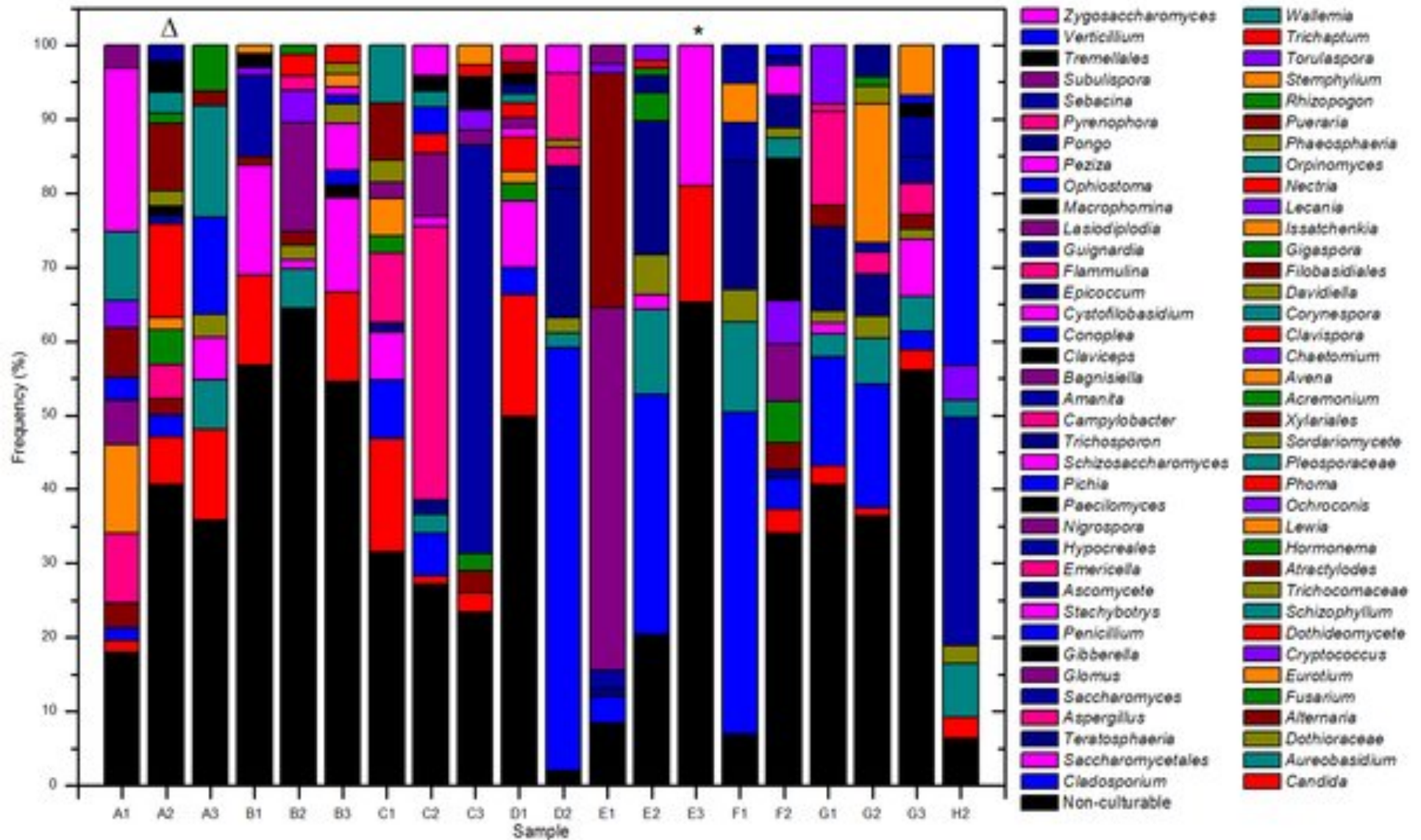
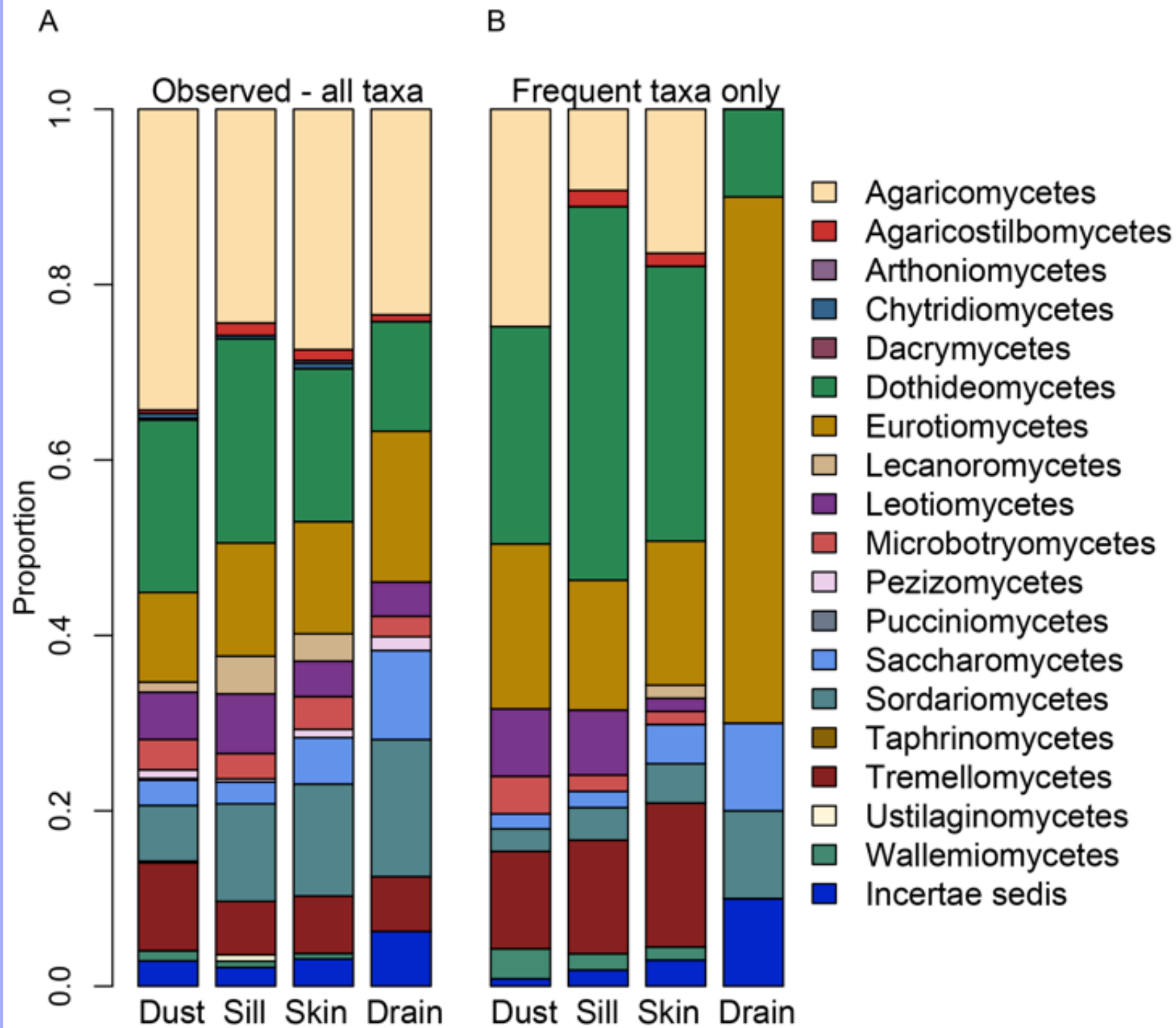


# NGS and molecular identification of fungi

Henrik Nilsson, University of Gothenburg





# High proportion of incorrectly identified fungi

<input type="checkbox"/>	<a href="#">Uncultured Basidiomycota clone 6Bart1173S internal transcribed spacer 1, partial sequence; 5.8S r</a>	715	715	100%	0.0	100%	<a href="#">HQ022034.1</a>
<input type="checkbox"/>	<a href="#">Ascomycota sp. UP606 internal transcribed spacer 1, partial sequence; 5.8S ribosomal RNA gene,</a>	715	715	100%	0.0	100%	<a href="#">EF493313.1</a>
<input type="checkbox"/>	<a href="#">Uncultured ectomycorrhizal fungus clone 1042/19 internal transcribed spacer 1, partial sequence; 5</a>	715	715	100%	0.0	100%	<a href="#">DQ233781.1</a>
<input type="checkbox"/>	<a href="#">Ectomycorrhizal root tip 93-sepA_Ny1.EB-23.5 internal transcribed spacer 1, partial sequence; 5.8S</a>	715	715	100%	0.0	100%	<a href="#">AF476985.1</a>
<input type="checkbox"/>	<a href="#">Ascomycota sp. UP605 internal transcribed spacer 1, partial sequence; 5.8S ribosomal RNA gene,</a>	712	712	99%	0.0	100%	<a href="#">EF493312.1</a>
<input type="checkbox"/>	<a href="#">Uncultured fungus clone 3268K22 18S ribosomal RNA gene, partial sequence; internal transcribed</a>	658	658	99%	0.0	97%	<a href="#">KF617614.1</a>
<input type="checkbox"/>	<a href="#">Uncultured Pezizomycotina clone d331_1_13 18S ribosomal RNA gene, partial sequence; internal t</a>	636	636	99%	5e-179	96%	<a href="#">JQ346868.1</a>
<input type="checkbox"/>	<a href="#">Uncultured Pezizomycotina clone d330a_1_6 18S ribosomal RNA gene, partial sequence; internal t</a>	630	630	99%	3e-177	96%	<a href="#">JQ346852.1</a>
<input type="checkbox"/>	<a href="#">Uncultured fungus clone c67 18S ribosomal RNA gene, partial sequence; internal transcribed space</a>	627	627	100%	3e-176	96%	<a href="#">HM030615.1</a>

## Correct identification: *Archaeorhizomycetes*

Science 12 August 2011:  
Vol. 333 no. 6044 pp. 876–879  
DOI: 10.1126/science.1206958

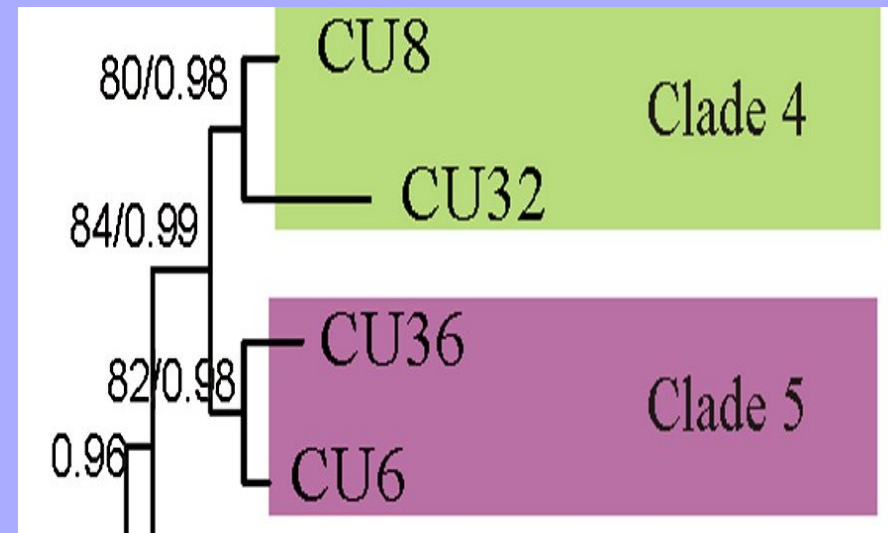
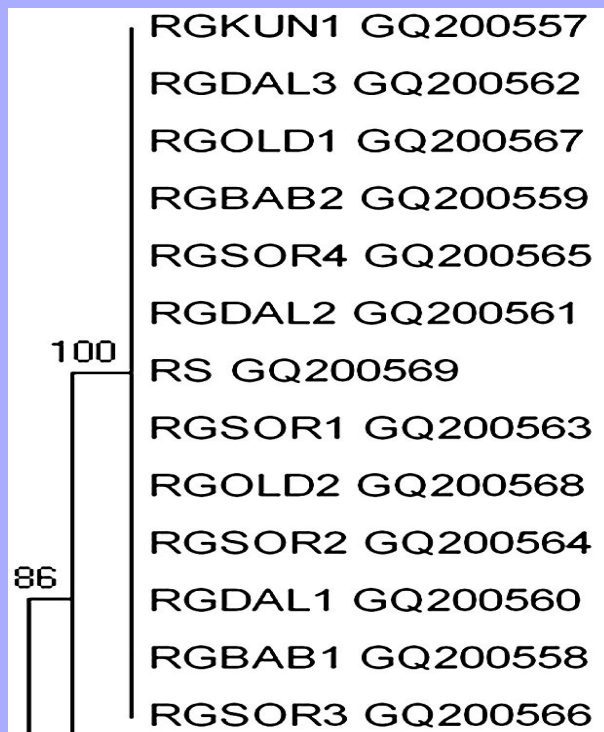
[< Prev](#) | [Table of Contents](#) | [Next >](#)

### REPORT

## Archaeorhizomycetes: Unearthing an Ancient Class of Ubiquitous Soil Fungi

Anna Rosling<sup>1,2,\*</sup>, Filipa Cox<sup>3</sup>, Karelyn Cruz-Martinez<sup>1</sup>, Katarina Ihrmark<sup>1</sup>, Gwen-Aëlle Grelet<sup>4</sup>,  
Björn D. Lindahl<sup>1</sup>, Audrius Menkis<sup>1</sup>, Timothy Y. James<sup>5,\*</sup>

# No name – no communication



	ITS1	5.8S	ITS2	Total	Percentage
<b>RG1ITS</b>					
Number of bases	193	154	243	590	
Number of substitution sites within isolates	2	0	10	12	2.03
<b>RG2ITS</b>					
Number of bases	192	154	243	589	
Number of substitution sites within isolates	2	0	4	6	1.02

CU 24	NRRL 58537	<i>Eugenia jambos</i> (Rose apple)	Chanthaburi (January 2006)
CU 25	NRRL 58538	<i>Lansium domesticum</i> Corr.	Chanthaburi (January 2006)
CU 26	NRRL 58539	<i>Cerbera odollum</i> Gaertn.	Nakhonratchasima (January 2006)
CU 27	NRRL 58540	<i>Kerriodoxa elegans</i> (Palm)	Prachuapkhirikhan (February 2006)
CU 28	NRRL 58541	<i>Pinus merkusii</i> Jungh. & de Vriese (Needle pine)	Prachuapkhirikhan (February 2006)
CU 29	NRRL 58542	<i>Pinus merkusii</i> Jungh. & de Vriese (Needle pine)	Prachuapkhirikhan (February 2006)
CU 30	NRRL 58543	Wood surface	Prachuapkhirikhan (February 2006)
CU 31	NRRL 58544	<i>Pinus merkusii</i> Jungh. & de Vriese (Needle pine)	Prachuapkhirikhan (February 2006)
CU 32	NRRL 58545	<i>Mangifera indica</i> L. (Mango)	Trat (March 2006)
CU 33	NRRL 58546	<i>Pandanus odoratissimus</i> (Screw pine)	Prachuapkhirikhan (March 2006)
CU 35	NRRL 58547	<i>Hopea ferrea</i> Laness.	Patumthani (March 2006)



## The UNITE database (<http://unite.ut.ee>)

- All fungal ITS sequences in GenBank
- ...clustered to ~species level (95%-100% similarity in 0.5% steps) – *species hypotheses*

[illegible]

- ...unique names of all such species hypotheses:

Archaeorhizomyces | AY394904 | SH197124.06FU

Or in short: **SH197124.06FU**

http://unite.ut.ee/sh/SH197124.06FU


FirefoxFileEditViewHistoryBookmarksToolsWindowHelp

Outlook Web AppUNITE - Species Hypotheses

unite.ut.ee/sh/SH197124.06FU

Google

Most VisitedSave to Mendeleystats.distributed....The rc5 ArchivesR. Henrik Nilsson...ResearchGateftp://ftp.ncbi.nih....



Unified system for the DNA based fungal species linked to the classification  
Ver. 6.0

HomeRun AnalysisAnnotationsSearch PagesWorkbenchResourcesNotes and newsAcknowledgements

Username: \*\*\*\*\*Log in

Species Hypothesis pages version 6 (release date: pre-release)

Archaeorhizomyces | SH197124.06FU

Distance to the closest SH (read more): 1.5%


No of sequences in SH: 6

Placement in the fungal classification (read more):  
Fungi; Ascomycota; Taphrinomycotina; Archaeorhizomycetes; Incertae sedis;  
Archaeorhizomycetales; Archaeorhizomycetaceae

Links to taxon name in: Index Fungorum; NCBI

Representative sequence (selected automatically by the program): AY394904

Large map (incl. map info)



MapSatellite

Google

Terms of Use

1.5%1%0.5%2%2.5%3%

Sequence ID	UNITE taxon name	INSID taxon name	Country	DNA source	Interacting taxa	Clustering based on: Full ITS
<a href="#">more</a>   <a href="#">FJ152542</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pezizomycotina)	Canada	Ectomycorrhiza	Tsuga heterophylla	-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA
<a href="#">more</a>   <a href="#">EU057084</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pezizomycotina)	Canada	Ectomycorrhiza	Tsuga heterophylla	-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA
<a href="#">more</a>   <a href="#">DQ481985</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pezizomycotina)	Canada	Ectomycorrhiza	Tsuga heterophylla	-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA
<a href="#">more</a>   <a href="#">DQ481984</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pezizomycotina)	Canada	Ectomycorrhiza	Tsuga heterophylla	-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA
<a href="#">more</a>   <a href="#">AY394904</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pezizomycotina)	Canada	Living culture	Tsuga heterophylla	-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA
<a href="#">more</a>   <a href="#">JQ989336</a>	Archaeorhizomyces	Fungi (uncultured fungus)				-----ATGAATGGC-----TTTGCC-TTCAACCA--TCAACCCGTGGAAGCAAGACGTGCTTTGGCGCTCCGA--CGCCACGTTTA

chimeric

low quality

UNITE core sequence

automatically chosen SH representative sequence

Ex = sequence to be excluded from the next version of global key

- ...named as far as possible (phylum, class, order...)
- ...with ecological/geographical metadata
- ...with substandard sequences pruned

...web-based, third-party sequence annotation style!

Sequence ID	UNITE taxon name	INSD taxon name	Country	DNA source	Interacting taxa	97%	Alignment based on:	Full ITS
<a href="#">more</a>   <a href="#">EF434026</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Soil fungal DNA				
<a href="#">more</a>   <a href="#">GQ223472</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Germany	Orchid mycorrhiza	Gymnadenia conopsea			
<a href="#">more</a>   <a href="#">KC965637</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
<a href="#">more</a>   <a href="#">AB828010</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...						
<a href="#">more</a>   <a href="#">FJ152543</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">AY702735</a>	Archaeorhizomyces	Fungi (uncultured fungus from ...	USA	Ectomycorrhiza	Abies			
<a href="#">more</a>   <a href="#">KC876142</a>	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
<a href="#">more</a>   <a href="#">KC876143</a>	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
<a href="#">more</a>   <a href="#">JQ346852</a>	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
<a href="#">more</a>   <a href="#">JQ346868</a>	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
<a href="#">more</a>   <a href="#">DQ069012</a>	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	Lithuania	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">FR877526</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Denmark	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">FM992983</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Sweden	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">AF481369</a>	Archaeorhizomyces	Fungi (ectomycorrhizal root ti...	Sweden	Ectomycorrhiza	Pinaceae			
<a href="#">more</a>   <a href="#">HQ212270</a>	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	USA	Plant root	Betula nana			
<a href="#">more</a>   <a href="#">FJ440895</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Pyrola picta			
<a href="#">more</a>   <a href="#">HM164555</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Betula papyrifera			
<a href="#">more</a>   <a href="#">FJ626930</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Soil fungal DNA				
<a href="#">more</a>   <a href="#">EU554708</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Ectomycorrhiza	Populus			
<a href="#">more</a>   <a href="#">DQ233843</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Finland	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">HM164554</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
<a href="#">more</a>   <a href="#">HM164553</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
<a href="#">more</a>   <a href="#">JN012085</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
<a href="#">more</a>   <a href="#">JN889799</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA					
<a href="#">more</a>   <a href="#">JN032573</a>	Archaeorhizomyces	Fungi (uncultured fungus)						
<a href="#">more</a>   <a href="#">FJ152542</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">DQ481984</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">DQ481985</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">EU057084</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">AY394904</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Living culture	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">JQ989336</a>	Archaeorhizomyces	Fungi (uncultured fungus)						
<a href="#">more</a>   <a href="#">HM030615</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Soil fungal DNA				

- ...and circumscribed as well as possible

Some SHs are best circumscribed at 97%:

<a href="#">more</a>   <a href="#">JF911350</a>	Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">HQ433226</a>	Colletotrichum (Colletotrichum...	Australia		
<a href="#">more</a>   <a href="#">JF911349</a>	Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">KC790947</a>	<b>Colletotrichum sansevieriae</b>	Japan	Living culture ( <b>Ex-type</b> )	
<a href="#">more</a>   <a href="#">KC847065</a>	Colletotrichum (Colletotrichum...			

Many others require tighter clustering, here 98.5% and 99%:

<a href="#">more</a>   <a href="#">KC842385</a>	Colletotrichum (Colletotrichum...			
<a href="#">more</a>   <a href="#">KC297079</a>	<b>Colletotrichum proteae</b>		Living culture ( <b>Ex-type</b> )	
<a href="#">more</a>   <a href="#">JX010187</a>	<b>Colletotrichum nupharicola</b>	USA	Living culture ( <b>Ex-holotype</b> )	
<a href="#">more</a>   <a href="#">JX010188</a>	Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">JX145174</a>	Colletotrichum (Colletotrichum...	USA		

Others require 99.5% or 100%:

<a href="#">more</a>   <a href="#">JX014404</a>	Colletotrichum (Colletotrichum...			
<a href="#">more</a>   <a href="#">FJ981603</a>	Colletotrichum (Colletotrichum...	Brazil		
<a href="#">more</a>   <a href="#">FJ981604</a>	Colletotrichum (Colletotrichum...	Brazil		
<a href="#">more</a>   <a href="#">JQ005235</a>	<b>Colletotrichum brasiliense</b>	Brazil	Living culture ( <b>Ex-type</b> )	
<a href="#">more</a>   <a href="#">JQ005234</a>	Colletotrichum (Colletotrichum...	Brazil		

Some species have mutually fully conserved ITS regions:

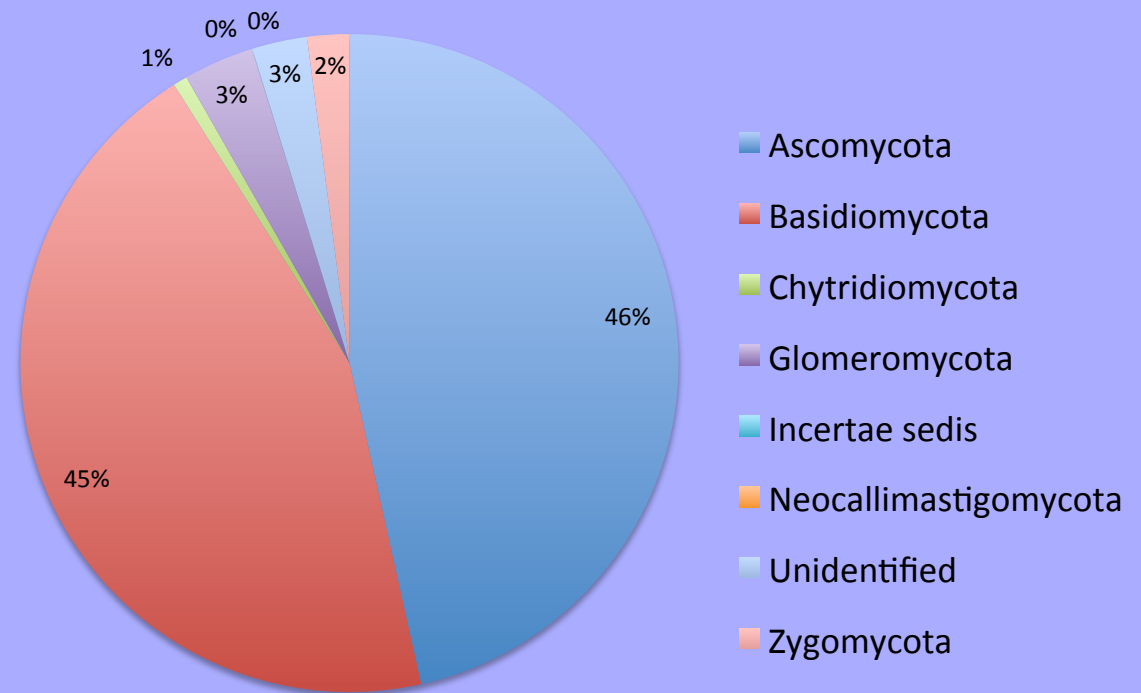
<a href="#">more</a>   <a href="#">JX145159</a>	<b>Colletotrichum temperatum</b>	Colletotrichum (Colletotrichum...	USA	Living culture ( <b>Ex-type</b> )	Vaccinium macrocarpon
<a href="#">more</a>   <a href="#">JX145135</a>		Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">KC297057</a>		Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">KC297058</a>		Colletotrichum (Colletotrichum...	USA		
<a href="#">more</a>   <a href="#">KF242093</a>		Colletotrichum (Colletotrichum...	Thailand		
<a href="#">more</a>   <a href="#">KF242094</a>	<b>Colletotrichum syzygicola</b>	Colletotrichum (Colletotrichum...	Thailand	Living culture ( <b>Ex-type</b> )	Syzygium samarangense



%	SHs	Singleton SHs
97	17 432	22 157
97.5	18 536	24 796
98	19 558	27 915
98.5	20 885	32 618
99	22 396	40 973
99.5	26 397	63 881
Dynamic	4 403 RefS 16 783 RepS	

At a default of 98.5% similarity:

20,885 non-singleton SHs  
32,618 singleton SHs



**Latest version:**

<1% of SH unassigned  
at phylum level

NGS pipelines

**SnoWMAn**

**UCHIME**



Various other databases  
and resources



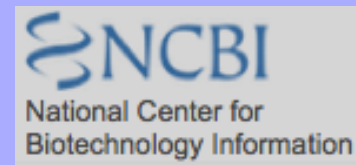
Standalone BLAST files

**ISHAM**



**mothur**

**EU BOLD**  
*EUBOLD - European Barcoding of Life Database*



**BLAST**

SCATA  
Sequence Clustering and Analysis of Tagged Amplicons  
Department of Forest Mycology and Pathology



[Home](#) [Jobs](#) [Datasets](#) [Reference Sequences](#) [Tag Sets](#) [Parameter Sets](#) [Login](#) [Register](#) [Help](#)

UNITE - fungal identification with rDNA ITS sequences | Version 6 | date: 2013-11-19 | Cluster code: UCL6\_000601

This set of sequences contains genera: Archaeorhizomyces
Total number of sequences in cluster: 75

- chimeric
  - low quality
  - UNITE core sequence
  - automatically chosen 98.5% SH representative sequence
  - Ex = sequence to be excluded from the next version of global key
- (filled, coloured circle) manually chosen SH reference sequence, overrides automatically chosen representative sequence

Sequence ID	UNITE taxon name	INSD taxon name	Country	DNA source	Interacting taxa	SH	Alignment based on: Full ITS	Order sequences by: combi
						97%		
more   EF434026	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Soil fungal DNA				
more   GQ223472	Archaeorhizomyces	Fungi (uncultured fungus)	Germany	Orchid mycorrhiza	Gymnadenia conopsea			
more   KC965637	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
more   AB828010	Archaeorhizomyces	Fungi (uncultured ectomycorri...						
more   FJ152543	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
more   AY702735	Archaeorhizomyces	Fungi (uncultured fungus from ...	USA	Ectomycorrhiza	Abies			
more   KC876142	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
more   KC876143	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
more   JQ346852	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
more   JQ346868	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
more   DQ069012	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	Lithuania	Ectomycorrhiza	Picea abies			
more   FR877526	Archaeorhizomyces	Fungi (uncultured ectomycorri...	Denmark	Ectomycorrhiza	Picea abies			
more   FM992983	Archaeorhizomyces	Fungi (uncultured ectomycorri...	Sweden	Ectomycorrhiza	Picea abies			
more   AF481369	Archaeorhizomyces	Fungi (ectomycorrhizal root ti...	Sweden	Ectomycorrhiza	Pinaceae			
more   HQ212270	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	USA	Plant root	Betula nana			
more   FJ440895	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Pyrola picta			
more   HM164555	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Betula papyrifera			
more   FJ626930	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Soil fungal DNA				
more   EU554708	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Ectomycorrhiza	Populus			
more   DQ233843	Archaeorhizomyces	Fungi (uncultured ectomycorri...	Finland	Ectomycorrhiza	Picea abies			
more   HM164554	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
more   HM164553	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
more   JN012085	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
more   JN889799	Archaeorhizomyces	Fungi (uncultured fungus)	USA					
more   JN032573	Archaeorhizomyces	Fungi (uncultured fungus)						
more   FJ152542	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
more   DQ481984	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
more   DQ233781	Archaeorhizomyces finlayi	Fungi (uncultured ectomycorri...	Finland	Ectomycorrhiza	Picea abies			
more   AF476985	Archaeorhizomyces finlayi	Fungi (ectomycorrhizal root ti...	Sweden	Ectomycorrhiza	Pinaceae			
more   EF493313	Archaeorhizomyces finlayi	Ascomycota (Ascomycota sp UP60...	Sweden					
more   HQ022034	Archaeorhizomyces finlayi	Basidiomycota (uncultured Basi...	USA	Soil fungal DNA				
more   EF493312	Archaeorhizomyces finlayi	Ascomycota (Ascomycota sp UP60...	Sweden					
more   JF836021	Archaeorhizomyces finlayi	Archaeorhizomyces (Archaeorhiz...	Sweden	Living culture (Ex-holotype)				
more   JQ912673	Archaeorhizomyces finlayi	Archaeorhizomyces (Archaeorhiz...						
more   EF619847	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	USA	Fungal mycelium (ingrowth bag)	Pinus taeda			
more   JQ711841	Archaeorhizomycetales	Ascomycota (Ascomycota sp RT_2...	Canada	Ectomycorrhiza	Pinus contorta			
more   HM146849	Archaeorhizomvces	Ascomvcota (uncultured Ascomvc...	Great Britain	Ectomvcorrhiza	Pinus sylvestris			

## INSD taxon name

Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured ectomycorrhhi...  
Pezizomycotina (uncultured Pez...  
Fungi (uncultured fungus from ...  
Taphrinomycotina (uncultured A...  
Taphrinomycotina (uncultured A...  
Pezizomycotina (uncultured Pez...  
Pezizomycotina (uncultured Pez...  
Ascomycota (uncultured Ascomyc...  
Fungi (uncultured ectomycorrhhi...  
Fungi (uncultured ectomycorrhhi...  
Fungi (ectomycorrhizal root ti...  
Ascomycota (uncultured Ascomyc...  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured ectomycorrhhi...  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Pezizomycotina (uncultured Pez...  
Pezizomycotina (uncultured Pez...  
Pezizomycotina (uncultured Pez...  
Pezizomycotina (uncultured Pez...  
Pezizomycotina (uncultured Pez...  
Fungi (uncultured fungus)  
Fungi (uncultured fungus)  
Fungi (uncultured ectomycorrhhi...  
Fungi (ectomycorrhizal root ti...

## Original names

Largely uninformative or misleading



UNITE taxon name	INSD taxon name
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured ectomycorrhhi...
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Fungi (uncultured fungus from ...
Archaeorhizomycetales	Taphrinomycotina (uncultured A...
Archaeorhizomycetales	Taphrinomycotina (uncultured A...
Archaeorhizomycetales	Pezizomycotina (uncultured Pez...
Archaeorhizomycetales	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Ascomycota (uncultured Ascomyc.
Archaeorhizomyces	Fungi (uncultured ectomycorrhhi...
Archaeorhizomyces	Fungi (uncultured ectomycorrhhi...
Archaeorhizomyces	Fungi (ectomycorrhizal root ti...
Archaeorhizomyces	Ascomycota (uncultured Ascomyc.
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured ectomycorrhhi...
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Pezizomycotina (uncultured Pez...
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces	Fungi (uncultured fungus)
Archaeorhizomyces finlayi	Fungi (uncultured ectomycorrhhi...
Archaeorhizomyces finlayi	Fungi (ectomycorrhizal root ti...

But improvement is easy

...and *must* be easy

[Main menu](#)[Add taxon occurrence](#)[Add](#)[Search and edit](#)[Add and edit taxon names](#)[UNITE Species Hypotheses](#)[Clipboard](#)[Workgroups](#)[Profile](#)

You are adding determination to sequence:

[EF434026](#)

Add determination [Comment?](#)

Fields marked \* are compulsory.

**Kingdom \***

Fungi

**Species name (drop-down list)**

Archaeo [info?](#) [Clear species name](#)

**Species name (if not in the list)**

☐ **Lock determination**

Archaeorhizomyces Rosling & T.Y. James (gen)

Archaeorhizomyces finlayi Rosling & T.Y. James (spe)

Archaeorhizomycetaceae Rosling and T. James (fam)

Archaeorhizomycetales Rosling and T. James (ord)

Archaeorhizomycetes (cls)

Archaeospora J.B. Morton & D. Redecker (gen)

**Determined by**

Start by typing in family name or [Add n](#)

**Determined by**

**Date determined**

Archaeospora schenckii Sieverd. & S. Toro (spe)

Archaeospora trappei (R.N. Ames & Linderman) J.B. Morton & D. Redecker (spe)

Archaeosporaceae (fam)

Archaeosporales (ord)

Add determination

Reset

Exit

# Taxonomic re-annotation powered by Index Fungorum

Country	Interacting taxa
USA	
Germany	<i>Gymnadenia conopsea</i>
Canada	
Canada	<i>Tsuga heterophylla</i>
USA	<i>Abies</i>
Lithuania	<i>Picea abies</i>
Denmark	<i>Picea abies</i>
Sweden	<i>Picea abies</i>
Sweden	Pinaceae
USA	<i>Betula nana</i>
USA	<i>Pyrola picta</i>
USA	<i>Betula papyrifera</i>
Canada	
Canada	<i>Populus</i>
Finland	<i>Picea abies</i>
USA	<i>Picea mariana</i>
USA	<i>Picea mariana</i>
Canada	
USA	
Canada	<i>Tsuga heterophylla</i>
Canada	<i>Tsuga heterophylla</i>
Canada	<i>Tsuga heterophylla</i>
Canada	<i>Tsuga heterophylla</i>
Canada	<i>Tsuga heterophylla</i>
USA	
Finland	<i>Picea abies</i>
Sweden	Pinaceae
Sweden	
USA	
Sweden	

~40% of all public ITS sequences are annotated with country of collection.

<25% of all public ITS sequences are annotated with a host.

**Lifestyle, Substrate and Interacting taxon**

[Hide form](#)

**Specimen lifestyle**

**Lifestyle**

**Nutritional group**

**Specimen substrate**

**Kingdom**

**Species name (drop-down list)**  [info?](#) [Clear species name](#)

**Species name (if not in the list)**  [info?](#)

**Substrate type**

**Substrate text**

**Interacting taxon**

**Name of taxon**  [Clear species name](#)

**Type of interacting taxon**

**Type of interaction**  [info?](#)

**Interacting taxon text**

[+ Add another interacting taxon](#)

Addition of geo/ecological  
metadata easy, standards-  
compliant  
(ISO / Darwin Core)

**PlutoF**  
Cloud database and computing services for the biologist

You are logged in as hmlisson  
[Log out here](#)

**Main menu**

- Add taxon occurrence
- Add
- Search and edit
- Add and edit taxon names
- UNITE Species Hypotheses
- Clipboard
- Workgroups

**Edit sequence** [Comment?](#)

Fields marked \* are compulsory.

**Sequence \*** (only IUPAC characters)

**Sequence type**   
5.8S  
ITS2  
LSU rDNA  
mitochondrial

**Sequence completeness**

**Sequence availability \***  ☐ sequence annotation locked

**Sequence isolated from**

**Remarks**

**Sequence id \***

**PCR primers**

☐ low sequence quality (will be excluded from the analysis)

☐ chimeric sequence (will be excluded from the analysis)

EcM lineage (Tedesco et al. 2010. Mycorrhiza 20: 217-263.)

[Clear name](#) [Info?](#)

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**Main menu**

- Add taxon occurrence
- Add
- Search and edit
- Add and edit taxon names
- UNITE Species Hypotheses
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**Cross, P.W., Groenewald, J.Z., Summerell, B.A., Wingfield, B.D. and Wingfield, M.J.; Co-occurring species of Teratosphaeria on Eucalyptus; Persoonia 22, 38-48 (2009)**

**Study availability**

Available for: INSD, (1) Study downloaded from INSD

Study is annotated: N/A

Inserted by: Kessy Abarenkov, 2010-01-24

[View all sequences \(27\) under this study.](#)

Sequence ID	Taxon name	Isolated from	Interacting taxa	Locality	Plot name
FJ023537		Plant leaf		Australia	Plot, <a href="#">Change</a>
FJ023538		Plant leaf		Australia	Plot, <a href="#">Change</a>
FJ023539	<i>Teratosphaeria veloci</i>	Living culture		Australia, 13.68028° S 131.95139° E	
FJ023540				Republic of South Africa	Plot, <a href="#">Change</a>
FJ493182				Australia	Plot, <a href="#">Change</a>
FJ493183				Australia	Plot, <a href="#">Change</a>
FJ493184				Australia	Plot, <a href="#">Change</a>
FJ493185				Australia	Plot, <a href="#">Change</a>
FJ493186				Australia	Plot, <a href="#">Change</a>
FJ493187				Kenya	Plot, <a href="#">Change</a>
FJ493188				Brazil	Plot, <a href="#">Change</a>
FJ493189				Brazil	Plot, <a href="#">Change</a>
FJ493190				Unspecified	Plot, <a href="#">Change</a>
FJ493191	<i>Phaeophleospora eugenicola</i>	Living culture		Brazil	
FJ493192	<i>Readeriella mirabilis</i>	Living culture		Australia	
FJ493193				Australia	Plot, <a href="#">Change</a>
FJ493194				Colombia	Plot, <a href="#">Change</a>
FJ493195				Australia	Plot, <a href="#">Change</a>
FJ493196	<i>Teratosphaeria profusa</i>	Living culture		Australia	
FJ493197	<i>Teratosphaeria alboconidia</i>	Living culture		Australia, 13.68028° S 131.98472° E	
FJ493198				Spain	Plot, <a href="#">Change</a>
FJ493199				Republic of South Africa	Plot, <a href="#">Change</a>
FJ493200				Unspecified	Plot, <a href="#">Change</a>
FJ493201				Unspecified	Plot, <a href="#">Change</a>
FJ493217				Republic of South Africa	Plot, <a href="#">Change</a>
FJ493222				Bolivia	Plot, <a href="#">Change</a>
FJ493225				Spain	Plot, <a href="#">Change</a>

Specimens linked to this study: CBS H-20262 PREM 56551 CBS 125004 CBS 125007 CBS 124061

Plots linked to this study:

[Search studies](#)





Oxford Journals > Science & Mathematics > Database > Volume 2014 > 10.1093/database/bau061

## Finding needles in haystacks: linking scientific names, reference specimens and molecular data for Fungi

Conrad L. Schoch<sup>1,\*†</sup>, Barbara Robbertse<sup>1</sup>, Vincent Robert<sup>2</sup>, Duong Vu<sup>2</sup>, Gianluigi Cardinali<sup>3</sup>, Laszlo Irinyi<sup>4</sup>, Wieland Meyer<sup>4</sup>, R. Henrik Nilsson<sup>5</sup>, Karen Hughes<sup>6</sup>, Andrew N. Miller<sup>7</sup>, Paul M. Kirk<sup>8</sup>, Kessy Abarenkov<sup>9</sup>, M. Catherine Aime<sup>10</sup>, Hiran A. Ariyawansa<sup>11</sup>, Martin Bidartondo<sup>12</sup>, Teun Boekhout<sup>2</sup>, Bart Buyck<sup>13</sup>, Qing Cai<sup>14</sup>, Jie Chen<sup>11</sup>, Ana Crespo<sup>15</sup>, Pedro W. Crous<sup>2</sup>, Ulrike Damm<sup>16</sup>, Z. Wilhelm De Beer<sup>17</sup>, Bryn T. M. Dentinger<sup>8</sup>, Pradeep K. Divakar<sup>15</sup>, Margarita Dueñas<sup>18</sup>, Nicolas Feau<sup>19</sup>, Katerina Fliegerova<sup>20</sup>, Miguel A. García<sup>21</sup>, Zai-Wei Ge<sup>14</sup>, Gareth W. Griffith<sup>22</sup>, Johannes Z. Groenewald<sup>2</sup>, Marizeth Groenewald<sup>2</sup>, Martin Grube<sup>23</sup>, Marieka Gryzenhout<sup>24</sup>, Cécile Gueidan<sup>25</sup>, Liangdong Guo<sup>26</sup>, Sarah Hambleton<sup>27</sup>, Richard Hamelin<sup>19</sup>, Karen Hansen<sup>28</sup>, Valérie Hofstetter<sup>29</sup>, Seung-Beom Hong<sup>30</sup>, Jos Houbraken<sup>2</sup>, Kevin D. Hyde<sup>11</sup>, Patrik Inderbitzin<sup>31</sup>, Peter R. Johnston<sup>32</sup>, Samantha C. Karunarathna<sup>11</sup>, Urmas Köljal<sup>9</sup>, Gábor M. Kovács<sup>33,34</sup>, Ekaphan Kraichak<sup>35</sup>, Krisztina Krizsan<sup>36</sup>, Cletus P. Kurtzman<sup>37</sup>, Karl-Henrik Larsson<sup>38</sup>, Steven Leavitt<sup>35</sup>, Peter M. Letcher<sup>39</sup>, Kare Liimatainen<sup>40</sup>, Jian-Kui Liu<sup>11</sup>, D. Jean Lodge<sup>41</sup>, Janet Jennifer Luangsa-ard<sup>42</sup>, H. Thorsten Lumbsch<sup>35</sup>, Sajeewa S.N. Maharachchikumbura<sup>11</sup>, Dimuthu Manamgoda<sup>11</sup>, María P. Martín<sup>18</sup>, Andrew M. Minnis<sup>43</sup>, Jean-Marc Moncalvo<sup>44</sup>, Giuseppina Mule<sup>45</sup>, Karen K. Nakasone<sup>46</sup>, Tuula Niskanen<sup>40</sup>, Ibai Olariaga<sup>28</sup>, Tamás Papp<sup>36</sup>, Tamás Petkovits<sup>36</sup>, Raquel Pino-Bodas<sup>47</sup>, Martha J. Powell<sup>39</sup>, Huzefa A. Raja<sup>48</sup>, Dirk Redecker<sup>49</sup>, J. M. Sarmiento-Ramirez<sup>18</sup>, Keith A. Seifert<sup>27</sup>, Bhushan Shrestha<sup>50</sup>, Soili Stenroos<sup>47</sup>, Benjamin Stielow<sup>2</sup>, Sung-Oui Suh<sup>51</sup>, Kazuaki Tanaka<sup>52</sup>, Leho Tedersoo<sup>9</sup>, M. Teresa Telleria<sup>18</sup>, Dhanushka Udayanga<sup>11</sup>, Wendy A. Untereiner<sup>53</sup>, Javier Diéguez Uribeondo<sup>18</sup>, Krishna V. Subbarao<sup>31</sup>, Csaba Vágvölgyi<sup>36</sup>, Cobus Visagie<sup>2</sup>, Kerstin Voigt<sup>54</sup>, Donald M. Walker<sup>55</sup>, Bevan S. Weir<sup>32</sup>, Michael Weiß<sup>56</sup>, Nalin N. Wijayawardene<sup>11</sup>, Michael J. Wingfield<sup>17</sup>, J. P. Xu<sup>57</sup>, Zhu L. Yang<sup>14</sup>, Ning Zhang<sup>58</sup>, Wen-Ying Zhuang<sup>26</sup> and Scott Federhen<sup>1</sup>

+ Author Affiliations

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Database (2014) 2014 : bau061  
doi: 10.1093/database/bau061

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# Annotation efforts

## Tidying Up International Nucleotide Sequence Databases: Ecological, Geographical and Sequence Quality Annotation of ITS Sequences of Mycorrhizal Fungi

Leho Tedersoo , Kessy Abarenkov, R. Henrik Nilsson, Arthur Schüssler, Gwen-Aëlle Grelet, Petr Kohout, Jane Oja, Gregory M. Bonin, Teele Jairus, Martin Ryberg, Karl-Henrik Larsson, Urmas Kõljalg

## Mycorrhizal fungi

### Towards a unified paradigm for sequence-based identification of fungi

FREE



Urmas Kõljalg<sup>1,2,\*</sup>, R. Henrik Nilsson<sup>3</sup>,  
Kessy Abarenkov<sup>2</sup>, Leho Tedersoo<sup>2</sup>, Andy  
F. S. Taylor<sup>4,5</sup>, Mohammad Bahram<sup>1</sup>, Scott  
T. Bates<sup>6</sup>, Thomas D. Bruns<sup>7</sup>, Johan  
Bengtsson-Palme<sup>8</sup>, Tony M. Callaghan<sup>9</sup>,  
Brian Douglas<sup>9</sup>, Tiia Drenkhan<sup>10</sup>, Ursula  
Eberhardt<sup>11</sup>, Margarita Dueñas<sup>12</sup>, Tine  
Grebenc<sup>13</sup>, Gareth W. Griffith<sup>9</sup>, Martin  
Hartmann<sup>14,15</sup>, Paul M. Kirk<sup>16</sup>, Petr Kohout  
<sup>1,17</sup>, Ellen Larsson<sup>3</sup>, Björn D. Lindahl<sup>18</sup>,  
Robert Lücking<sup>19</sup>, María P. Martín<sup>12</sup>, P.  
Brandon Matheny<sup>20</sup>, Nhu H. Nguyen<sup>7</sup>,  
Tuula Niskanen<sup>21</sup>, Jane Oja<sup>1</sup>, Kabir G.  
Peay<sup>22</sup>, Ursula Peintner<sup>23</sup>, Marko Peterson  
<sup>1</sup>, Kadri Põldmaa<sup>1</sup>, Lauri Saag<sup>1</sup>, Irja Saar<sup>1</sup>,  
Arthur Schüssler<sup>24</sup>, James A. Scott<sup>25</sup>,  
Carolina Senés<sup>24</sup>, Matthew E. Smith<sup>26</sup>,  
Ave Suija<sup>1,2</sup>, D. Lee Taylor<sup>27</sup>, M. Teresa  
Telleria<sup>12</sup>, Michael Weiss<sup>28</sup> and Karl-Henrik  
Larsson<sup>29</sup>

Issue



Molecular Ecology

Volume 22, Issue 21, pages  
5271–5277, November 2013

## Various Dikarya



# Improving ITS sequence data for identification of plant pathogenic fungi

R. Henrik Nilsson • Kevin D. Hyde • Julia Pawłowska • Martin Ryberg • Leho Tedersoo • Anders Bjørnsgaard Aas • Siti A. Alias • Artur Alves • Cajsa Lisa Anderson • Alexandre Antonelli • A. Elizabeth Arnold • Barbara Bahnmann • Mohammad Bahram • Johan Bengtsson-Palme • Anna Berlin • Sara Branco • Putarak Chomnunti • Asha Dissanayake • Rein Drenkhan • Hanna Friberg • Tobias Guldberg Frøslev • Bettina Halwachs • Martin Hartmann • Beatrice Henricot • Ruvishika Jayawardena • Ari Jumpponen • Håvard Kauserud • Sonja Koskela • Tomasz Kulik • Kare Liimatainen • Björn D. Lindahl • Daniel Lindner • Jian-Kui Liu • Sajeewa Maharachchikumbura • Dimuthu Manamgoda • Svante Martinsson • Maria Alice Neves • Tuula Niskanen • Stephan Nylinder • Olinto Liparini Pereira • Danilo Batista Pinho • Teresita M. Porter • Valentin Queloz • Taavi Riit • Marisol Sánchez-García • Filipe de Sousa • Emil Stefańczyk • Mariusz Tadych • Susumu Takamatsu • Qing Tian • Dhanushka Udayanga • Martin Unterseher • Zheng Wang • Saowanee Wikee • Jiye Yan • Ellen Larsson • Karl-Henrik Larsson • Urmas Kõljalg • Kessy Abarenkov

**Plant  
pathogenic  
fungi**

## 31,954 changes implemented

- 5,135 taxonomic re-annotations
- 25,028 additions of geographical/host data
- 1,368 specifications of reference sequences (~1,000 types)
- 401 broken sequences removed



**A comprehensive, automatically updated fungal ITS sequence dataset for reference-based chimera control in environmental sequencing efforts**

R. Henrik Nilsson<sup>1\*</sup>, Leho Tedersoo<sup>2</sup>, Martin Ryberg<sup>3</sup>, Erik Kristiansson<sup>4</sup>, Martin Hartmann<sup>5,6</sup>, Martin Unterseher<sup>7</sup>, Teresita M. Porter<sup>8</sup>, Johan Bengtsson-Palme<sup>9</sup>, Donald M. Walker<sup>10</sup>, Filipe de Sousa<sup>1</sup>, Hannes Andres Gamper<sup>11</sup>, Ellen Larsson<sup>1</sup>, Karl-Henrik Larsson<sup>12</sup>, Urmas Kõljalg<sup>2,13</sup>, Robert Edgar<sup>14</sup>, Kessy Abarenkov<sup>13</sup>

**Chimeras** ( 1,000 removed )



# Why do I get “Unidentified fungus”?

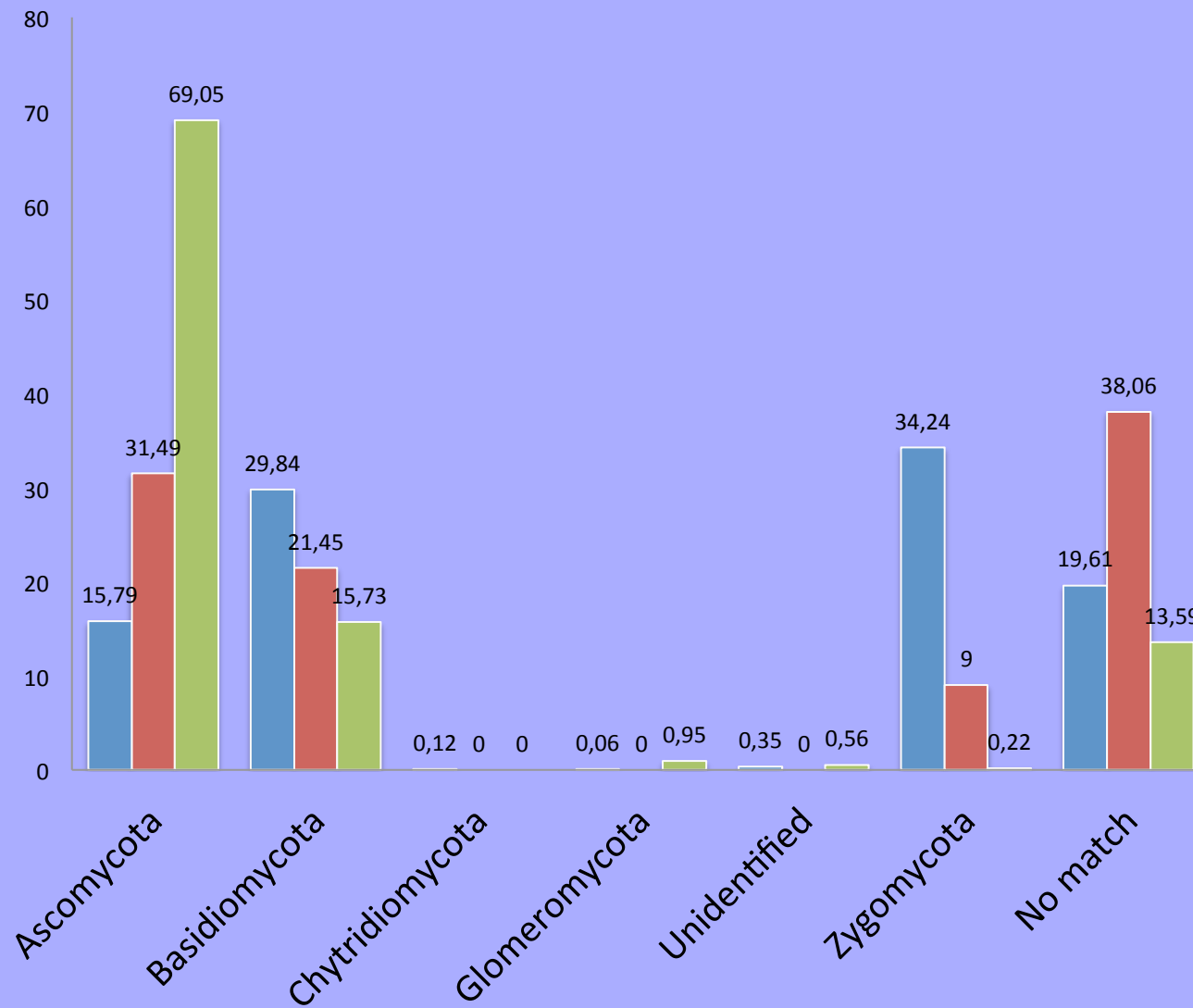
- Reference sequences poorly annotated (“fixed”, now less than 1% “Unidentified fungus”)
- Type material not sequenced



- NGS-based studies recover fungi that Sanger-based studies don't – not so easy to “fix”

# UNITE - new developments

Implementing Next Generation Sequences (NGS) into Sanger-based species hypotheses



## 3 NGS datasets:

Papua New Guinea  
2 448 RepS

Colombia  
454 RepS

Estonia  
2 730 RepS



						SH		
Sequence ID	UNITE taxon name	INSD taxon name	Country	DNA source	Interacting taxa	97% ▾	Alignment based on:	Full ITS ▾
						<div>▾</div>	<div>Send clusters to clipboard</div>	
<a href="#">more</a>   <a href="#">HQ260234</a>	Ascomycota	Fungi (uncultured fungus)	USA	Ericoid mycorrhiza	Rhododendron argyrophyllum	<div><div></div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div><div></div></div>	<div></div>
<a href="#">more</a>   <a href="#">HQ260254</a>		<a href="#">Fungi (uncultured fungus)</a>	<a href="#">USA</a>	<a href="#">Ericoid mycorrhiza</a>				
<a href="#">more</a>   <a href="#">GU256950</a>		Fungi (uncultured fungus)	China	Ericoid mycorrhiza				
<a href="#">more</a>   <a href="#">KC965698</a>		Fungi (uncultured fungus)	USA					
<a href="#">more</a>   <a href="#">HQ212173</a>		Pezizales (uncultured Phialea)	USA	Soil fungal DNA				
<a href="#">more</a>   <a href="#">UDB003032</a> <a href="#">Link out</a>	Mollisia solani		Lithuania	Fruitbody ( <b>Isotype</b> )		<div><div></div><div></div><div></div><div></div><div></div></div>	Locked sequence	<div></div>
<a href="#">more</a>   <a href="#">AM999567</a>	Helotiales	<a href="#">Fungi (uncultured fungus)</a>	<a href="#">Norway</a>	<a href="#">Plant leaf</a>	<a href="#">Bryophyta</a>			
<a href="#">more</a>   <a href="#">KC965215</a>		Fungi (uncultured fungus)	Canada			<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463174</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463092</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB465238</a>			<a href="#">Papua New Guinea</a>	<a href="#">Soil fungal DNA</a>		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB462602</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB462095</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463443</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463032</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463165</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463060</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB464721</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463066</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">FN298700</a>		Fungi (uncultured fungus)	Australia	Ectomycorrhiza		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB004118</a> <a href="#">Link out</a>	Helotiales		Australia	Ectomycorrhiza		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463839</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463182</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB462915</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">HQ850141</a>	Helotiales	Fungi (uncultured fungus)	China			<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463394</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB462920</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB461902</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB463333</a>			<a href="#">Papua New Guinea</a>	<a href="#">Soil fungal DNA</a>		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">HM230879</a>		Leotiomyces (uncultured Leot...	Ecuador			<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB464837</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB464686</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB464687</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB465674</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">UDB462067</a>			Papua New Guinea	Soil fungal DNA		<div><div></div><div></div><div></div><div></div><div></div></div>		
<a href="#">more</a>   <a href="#">JF519187</a>		Helotiales (uncultured Helotia...	Austria	Plant root	Fagus sylvatica	<div><div></div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div><div></div></div>	<div></div>
<a href="#">more</a>   <a href="#">HQ022264</a>	Pezizales (uncultured Pezizale...	USA						
<a href="#">more</a>   <a href="#">FM172821</a>	Fungi (Calluna vulgaris root a...	Germany	Living culture	Calluna vulgaris				
<a href="#">more</a>   <a href="#">FM172822</a>	Fungi (Calluna vulgaris root a...	Germany	Living culture	Calluna vulgaris				
<a href="#">more</a>   <a href="#">FM172836</a>	Fungi (Calluna vulgaris root a...	Germany	Living culture	Calluna vulgaris				
<a href="#">more</a>   <a href="#">FM172809</a>	Fungi (Calluna vulgaris root a...	Germany	Living culture	Calluna vulgaris				
<a href="#">more</a>   <a href="#">FM172837</a>	<a href="#">Fungi (Calluna vulgaris root a...</a>	<a href="#">Germany</a>	<a href="#">Living culture</a>	<a href="#">Calluna vulgaris</a>				
<a href="#">more</a>   <a href="#">FM172770</a>	Fungi (Calluna vulgaris root a...	Germany	Living culture	Calluna vulgaris				
<a href="#">more</a>   <a href="#">JQ347011</a>	Pezizales (uncultured Phialea)							
<a href="#">more</a>   <a href="#">HQ260181</a>		Fungi (uncultured fungus)	USA	Ericoid mycorrhiza	<div><div></div><div></div><div></div><div></div><div></div></div>			

# Improving identification success of indoor fungi

- Relevant taxonomists to go through “their” fungi in UNITE
  - Correct bad/missing names
  - Designate reference sequences for SHs
  - Add metadata on, e.g., country of collection
  - Remove broken sequences
- Sequences from type/authentic material
- Report *nomenclatural* issues to Index Fungorum or MycoBank
- ***...annotation effort for indoor fungi?***

**UNITE - fungal identification with rDNA ITS sequences | Version 6** | date: 2013-11-19 | Cluster code: **UCL6\_000601**

This set of sequences contains genera: Archaeorhizomyces  
Total number of sequences in cluster: 75

- chimeric
  - low quality
  - UNITE core sequence
  - automatically chosen 98.5% SH representative sequence
  - Ex = sequence to be excluded from the next version of global key
- (filled, coloured circle) manually chosen SH reference sequence, overrides automatically chosen representative sequence

Sequence ID	UNITE taxon name	INSD taxon name	Country	DNA source	Interacting taxa	SH	Alignment based on: <input type="text" value="Full ITS"/>	Order sequences by: <input type="text" value="combined"/>
						97%		
<a href="#">more</a>   <a href="#">EF434026</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Soil fungal DNA				
<a href="#">more</a>   <a href="#">GQ223472</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Germany	Orchid mycorrhiza	Gymnadenia conopsea			
<a href="#">more</a>   <a href="#">KC965637</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
<a href="#">more</a>   <a href="#">AB828010</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...						
<a href="#">more</a>   <a href="#">FJ152543</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">AY702735</a>	Archaeorhizomyces	Fungi (uncultured fungus from ...	USA	Ectomycorrhiza	Abies			
<a href="#">more</a>   <a href="#">KC876142</a>	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
<a href="#">more</a>   <a href="#">KC876143</a>	Archaeorhizomycetales	Taphrinomycotina (uncultured A...						
<a href="#">more</a>   <a href="#">JQ346852</a>	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
<a href="#">more</a>   <a href="#">JQ346868</a>	Archaeorhizomycetales	Pezizomycotina (uncultured Pez...						
<a href="#">more</a>   <a href="#">DQ069012</a>	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	Lithuania	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">FR877526</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Denmark	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">FM992983</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Sweden	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">AF481369</a>	Archaeorhizomyces	Fungi (ectomycorrhizal root ti...	Sweden	Ectomycorrhiza	Pinaceae			
<a href="#">more</a>   <a href="#">HQ212270</a>	Archaeorhizomyces	Ascomycota (uncultured Ascomyc...	USA	Plant root	Betula nana			
<a href="#">more</a>   <a href="#">FJ440895</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Pyrola picta			
<a href="#">more</a>   <a href="#">HM164555</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Betula papyrifera			
<a href="#">more</a>   <a href="#">FJ626930</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Soil fungal DNA				
<a href="#">more</a>   <a href="#">EU554708</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada	Ectomycorrhiza	Populus			
<a href="#">more</a>   <a href="#">DQ233843</a>	Archaeorhizomyces	Fungi (uncultured ectomycorrh...	Finland	Ectomycorrhiza	Picea abies			
<a href="#">more</a>   <a href="#">HM164554</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
<a href="#">more</a>   <a href="#">HM164553</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA	Ectomycorrhiza	Picea mariana			
<a href="#">more</a>   <a href="#">JN012085</a>	Archaeorhizomyces	Fungi (uncultured fungus)	Canada					
<a href="#">more</a>   <a href="#">JN889799</a>	Archaeorhizomyces	Fungi (uncultured fungus)	USA					
<a href="#">more</a>   <a href="#">JN032573</a>	Archaeorhizomyces	Fungi (uncultured fungus)						
<a href="#">more</a>   <a href="#">FJ152542</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			
<a href="#">more</a>   <a href="#">DQ481984</a>	Archaeorhizomyces	Pezizomycotina (uncultured Pez...	Canada	Ectomycorrhiza	Tsuga heterophylla			

☐ [Uncultured Archaeorhizomycetes clone QF3.2 18S ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence](#)

3. [ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence](#)

464 bp linear DNA

Accession: KC876142.1 GI: 526840446

[GenBank](#) [FASTA](#) [Graphics](#) [PopSet](#)

☐ [Uncultured Archaeorhizomycetes clone CBB3.21 18S ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence](#)

4. [ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence](#)

449 bp linear DNA

Accession: KC876141.1 GI: 526840445

[GenBank](#) [FASTA](#) [Graphics](#) [PopSet](#)