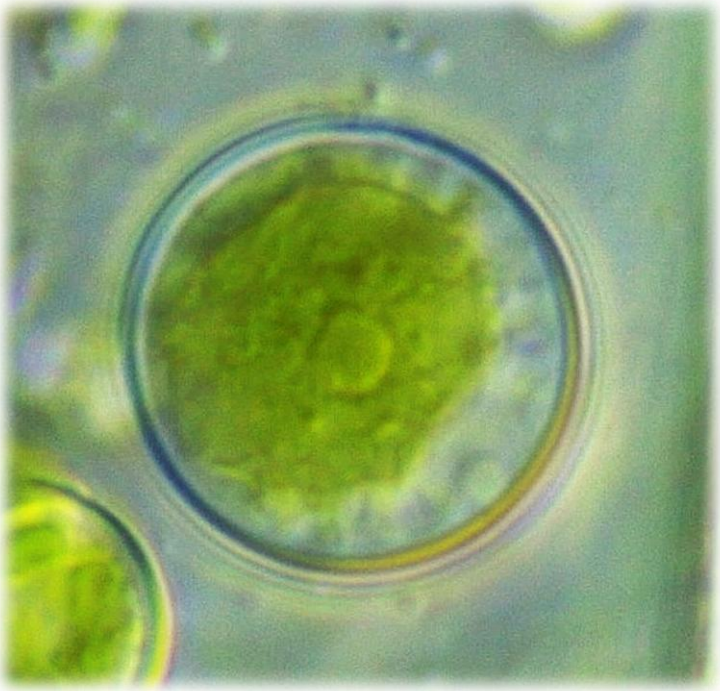
Advancing *Trebouxia* species delimitation: Proposal for a collaborative approach



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The genus *Trebouxia*

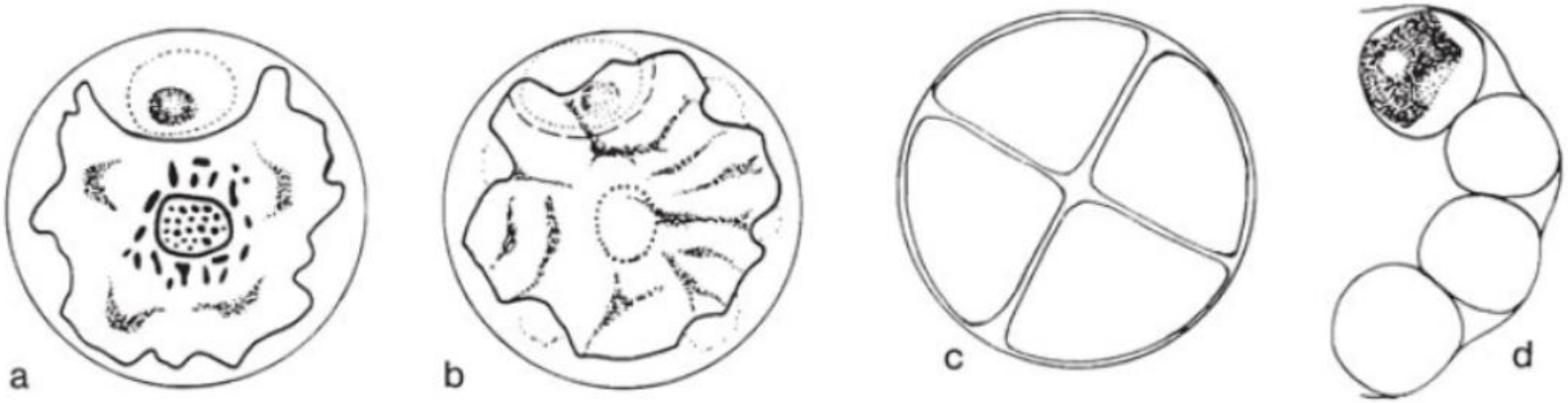
1. Trebouxia Puymaly 1924

Syn.: *Cystococcus* Nägeli sensu auct.; *Chlorococcum* Meneghini sensu Brand & Stockmayer 1925, non Meneghini 1843; *Pseudotrebouxia* Archibald 1975

Puymaly 1924, p. 107; Korschikoff 1953, p. 205; Ahmadjian 1967, p. 144; Bourrelly 1966, p. 129; Archibald 1975, p. 126; Komárek & Fott 1983, p. 116; Gärtner 1985 a, p. 101; 1985 b, p. 508; Friedl 1989 a, p. 125; Tschermak-Woess 1989 a, p. 192.

Zellen einzeln oder in Gruppen von Tetraden bis größeren Komplexen vereinigt, kugelig bis ellipsoidisch oder abgerundet, manchmal auch asymmetrisch. Zellwand dünn, nur selten etwas einseitig verdickt, ohne Gallerthüllen. Chloroplast parietal in jungen Zellen, in erwachsenen Zellen mehr oder weniger zentral mit gelapptem oder gekerbtem Rand, meist etwas von der Zellwand abgerückt. Mit einem oder mehreren, nackten, strukturierten oder multiplen Pyrenoiden[45]. Stärke wird meist als körnige Stromastärke im Chloroplasten abgelagert. Zellkern stets exzentrisch in einer deutlichen Einbuchtung des Chloroplasten liegend. Asexuelle Fortpflanzung durch Autosporen[46] und nackte, zweigeißelige Zoosporen mit oder ohne Stigma.

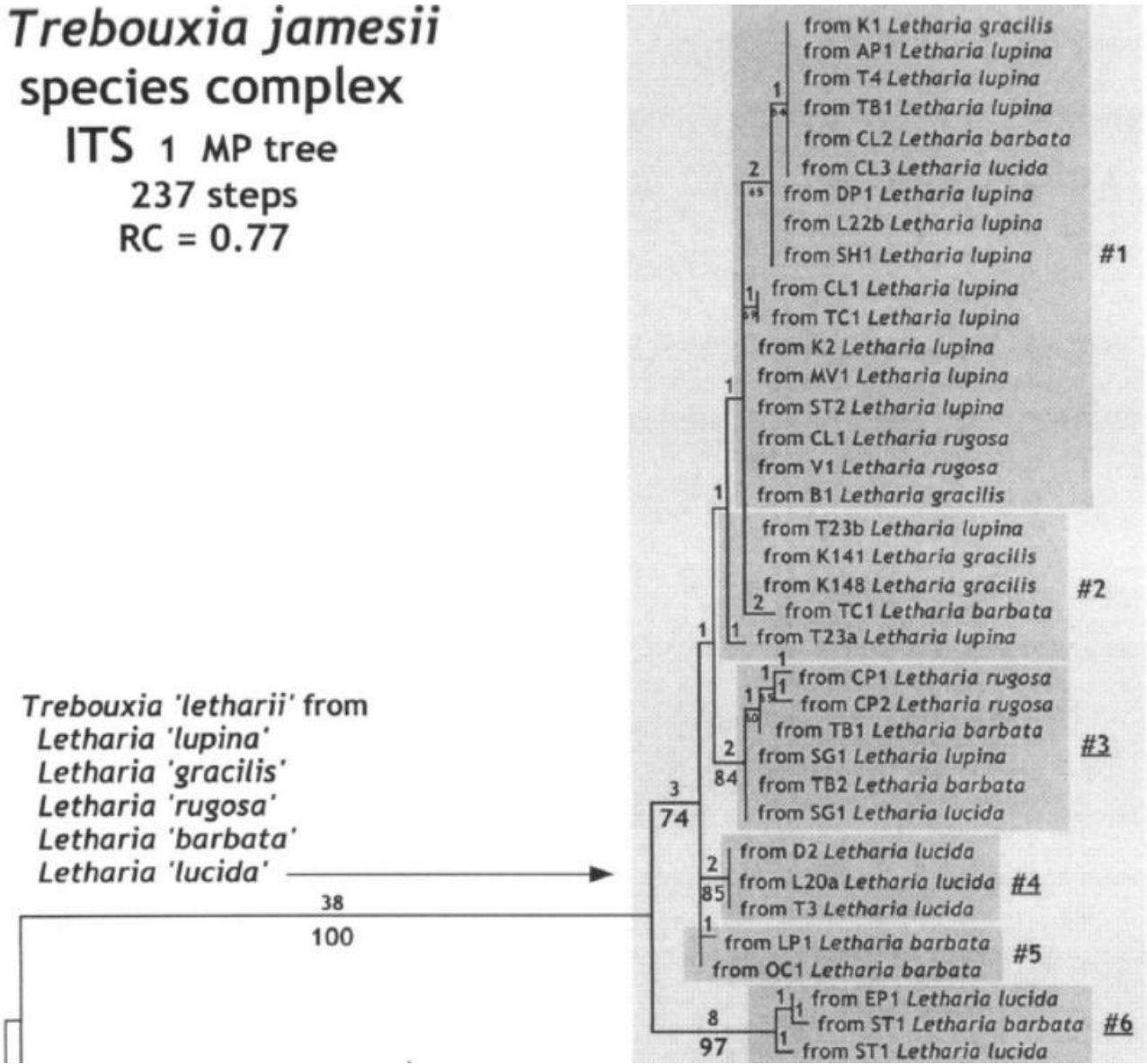
Mit derzeit 27 Arten, die nahezu ausschließlich als Phykobionten vorkommen.[47]



Ettl & Gärtner 1995

The genus *Trebouxia*

Many, many undescribed lineages

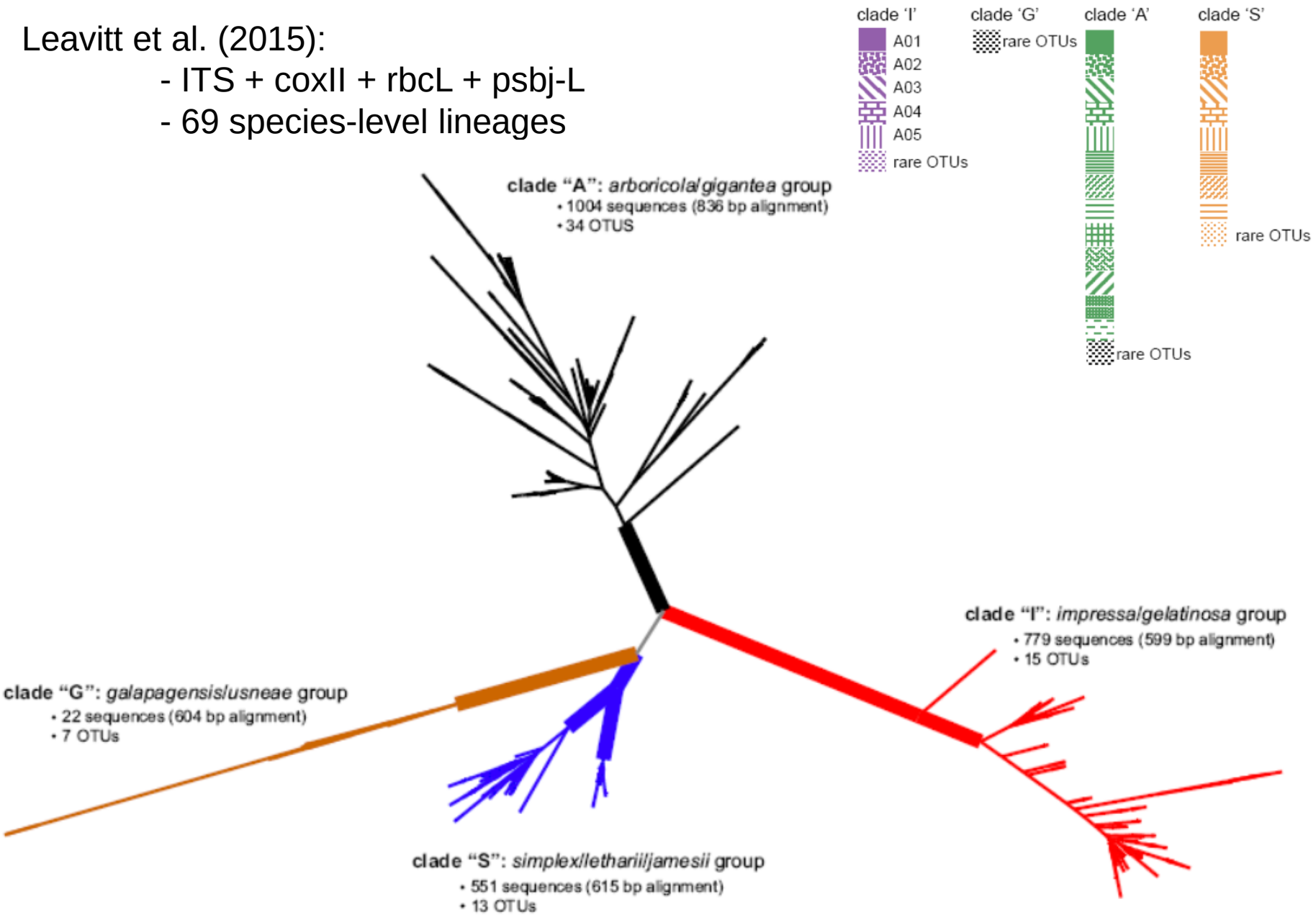


Kroken & Taylor 2000

The genus *Trebouxia*

Leavitt et al. (2015):

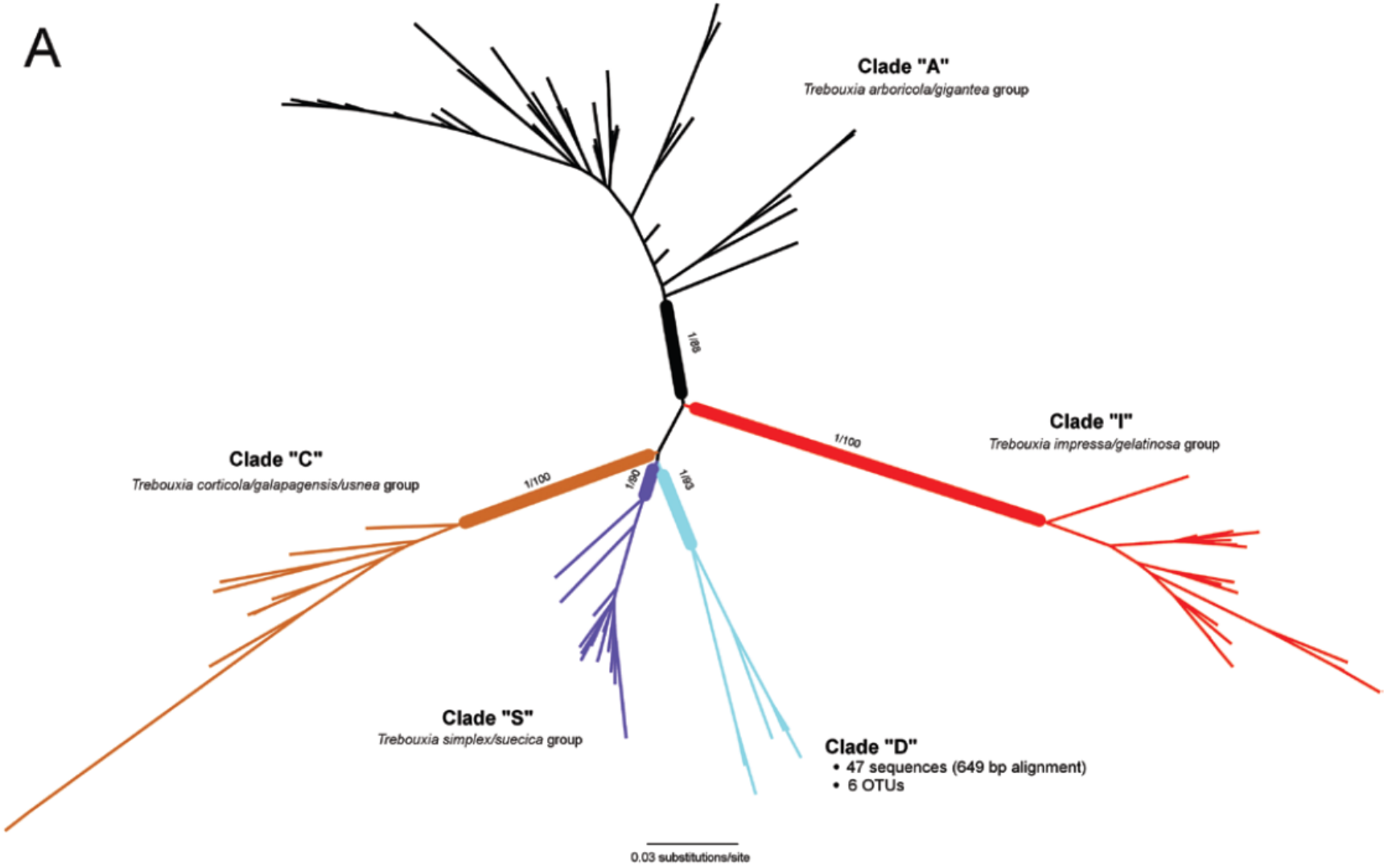
- ITS + coxII + rbcL + psbj-L
- 69 species-level lineages



The genus *Trebouxia*

Xu et al. (2020):

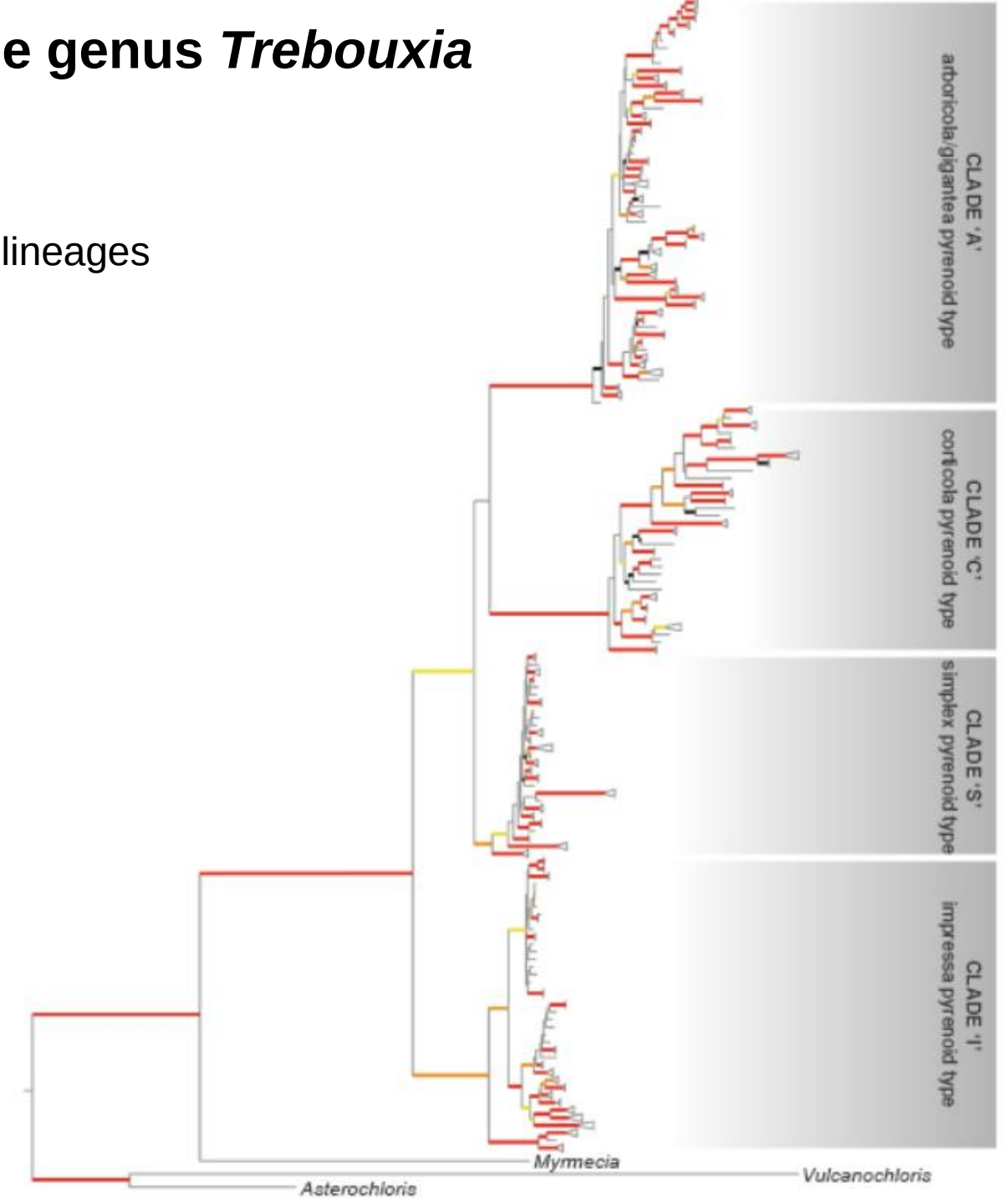
- ITS + LSU + coxII + rbcL
- 5 more OTUs



The genus *Trebouxia*

Muggia et al. (2020):

- ITS + coxII + rbcL
- 109 species-level lineages



Problems and challenges

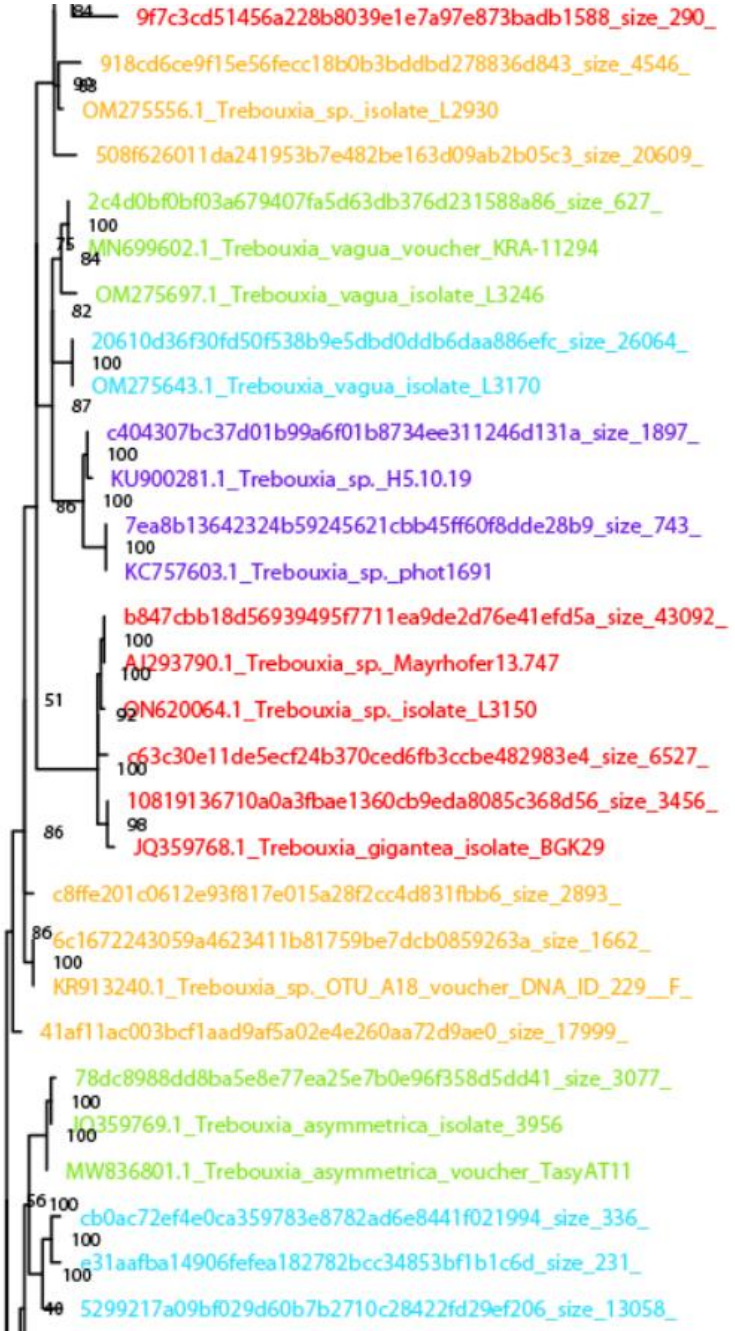
Huge genetic diversity:

- Actually, a total of 1066 unique ITS rDNA genotypes
- A number of genotypes yet undiscovered or revealed by eDNA investigations

The problem with species concept

Genetic delimitation

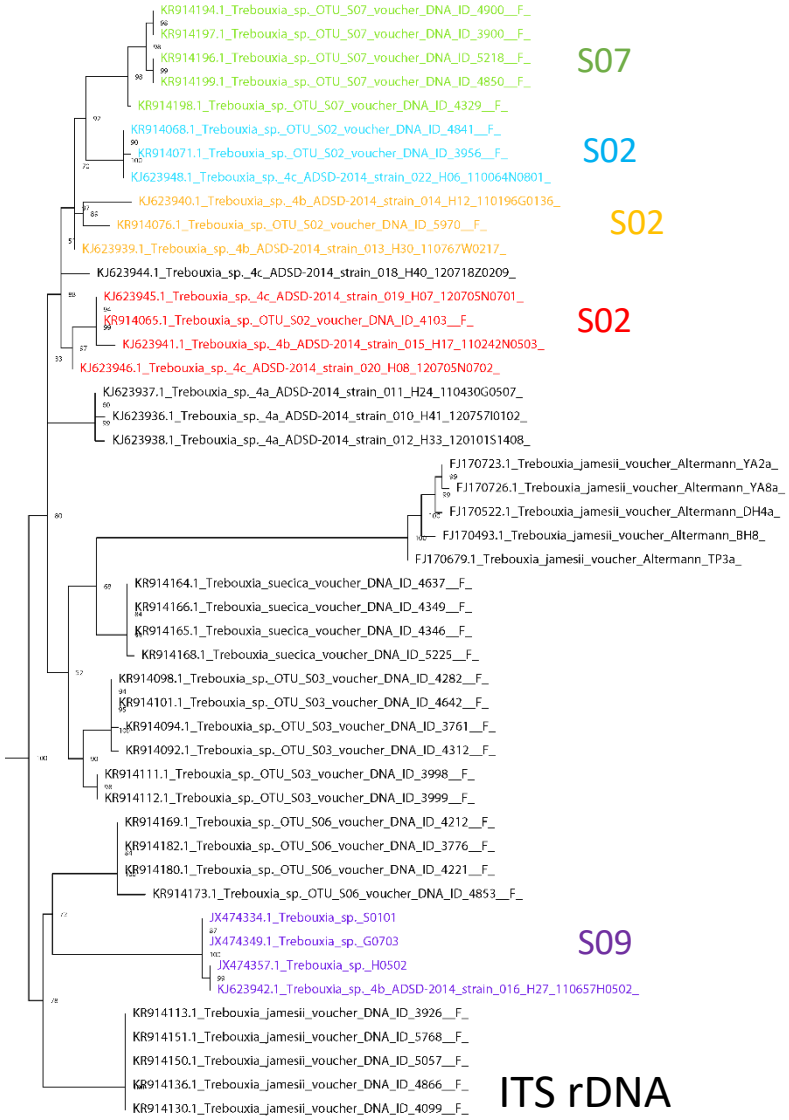
- Incongruent gene tree phylogenies

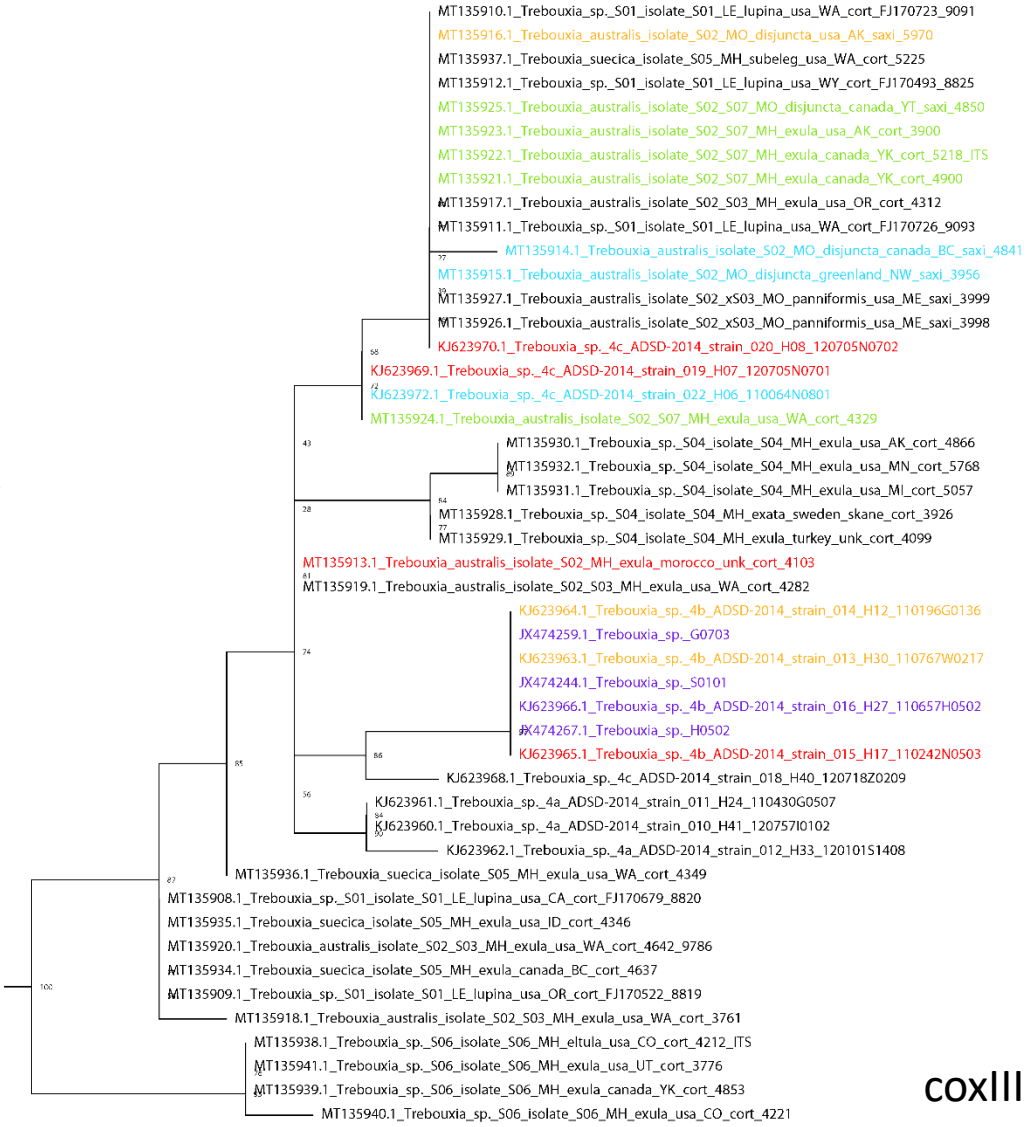


Problems and challenges

Genetic delimitation

- Incongruent gene tree phylogenies: clade S example





Possible solutions

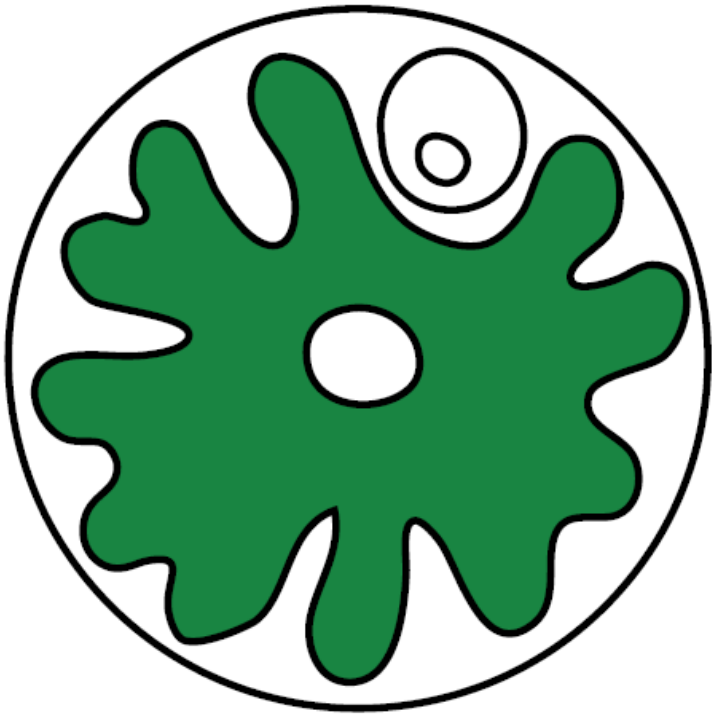
Robust phylogenetic framework

- Genome-wide multi-gene phylogenies (organellar genomes)

Better definition of species boundaries

- Host specificity, ecology, biogeography, morphology, …

A big cooperative effort



Advancing *Trebouxia* species delimitation: a proposal

Selection of one superclade

↓

Extensive sampling and isolation of strains / aquisition of cultures

↓

Obtaining organellar genomes

↓

Multigene phylogenies

↓

Host specificity, ecological, morphological and ecophysiological traits

↓

Defining species boundaries based on multiple evidences

↓

Selection of candidate loci for further analyses (e.g., intergenomic spacers)

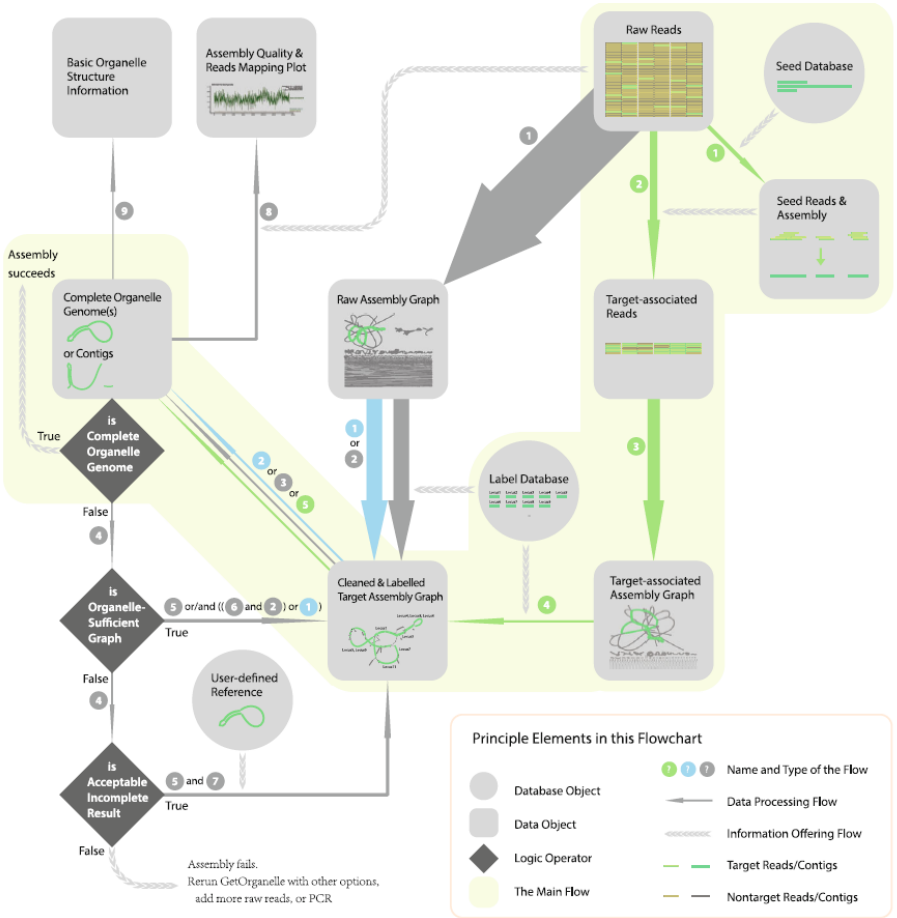
↓

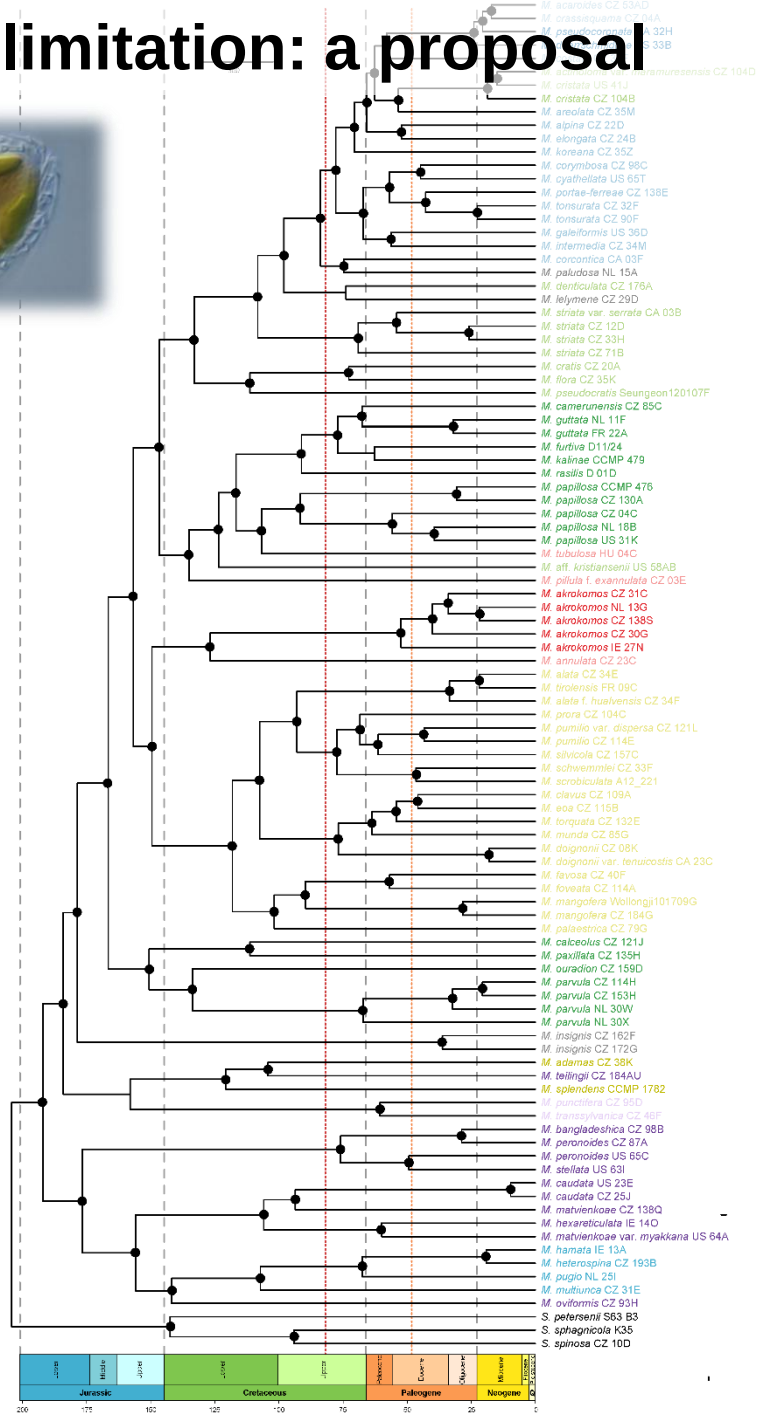
Updating the taxonomy

Advancing *Trebouxia* species delimitation: a proposal

- Organellar genomes – the genus *Mallomonas* as an example

- More than 300 strains sequenced so far
- 114 genes retrieved
- Full statistical support for all nodes
- All bioinfrormatic pipelines ready to apply for *Trebouxia*





Funding options

- COST Actions
  - Only "networking" activities are funded (meetings, workshops, exchanges students and postdocs, etc.)
  - BIG competition
- MSCA Doctoral Networks
  - An international network that jointly trains a group of PhD students (salaries for PhD students, funds for meetings, travel expenses)
  - BIG competition
- MSCA Staff Exchanges
  - It only funds exchanges from Europe "outside Europe" and/or between academic and non-academic sector within Europe
  - Quite weird, so SMALL competition (32% success rate in last call)
- Horizon Europe: Pillar II, Cluster 6
  - International research projects (funding for people, consumables, travel, sometimes some budget for instruments...), but should be precisely focused on a topic predefined programme.
  - Usually application aspect needed
- Biodiversa+
  - Research on biodiversity with an impact for society and policy.
  - Calls usually focused on biodiversity loss, climate change and pollution
  - BIG competition

Thank you for your attention

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Primus Research Programme