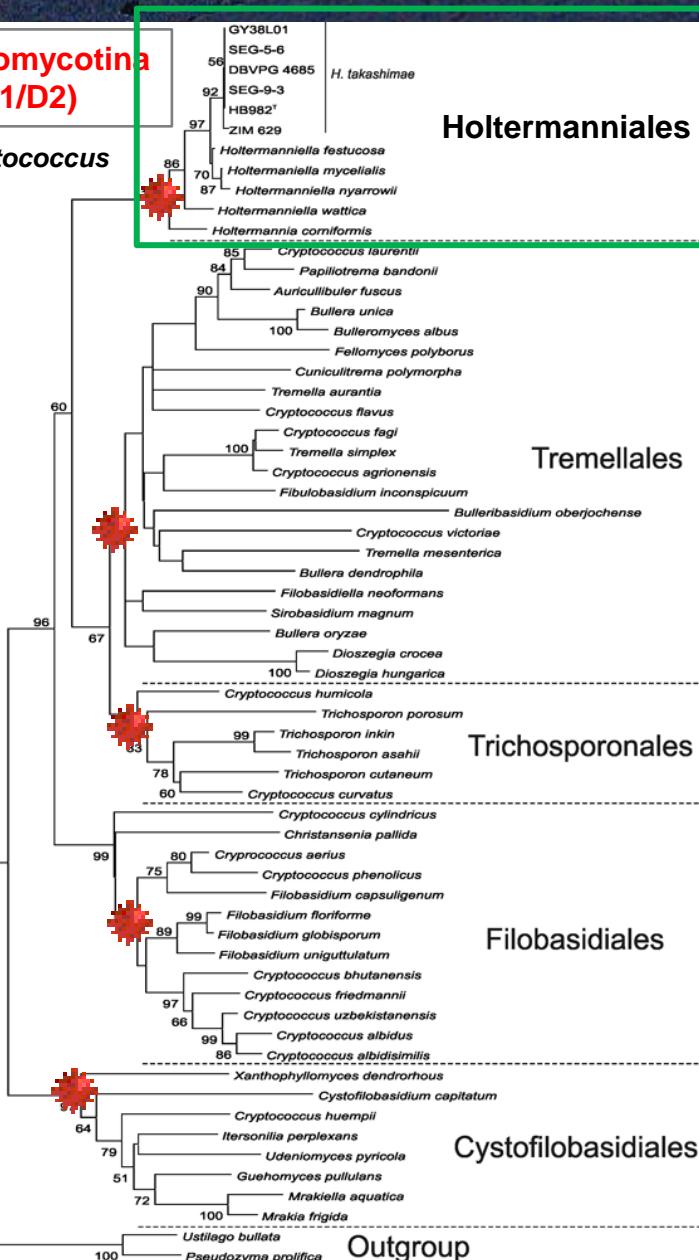


Contributions from Patagonia to yeast... taxonomy (Agaricomycotina)



**Agaricomycotina
(D1/D2)**

Cryptococcus



➤ New order: **Holtermanniales**

➤ New genus: **Holtermanniella**

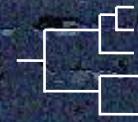
↳ 4 new combinations for *Cryptococcus* species

➤ New species: ***Holtermannia takashimae***

Holtermanniales (ITS)

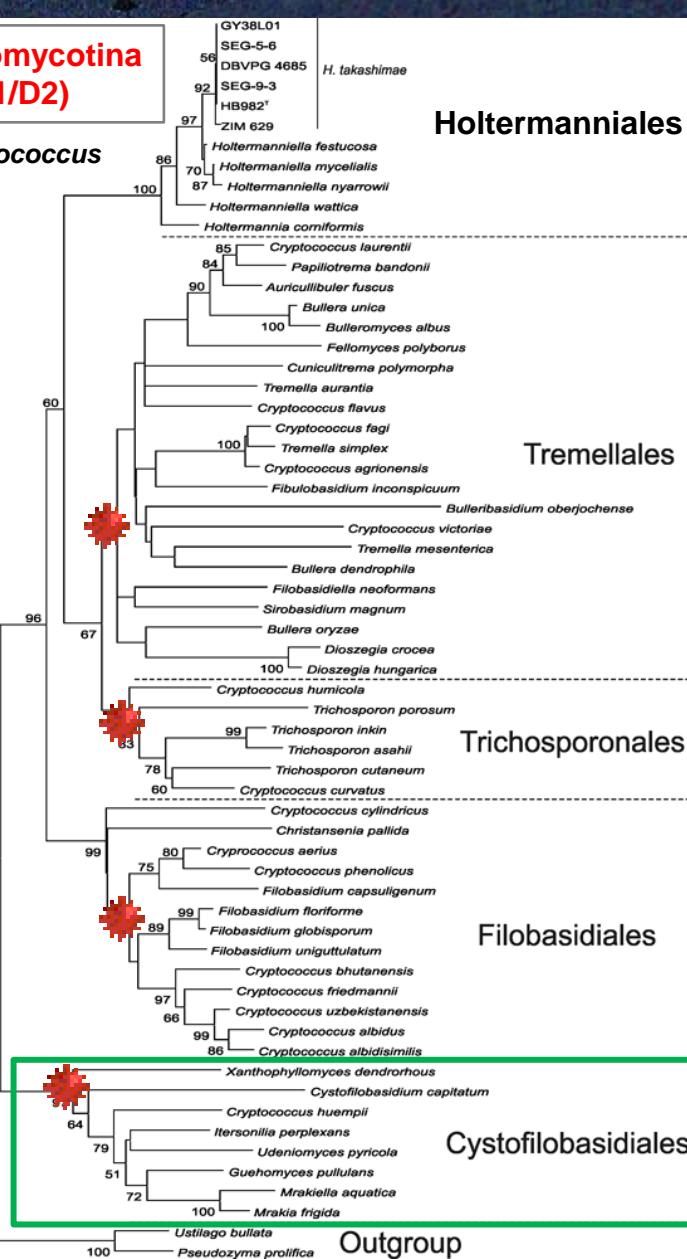
- A
 - H. takashimae* HB982^T - FM246501
 - H. takashimae* SEG-5-6 - FN430734
 - H. takashimae* VTT C-04546 - FM246503
 - H. takashimae* SEG-9-3 - FN430732
 - H. takashimae* CBS 10506 - FJ473372
 - H. takashimae* VTT C-04547 - FM246504
 - clone BF-OTU102 - AM901778
 - B
 - H. takashimae* CRUB1154 - FM246502
 - H. takashimae* HB 981 - FM246505
 - H. takashimae* DVBPG 4685 - FM882240
 - C
 - H. festucosa* VKM Y-2930^T - AY462120
 - H. mycelialis* CBS 7712^T - AF408417
 - H. nyarrowii* CBS 8805^T - AF400697
 - H. wattica* CBS 9496^T - FJ473373
- Holtermannia corniformis* CBS 6979^T - AF410472
- Filobasidium globisporum* CBS 7642^T - AF444336

Contributions from Patagonia to yeast... taxonomy (Agaricomycotina)



Agaricomycotina (D1/D2)

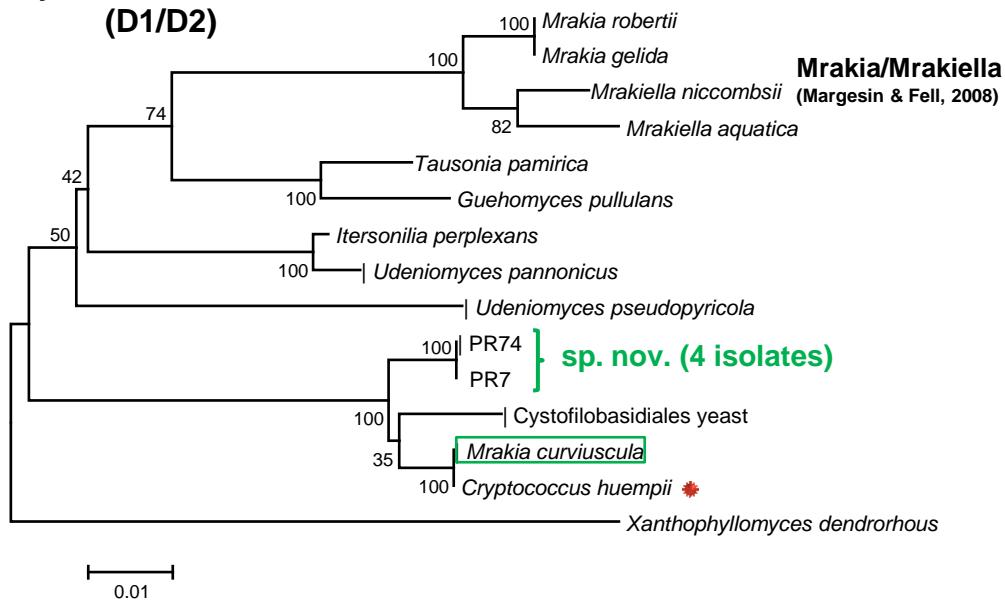
Cryptococcus



- Description of new genus/species
- Review status of *Mrakia curviuscula*
- New combination for *Crypt. huempfii*

Polyphyletic *Cryptococcus* restricted to 3 orders: Tremellales, Trichosporonales and Filobasidiales

Cystofilobasidiales (D1/D2)



Contributions from Patagonia to yeast... taxonomy (Agaricomycotina)

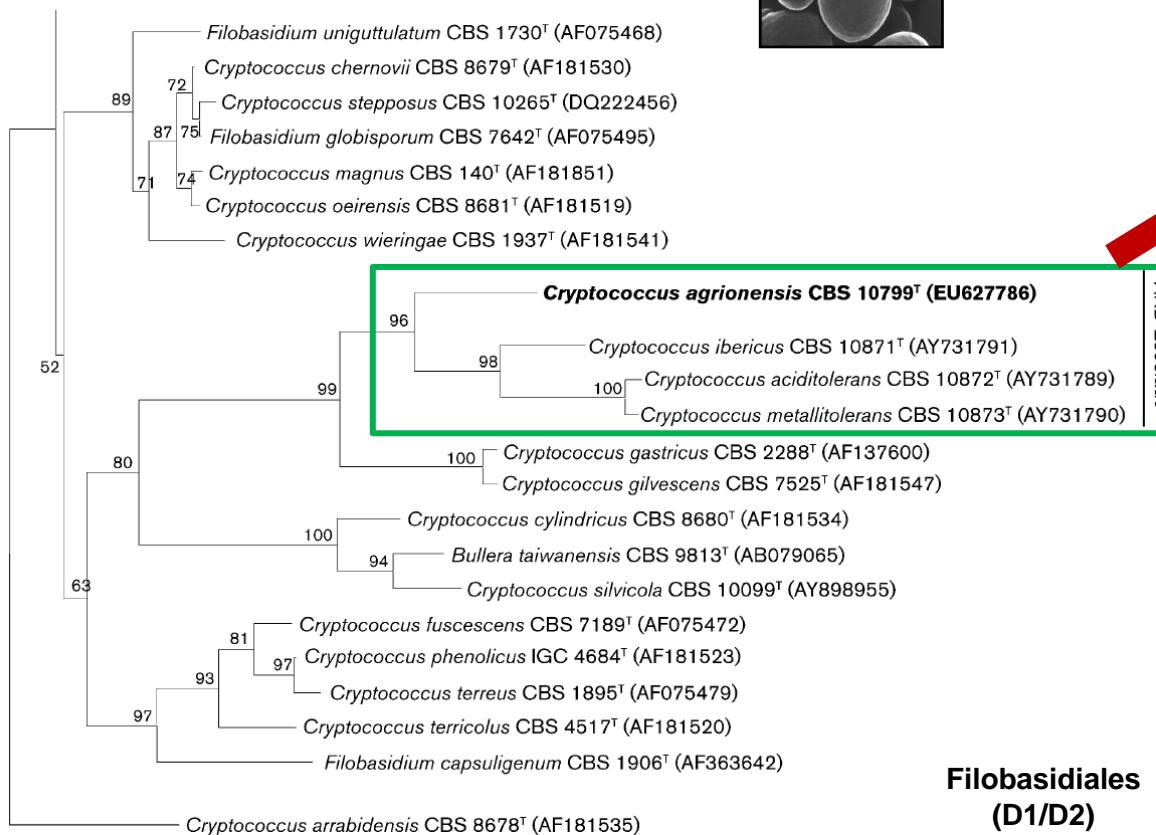
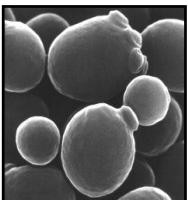


New concept: Eoclade (Gadanho & Sampaio, 2009)

Extreme environments:

pH (1.8-2.7) Toxic metals

➤ Acidotolerant yeasts and highly resistant to toxic metals



Exclusive combination of phylogenetic and ecological characteristics.

Volcanic origin (Russo et al., 2010)



Anthropogenic origin

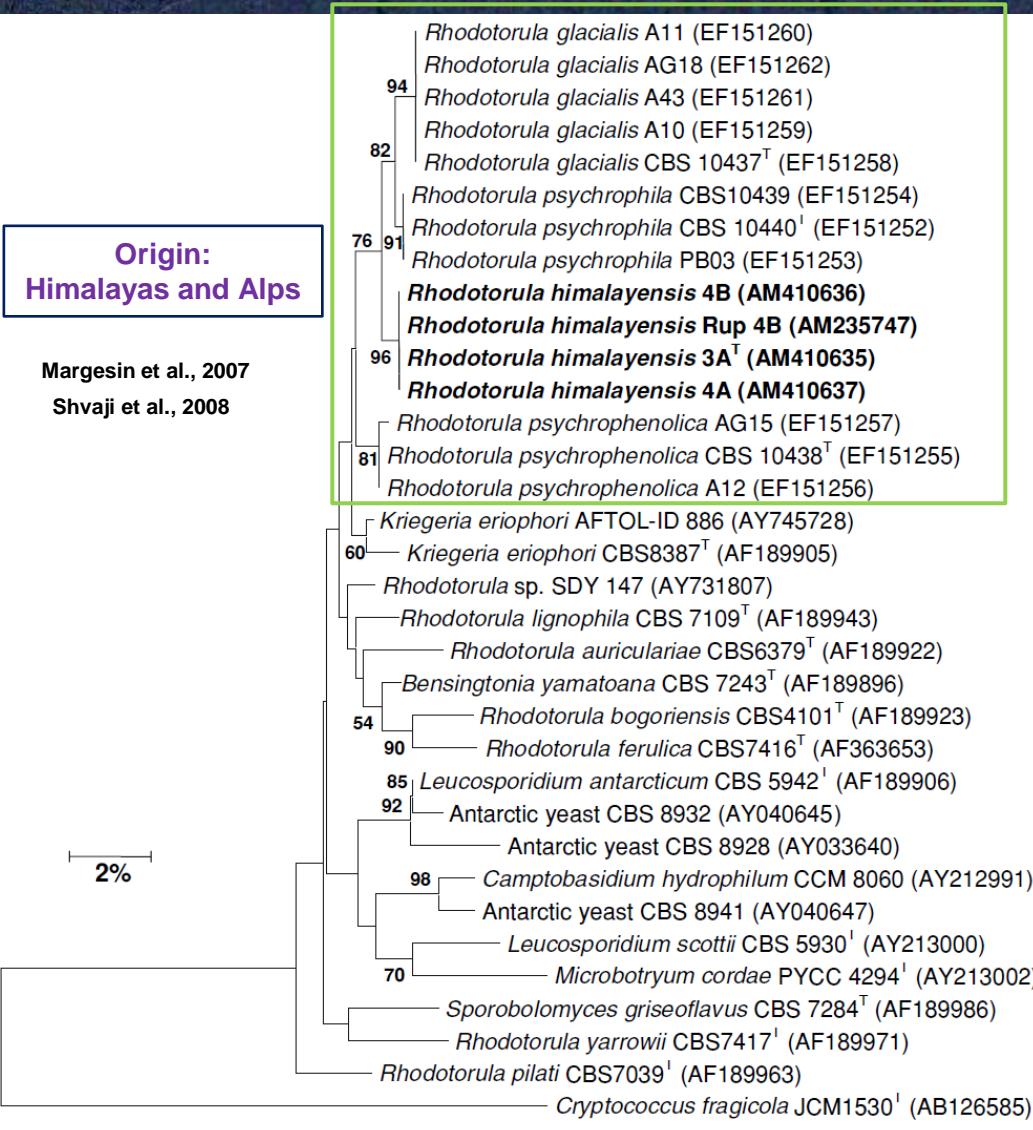


ARD: Acid Rock Drainage

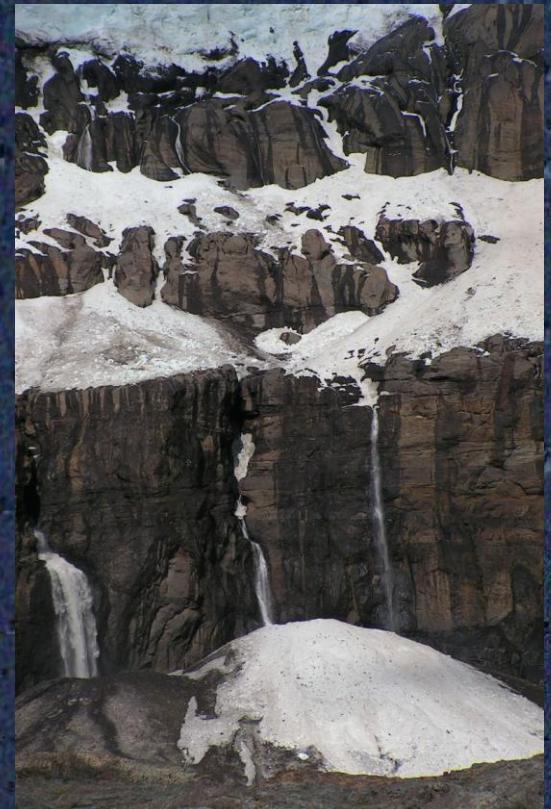
Contributions from Patagonia to yeast... taxonomy (Ecoclade)



➤ New concept: Ecoclade (Gadanho & Sampaio, 2009)



➤ Other example of an Ecoclade: Psychrophytic yeasts in the Microbotryomycetes

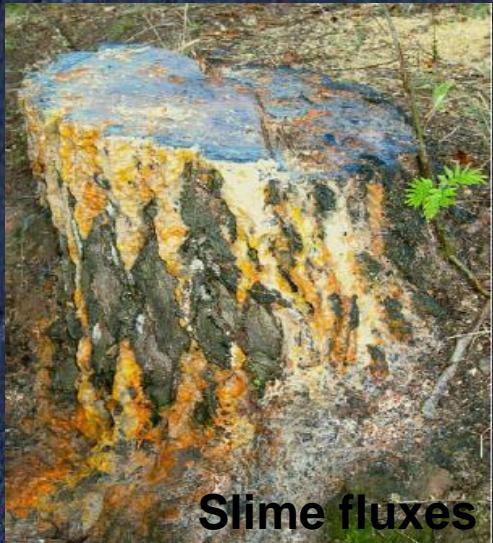


Contributions from Patagonia to yeast... biogeography



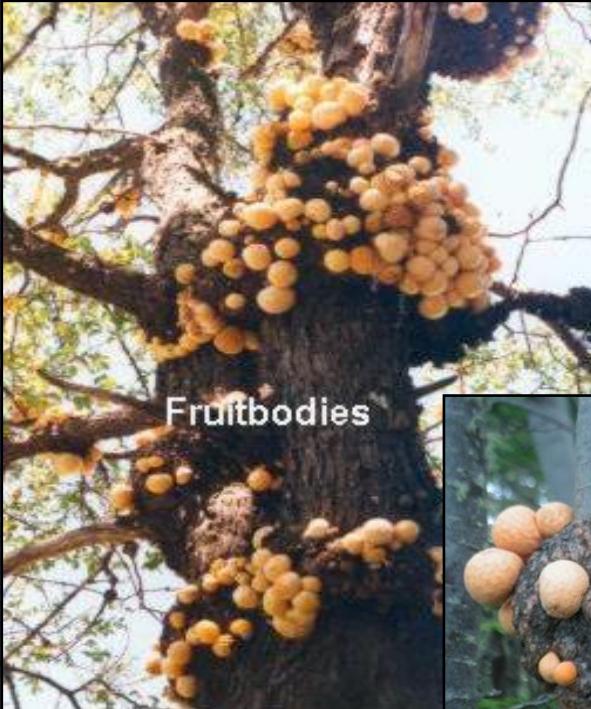
Xanthophyllomyces dendrorhous (Cystofilobasidiales)

North hemisphere



Betula, Cornus, Fagus trees

South hemisphere



Fruitbodies



Astaxanthin

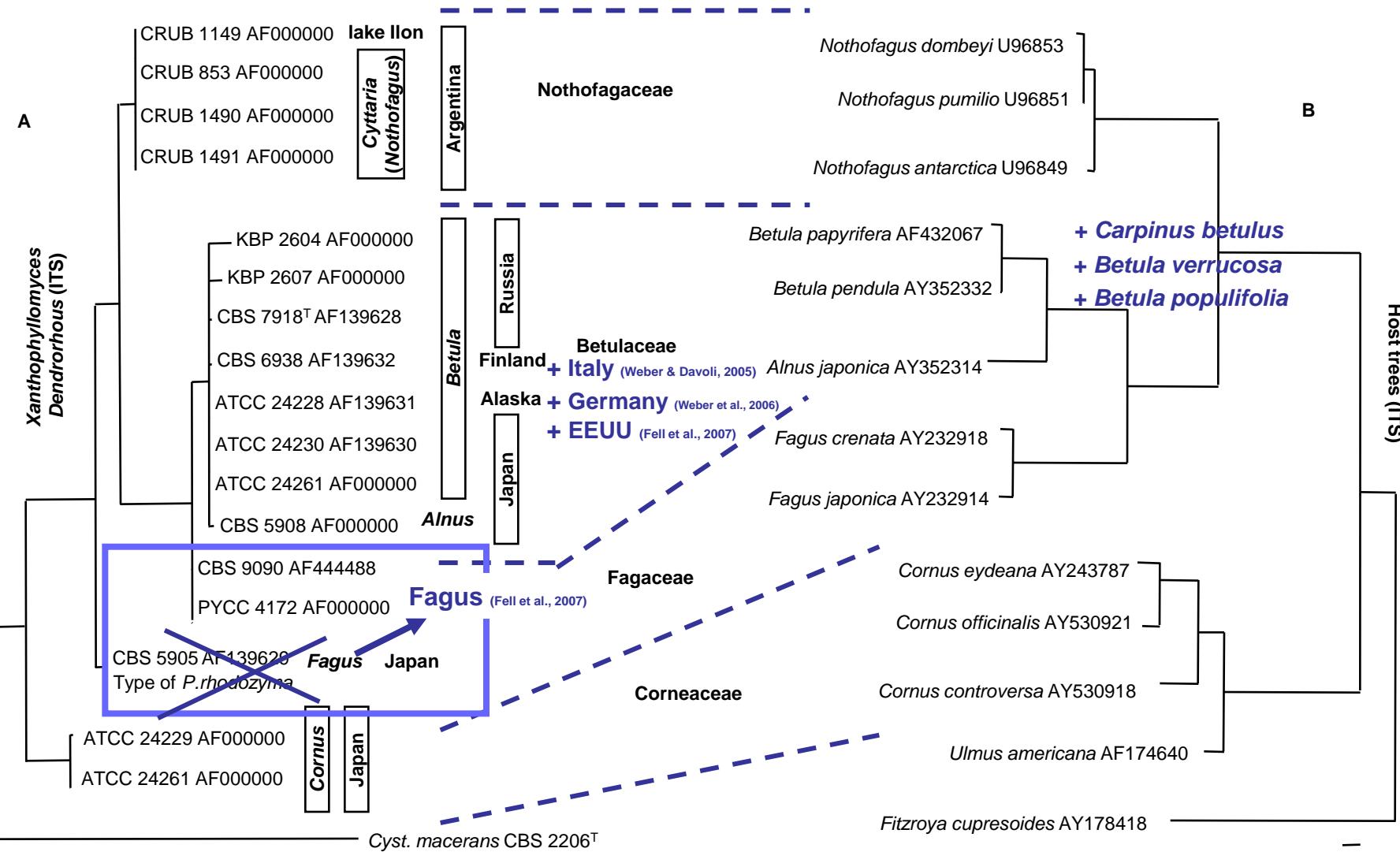


Cyttaria spp., exclusive parasite of *Nothofagus* trees

Contributions from Patagonia to yeast... biogeography



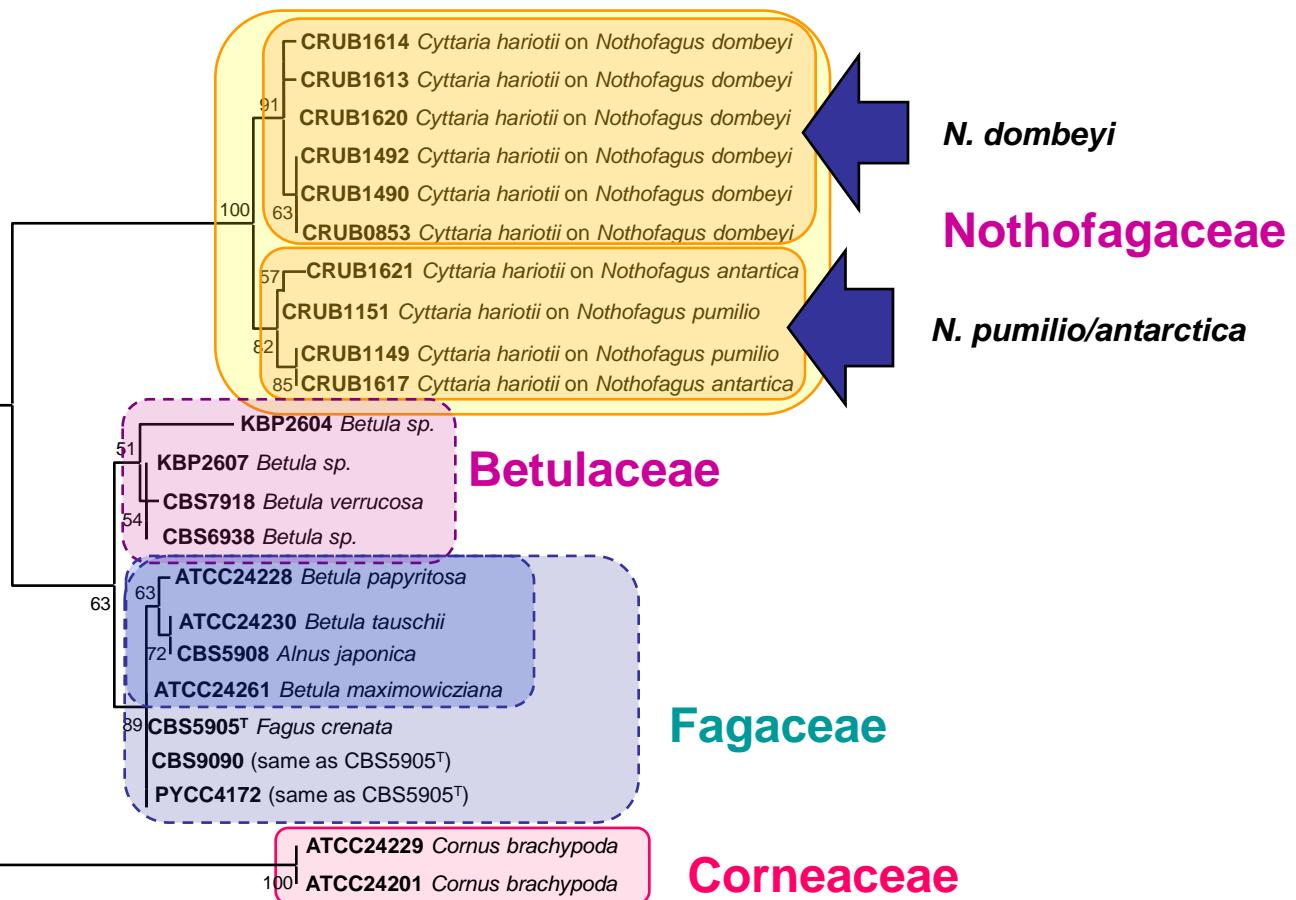
Relationship between *X. dendrophilous* lineages and hosts



Contributions from Patagonia to yeast... biogeography

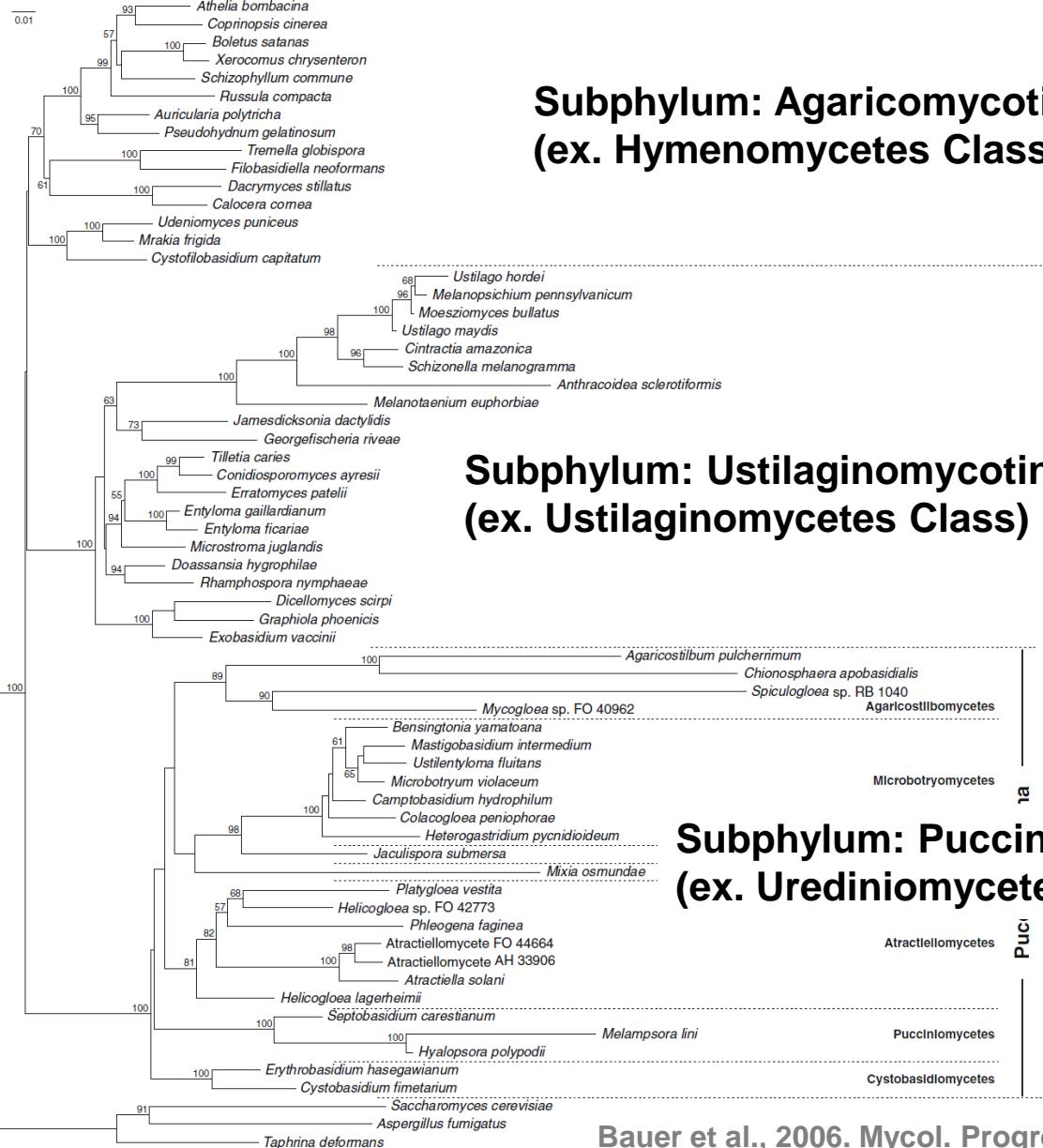
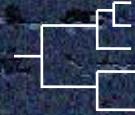


Phylogeny based on *crtl*, *crtS* and *idi* genes of *X. dendrorhous*

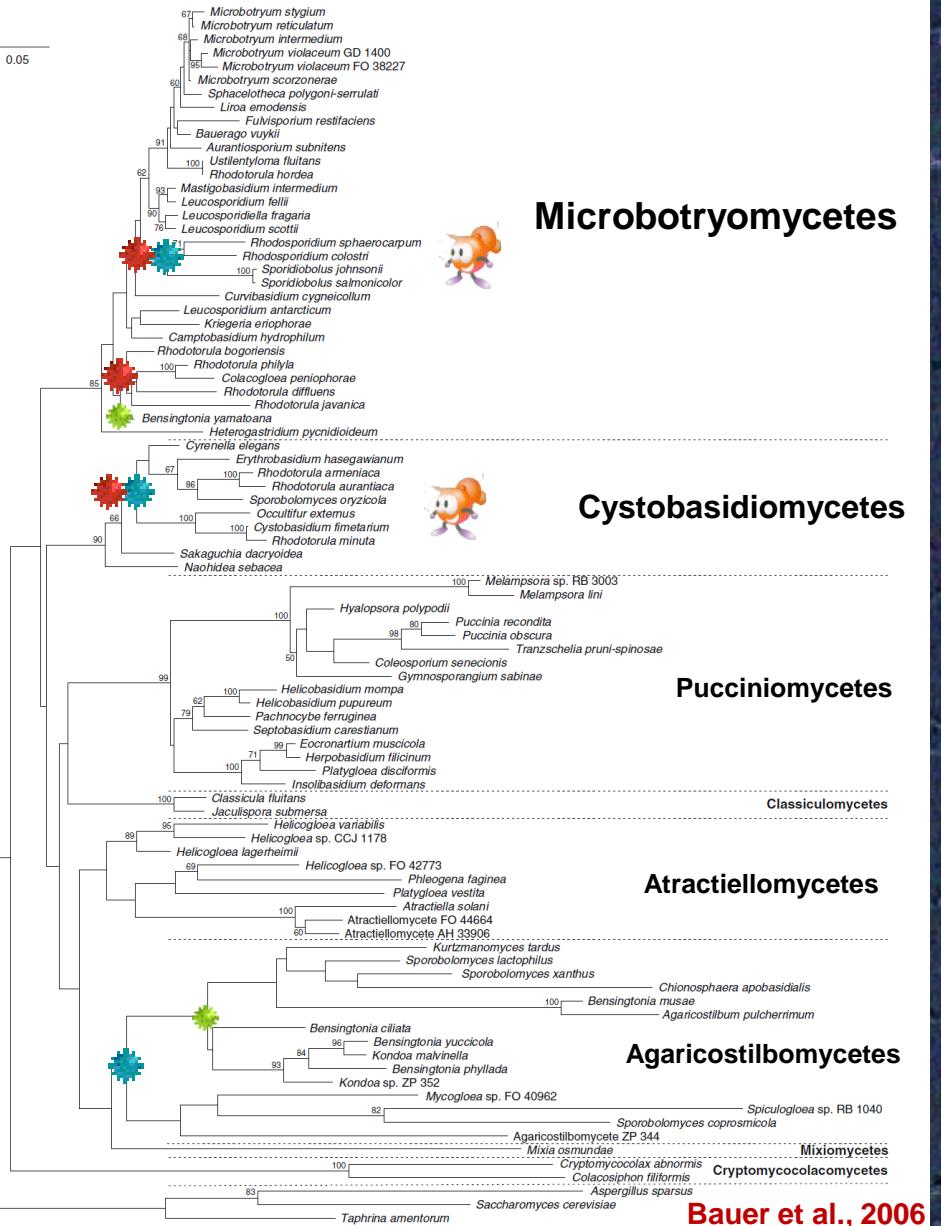


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Contributions from Patagonia to yeast... taxonomy (Basidiomycota)



Contributions from Patagonia to yeast... taxonomy (Pucciniomycotina)



Polyphyletic genera:

Rhodotorula

Sporobolomyces

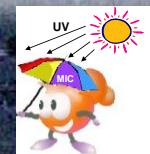
Bensingtonia



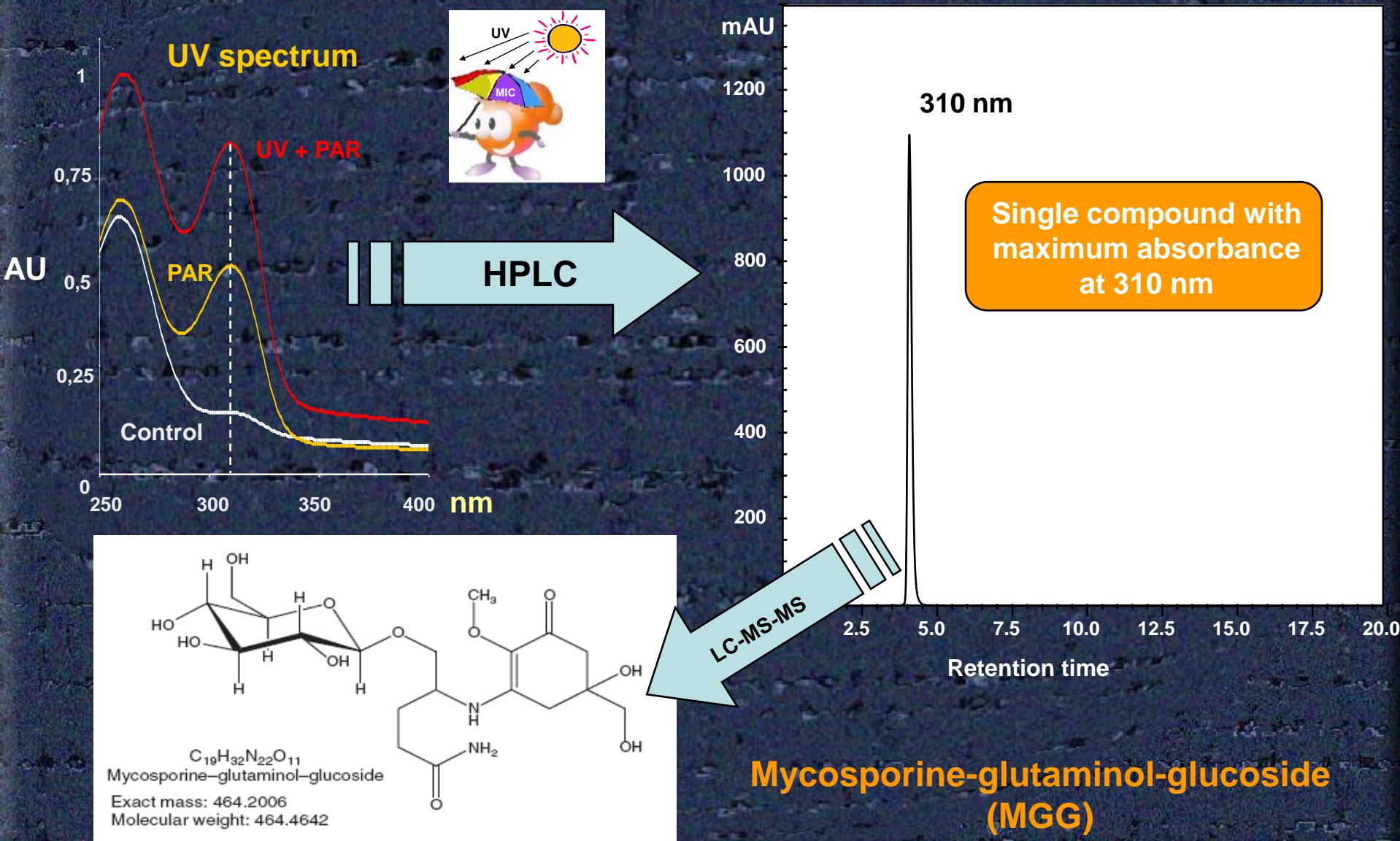
Carotenogenic (red) yeasts

Ballistoconidia forming yeasts

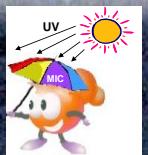
Contributions from Patagonia to yeast... Taxonomy (Mycosporines)



Mycosporines (MYC) in yeasts: Chemotaxonomical value

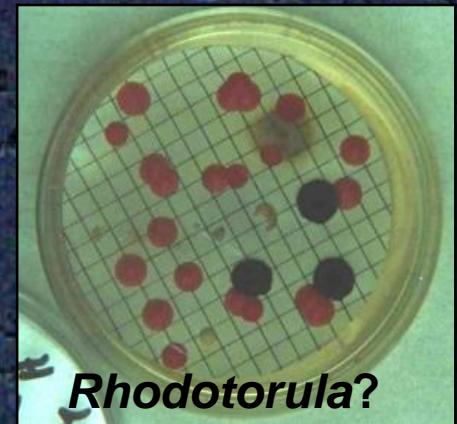
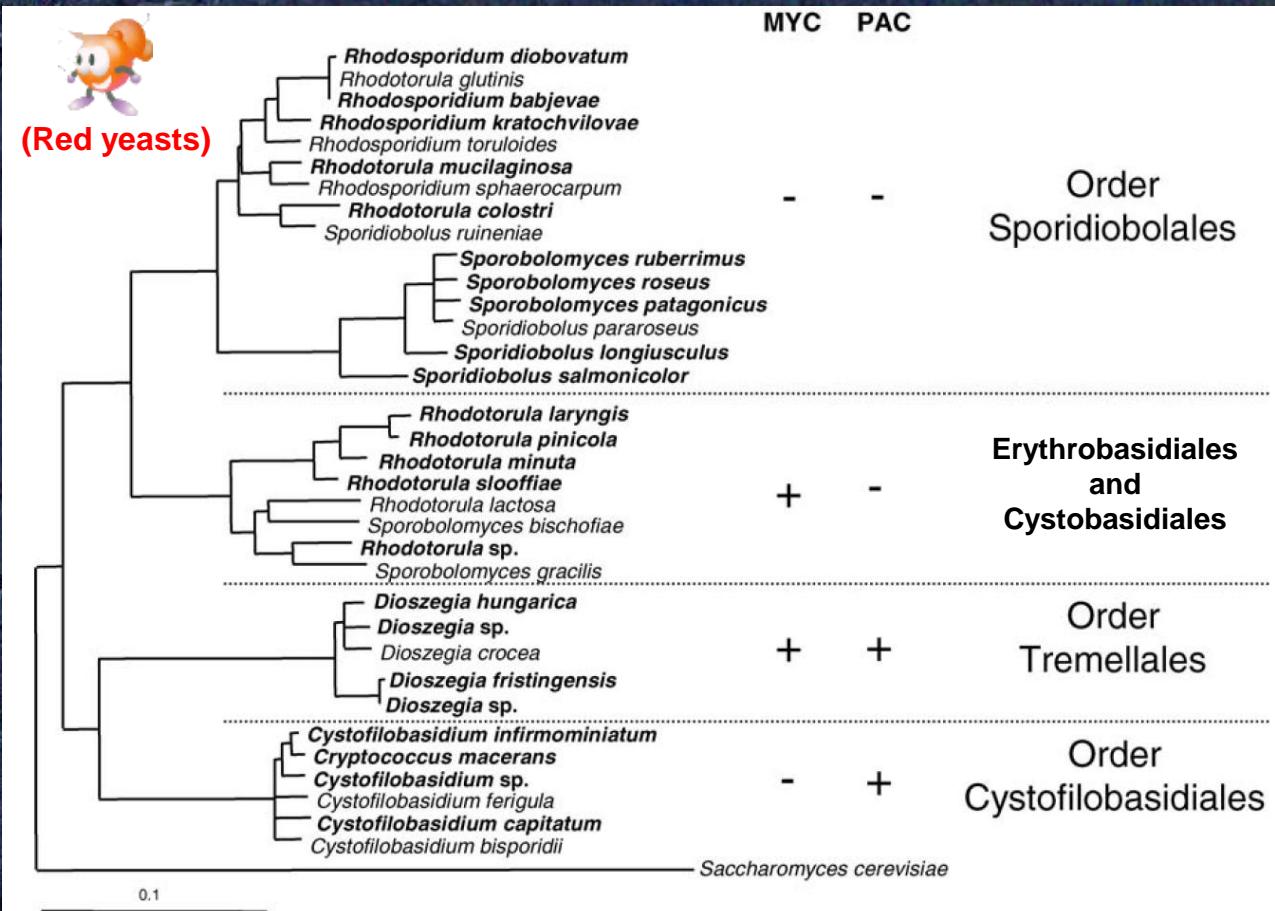


Contributions from Patagonia to yeast... Taxonomy (Mycosporines)



Mycosporines (MYC) in yeasts: Chemotaxonomical value

Species-specific characteristic

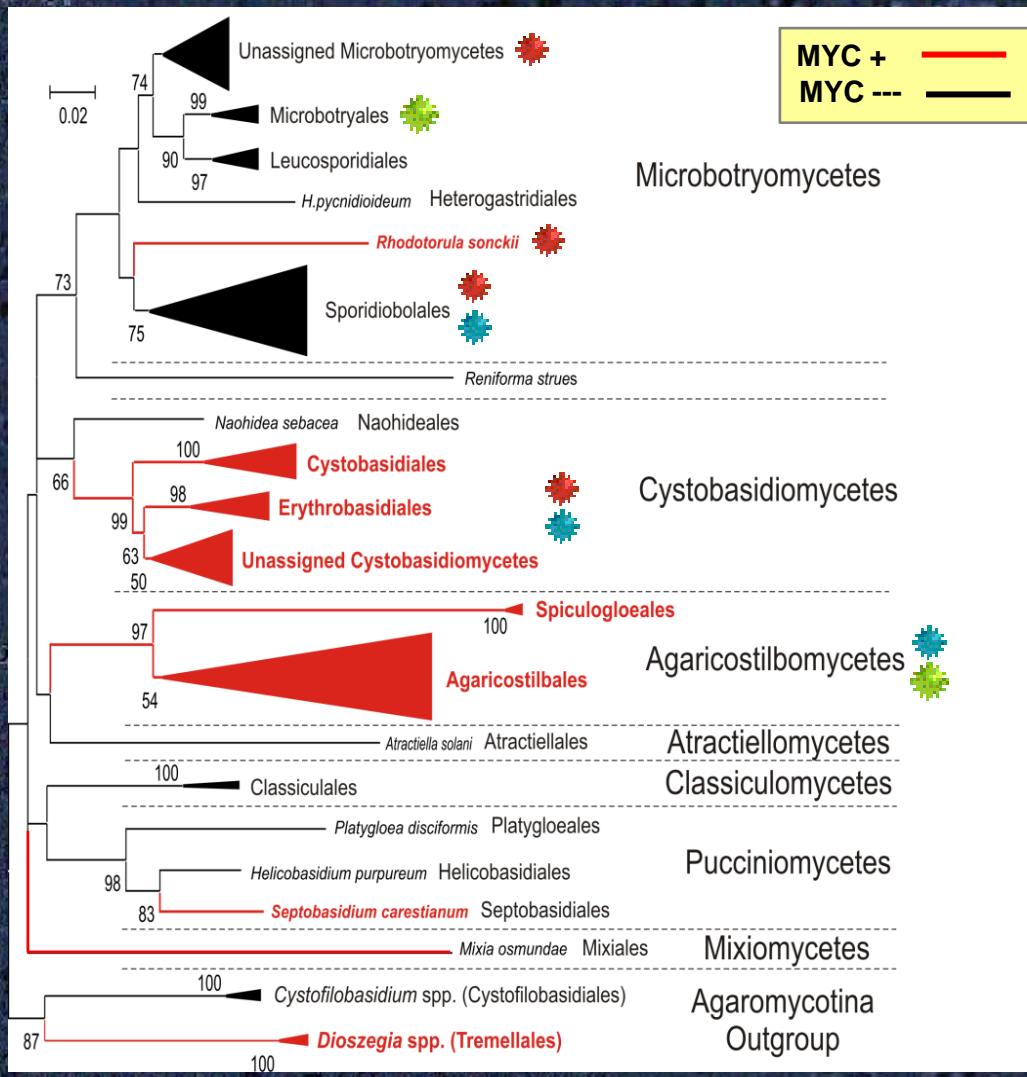


MYC, Mycosporine production; PAC, Production of amilaceous compounds

Contributions from Patagonia to yeast... Taxonomy (MYC:Pucciniomycotina)



Chemotaxonomical value of Mycosporines (MYC) in yeasts



Polyphyletic genera:

Rhodotorula

Sporobolomyces

Bensingtonia

Final Remarks



- Very few culture collections contain significant numbers of native yeasts from south-american natural environments, none is registered in WFCC or FELACC.
- ~20.000 south-american native yeast strains, are being preserved in only three culture collections. Including over 130 novel species. However, only 30-45% of these strains have been so far identified.
- Proposal of a new order and genus in the Agaricomycotina and reduction of the *Cryptococcus* polyphyletic condition.
- Contributions to the biogeography and population genetics of *Xanthophyllomyces*.
- The screening of Mycosporines synthesis in Pucciniomycotina, revealed this molecule has considerable value as a complementary chemotaxonomical tool.

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Lab. Microbiología Aplicada y Biotecnología – CRUB - UNComahue



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Dr. Martin Moline



Lic. Virginia de García



Lic. Cecilia Mestre



Lic. Natalia Fernández



Lic. Mario Muñoz



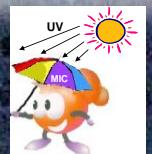
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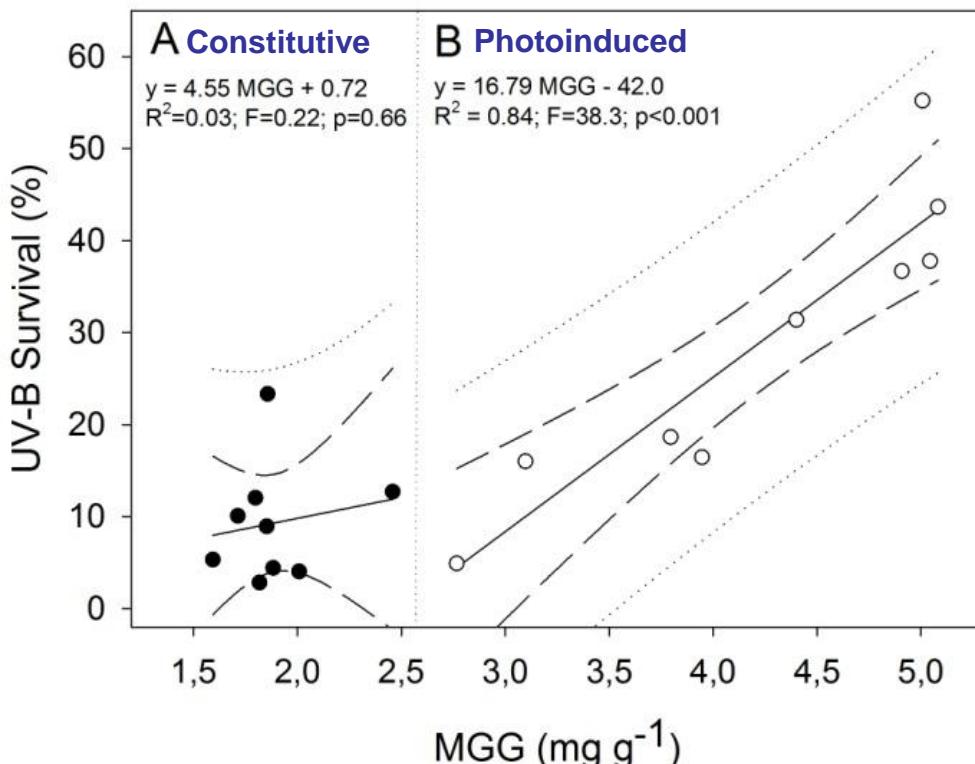


Contributions from Patagonia to yeast... Photobiology



Photoprotective role of MGG in yeasts

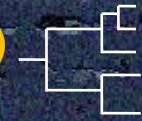
Cryptococcus stepposus



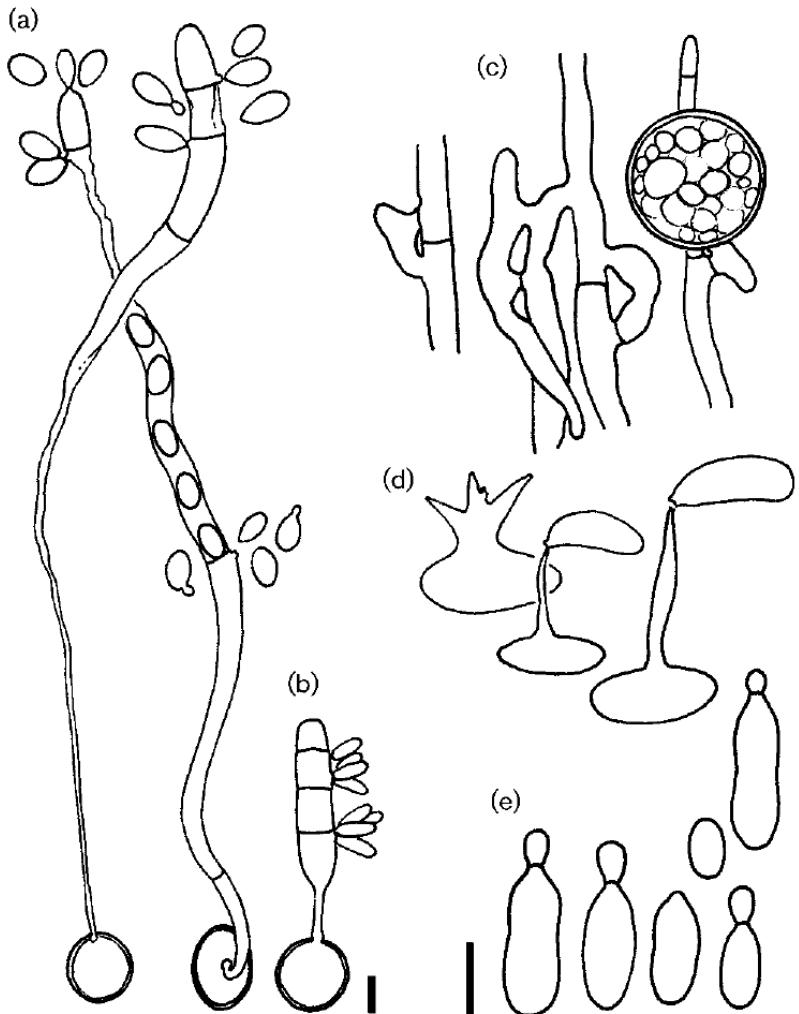
Moline et al., in press. Radiation Research

Strains with higher MGG levels are more tolerant to UV-B radiation

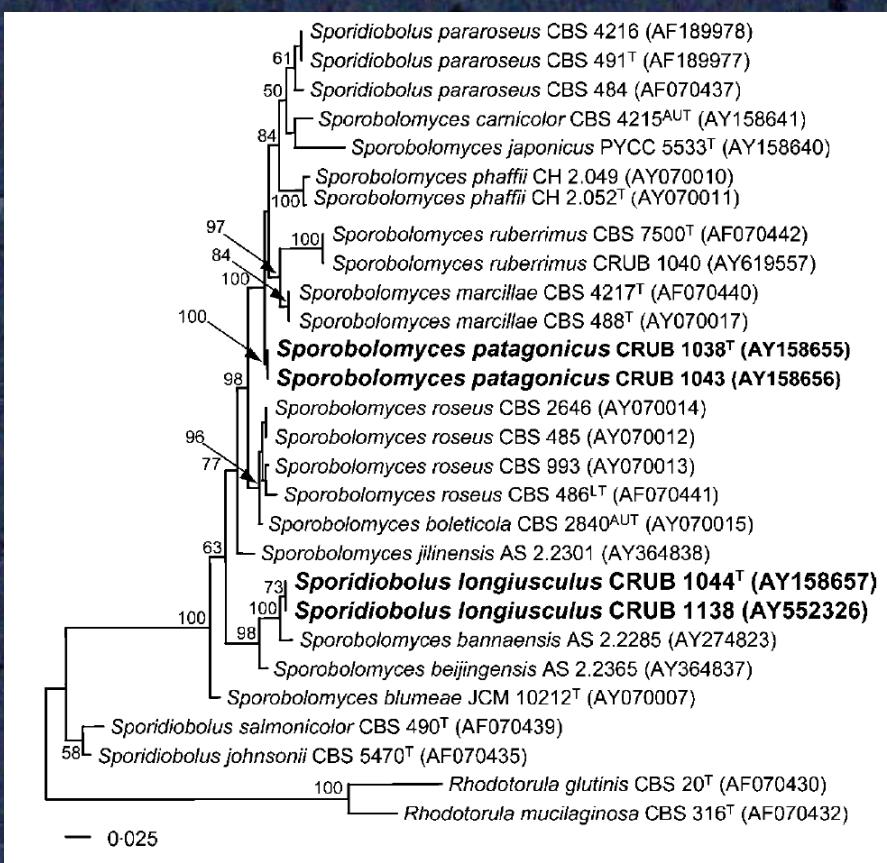
Contributions from Patagonia to yeast... taxonomy (Pucciniomycotina)



Novel ballistoconidia forming yeasts of the Sporidiobolales



Sporidiobolus longiusculus *Sporobolomyces patagonicus*



Contributions from Patagonia to yeast... taxonomy (Agaricomycotina)



Cystofilobasidium lacus-mascardii sp. nov.



Description of sexual state of *Cryptococcus macerans* -> *Cyst. macerans*

Cystofilobasidiales (D1/D2)

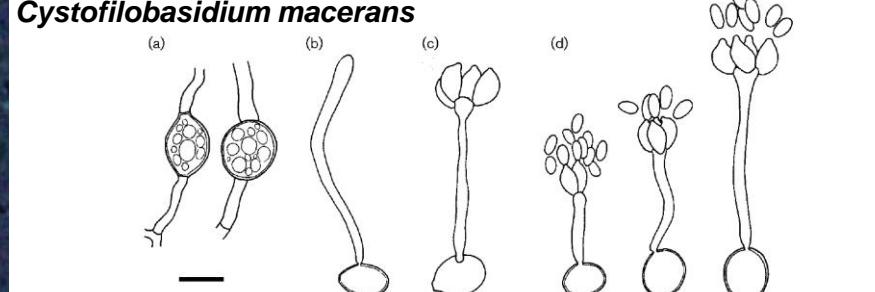
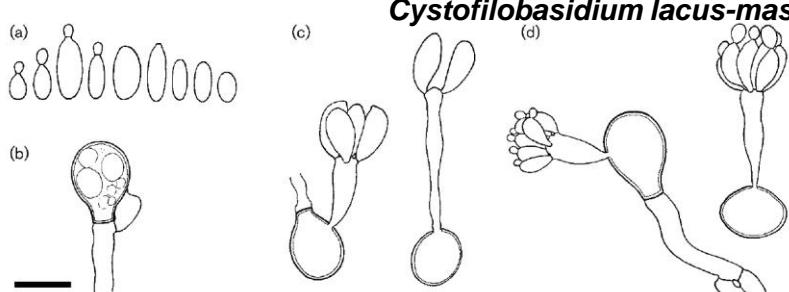
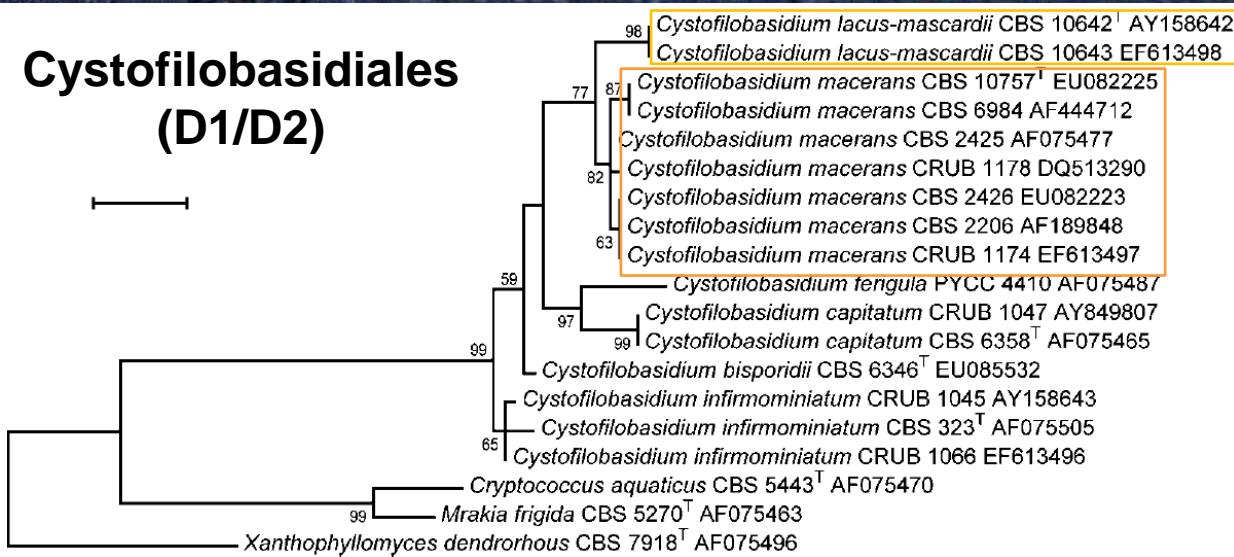


Fig. 2. Line drawings of *Cystofilobasidium lacus-mascardii* sp. nov. (a) Yeast cells of CBS 10642^T on MYP agar after 6 days at 20 °C. (b) Terminal teliospore of CBS 10642×CBS 10643. Note the clamp connection at the base of the teliospore. (c, d) Germinated teliospores with basidia and basidiospores of CBS 10642×CBS 10643. Note that, in (d), the basidiospores are forming buds while still attached to the basidia. Bar, 10 µm (same for all panels).

Fig. 4. Line drawings of *Cystofilobasidium macerans* sp. nov. CBS 10757^T, CBS 6984 and CBS 2206×CBS 2426. (a) Hyphae and mature teliospores (note the absence of clamp connections). (b) Initial stage of teliospore germination with young basidium. (c) Basidium with four basidiospores. (d) Mature basidia with basidiospores that are forming yeast cells by budding while still attached to the basidia. Bar, 10 µm (same for all panels).