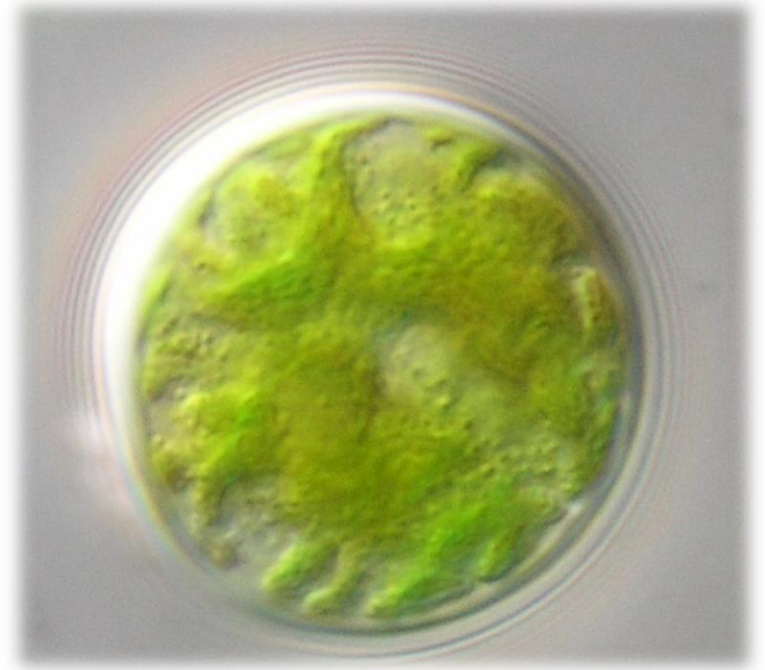


# The lichen symbiosis enigma



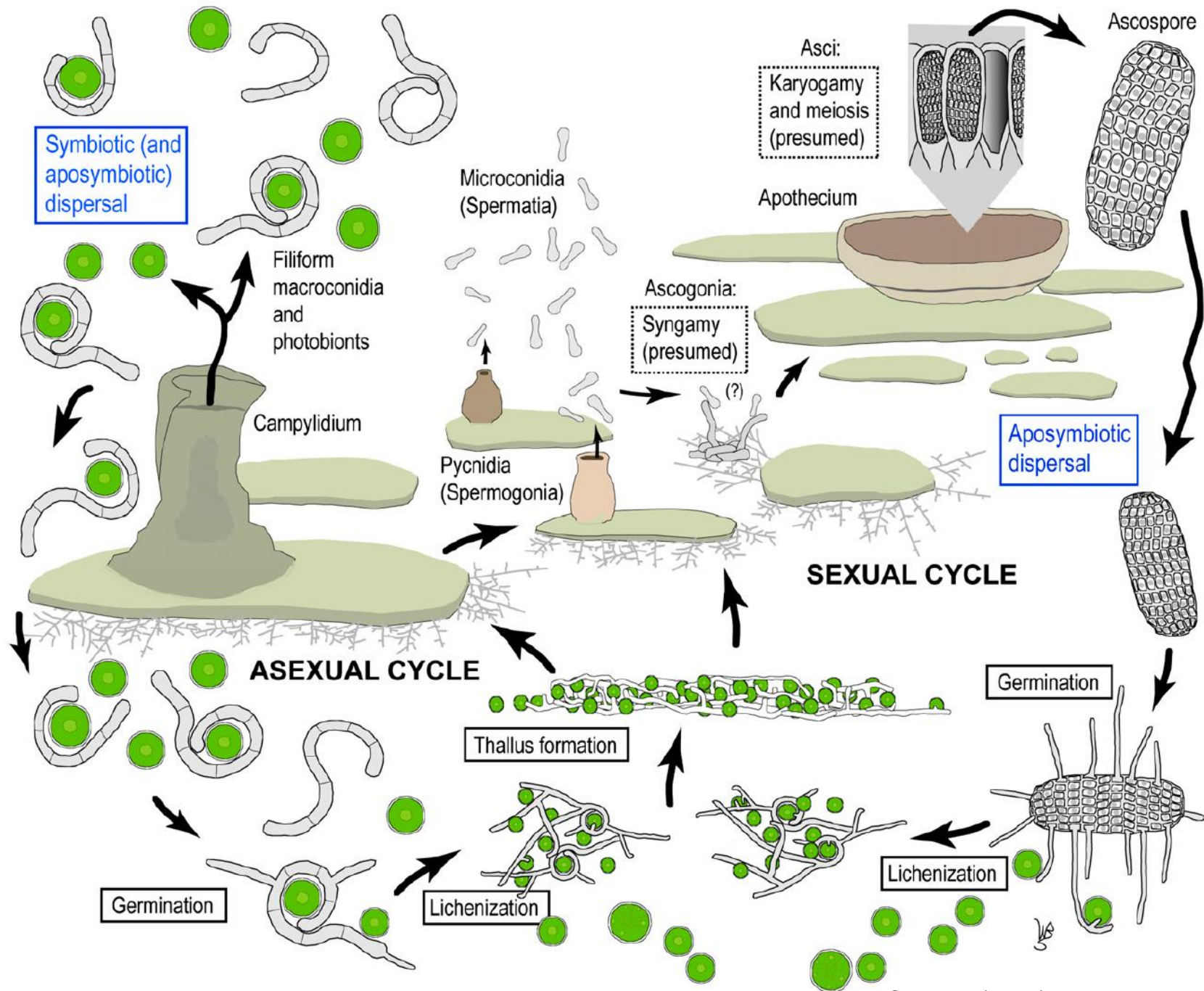
Pavel Škaloud, Zuzana Škvorová, Jana Steinová, Ivana Černajová, Patricia Moya, Helena Bestová, Ondřej Peksa



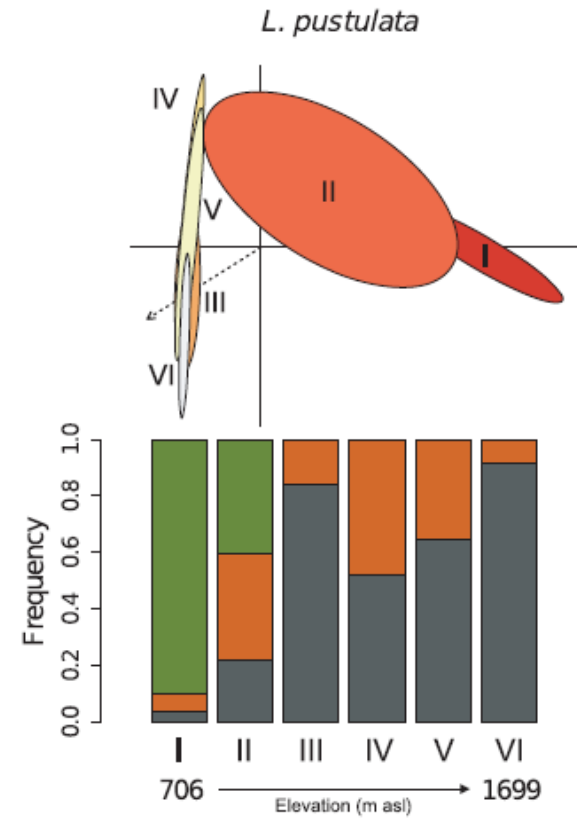
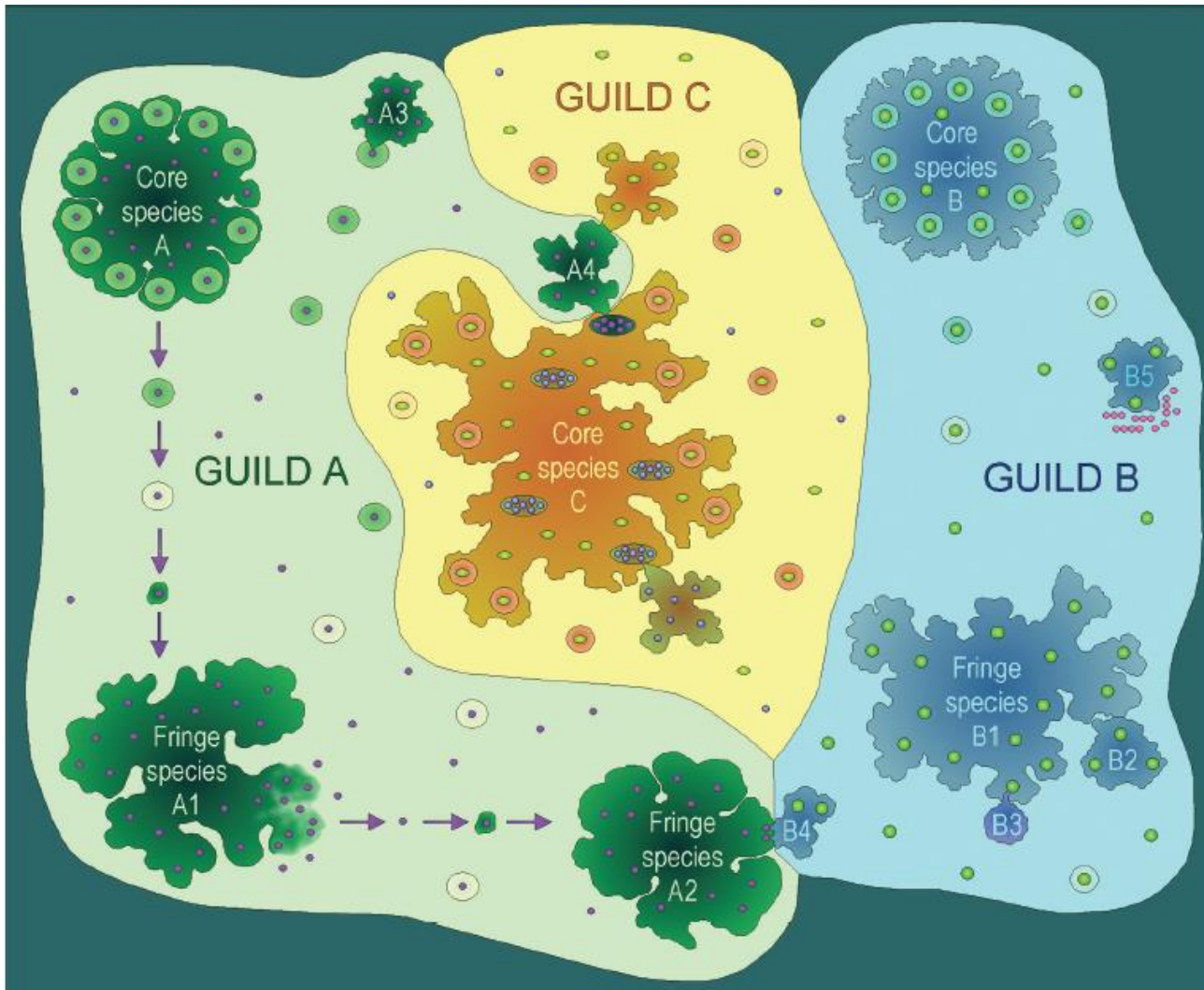
FACULTY OF SCIENCE  
Charles University



*Algal speciation & evolution lab*



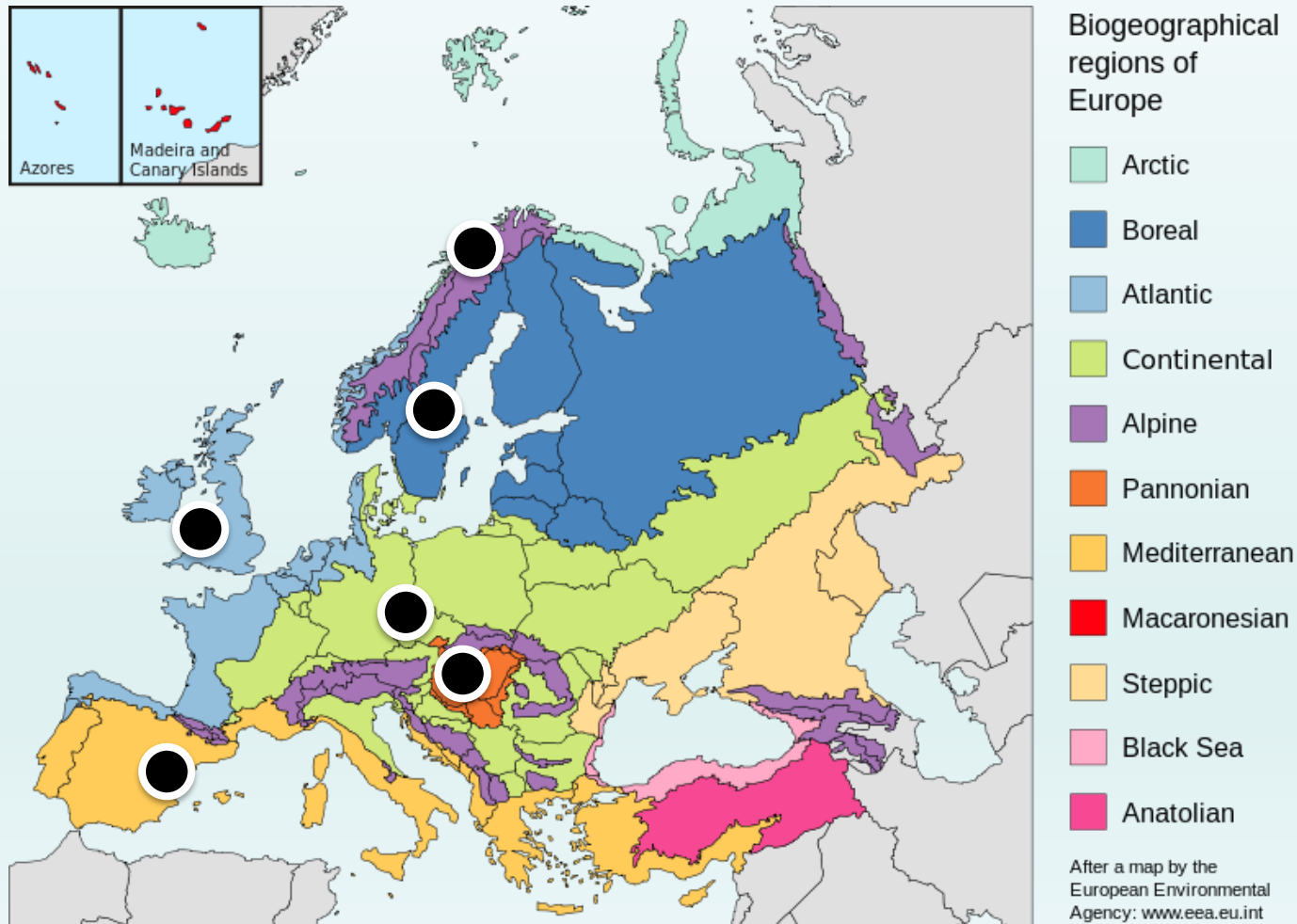




# Sampling

- 6 biogeographic regions in Europe
  - 8 sampling sites along the pH gradient
    - 20 *Cladonia* specimens
    - 1 composite soil and lichen sample

**960 lichens  
investigated**

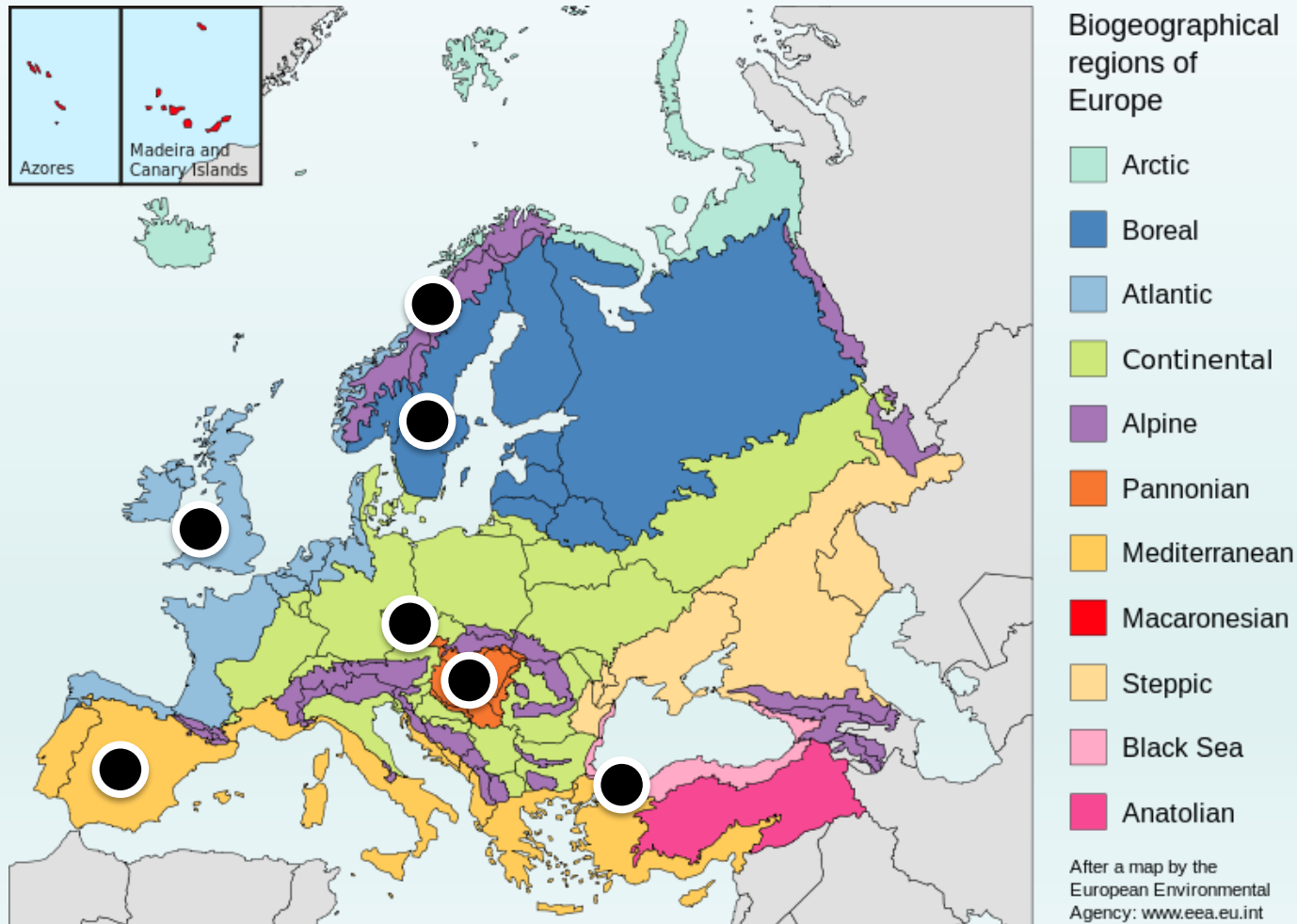






# Analyses

- 960 lichen thalli
  - Sanger sequencing of algae and fungi
- 48 composite soil and lichen samples
  - Illumina meta-barcoding of symbionts, soil chemical analyses

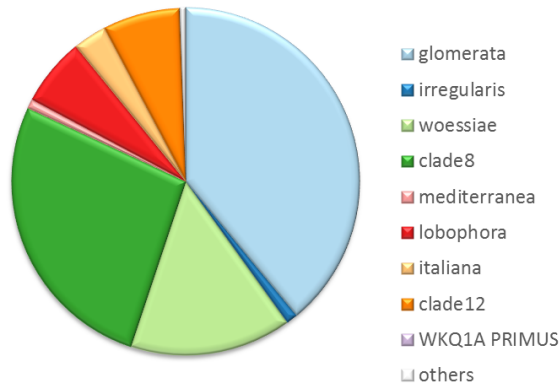




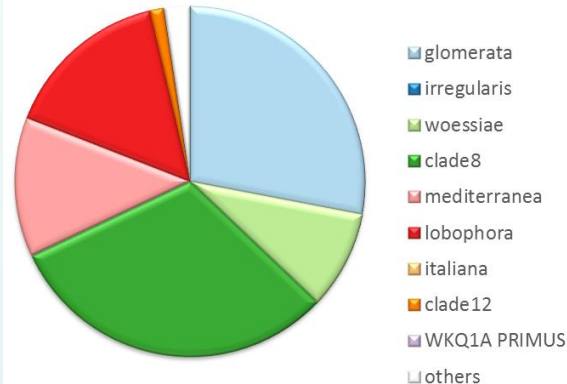
# Photobiont diversity in lichen thalli

- A total of 27 species detected in lichen thalli
- Metabarcoding of the whole lichen communities well corresponded to the Sanger sequencing results

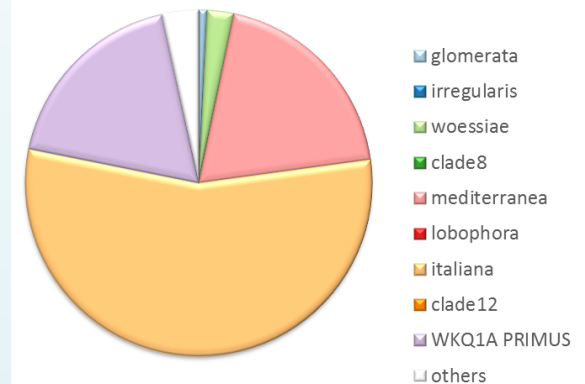
Temperate NGS lichens



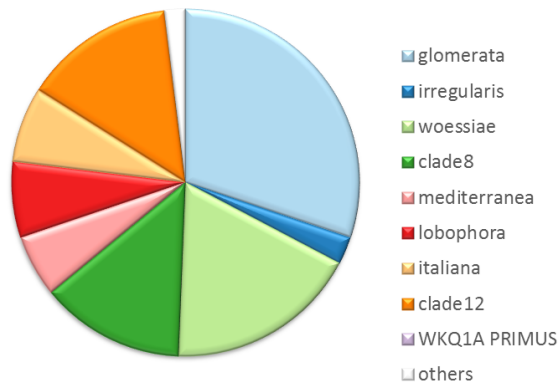
Pannonia NGS lichens



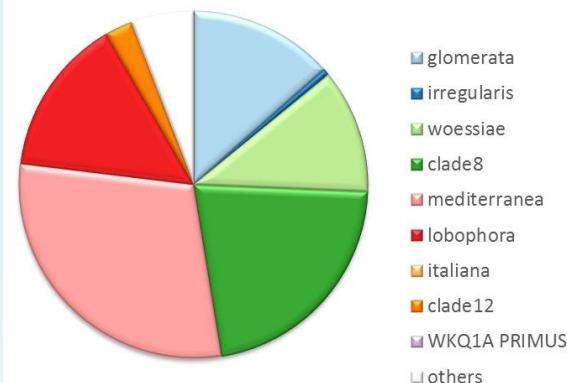
Oceanic NGS lichens



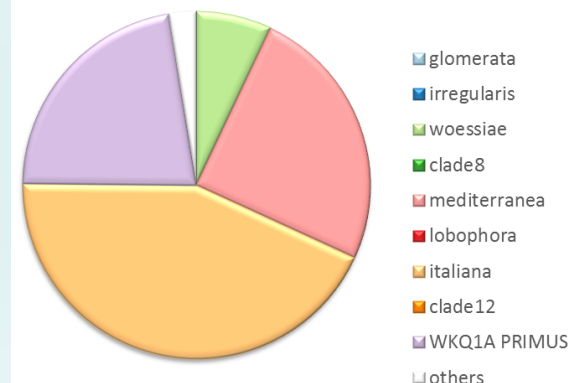
Temperate Sanger lichens



Pannonia Sanger lichens



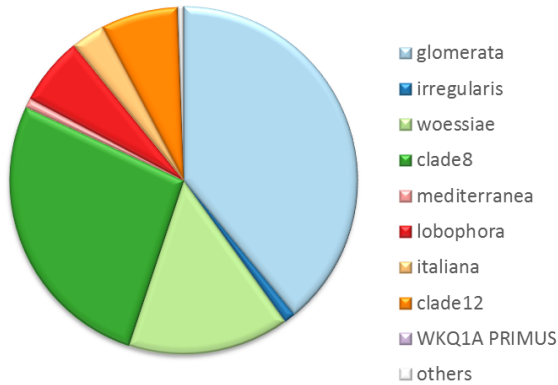
Oceanic Sanger lichens



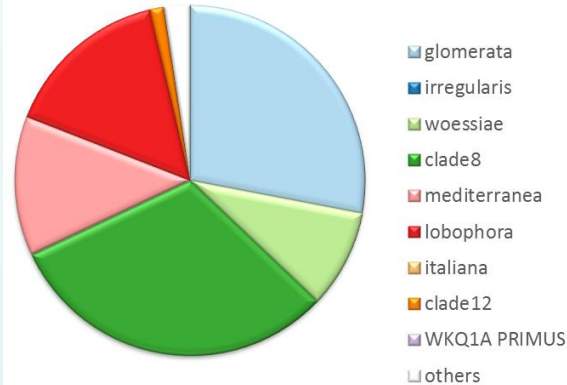
# Photobiont diversity in soil samples

- The soil samples dominated by a single photobiont species, *Asterochloris glomerata*

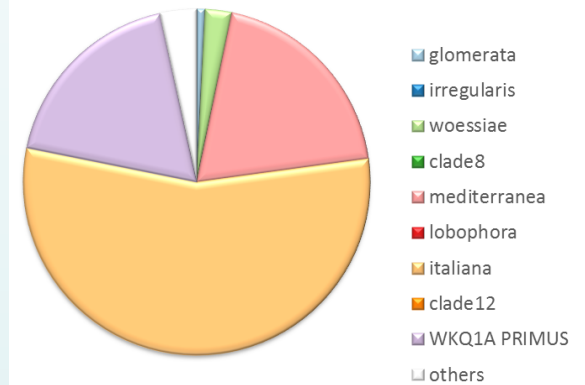
Temperate NGS lichens



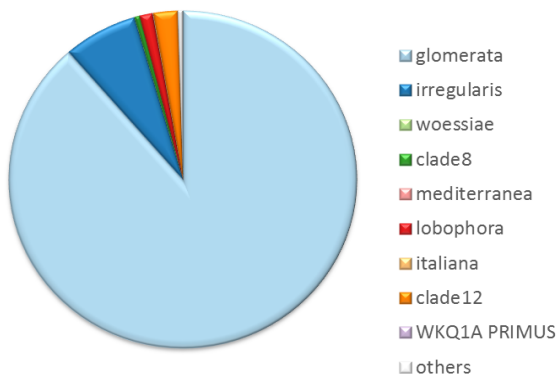
Pannonia NGS lichens



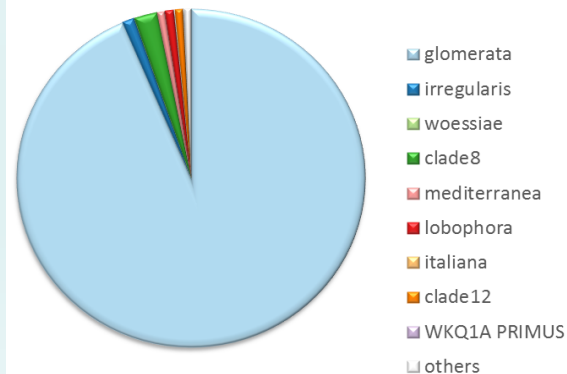
Oceanic NGS lichens



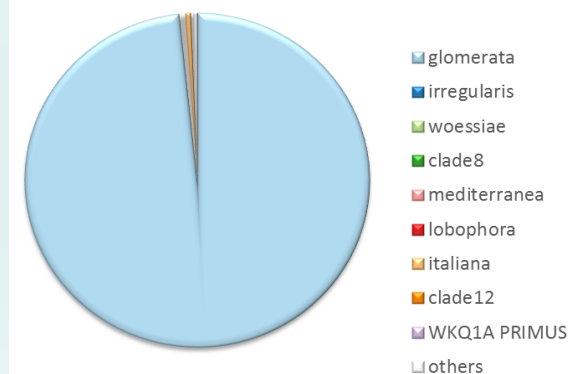
Temperate NGS soil



Pannonia NGS soil



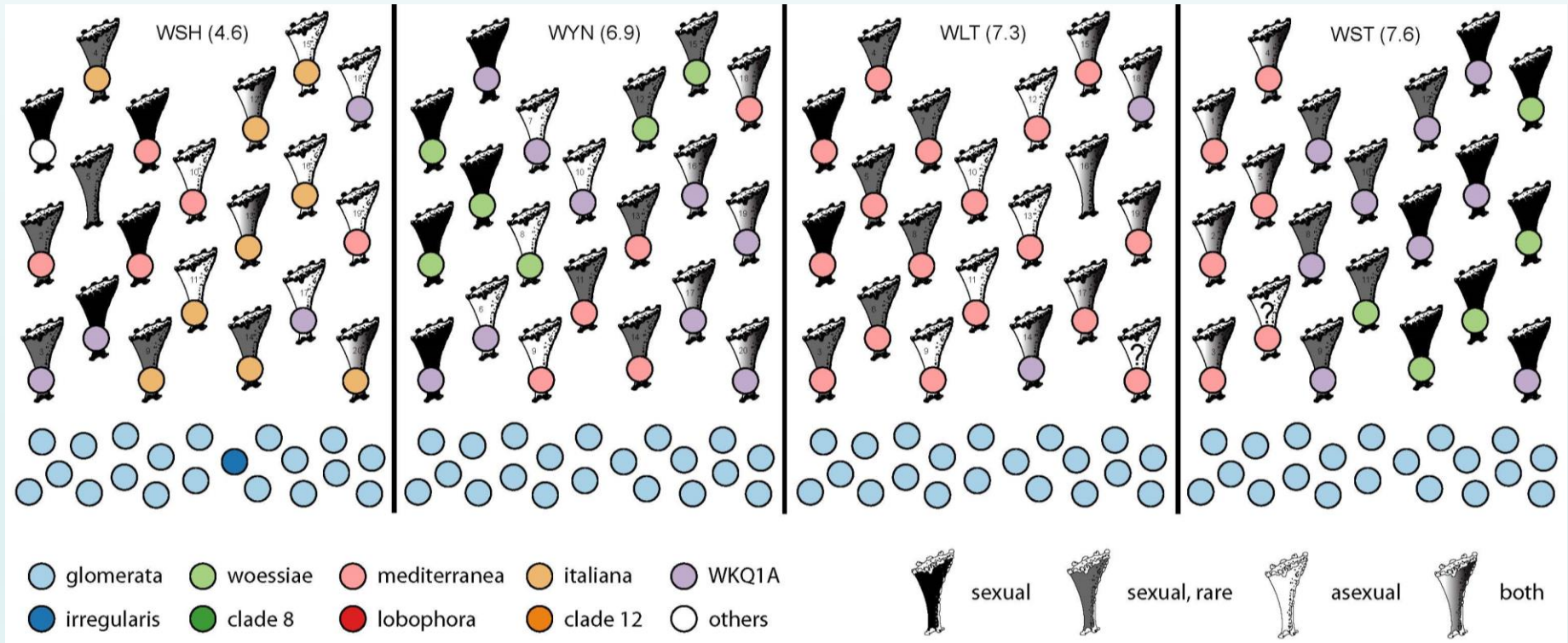
Oceanic NGS soil





# Symbiotic enigma

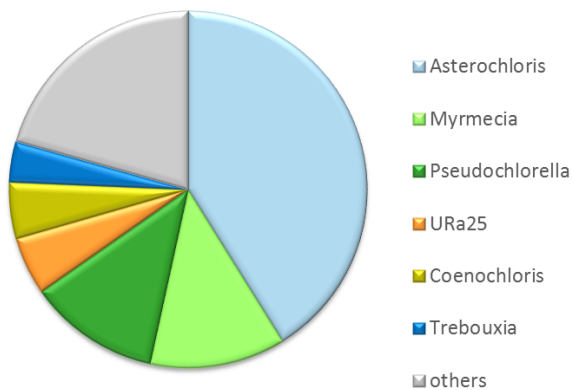
- Photobiont inventory of *Cladonia* lichen communities is not mirrored by the diversity of *Asterochloris* species in adjacent soil samples.
- Even the strictly sexually reproducing lichens do not contain the photobionts growing in the soil



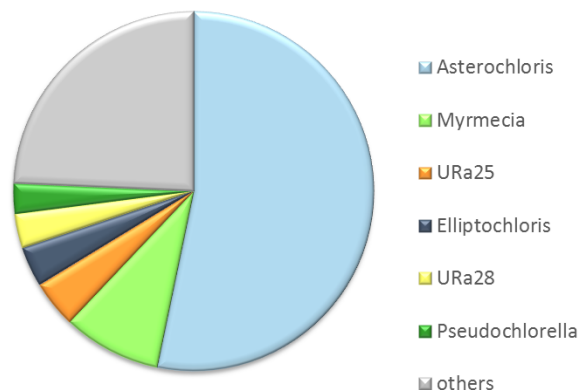
# *Systematic error in data acquisition and processing?*

- Very probably not
- Metabarcoding of lichen thalli almost perfectly match the results obtained by Sanger sequencing
- Taxonomic profiles of soil samples match well our expectations based on our knowledge of the ecology and diversity of soil algae.

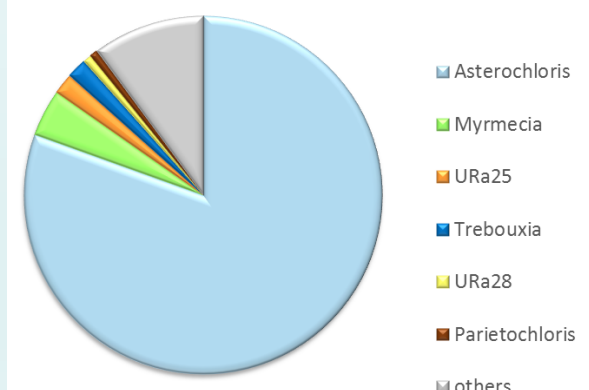
Temperate NGS soil



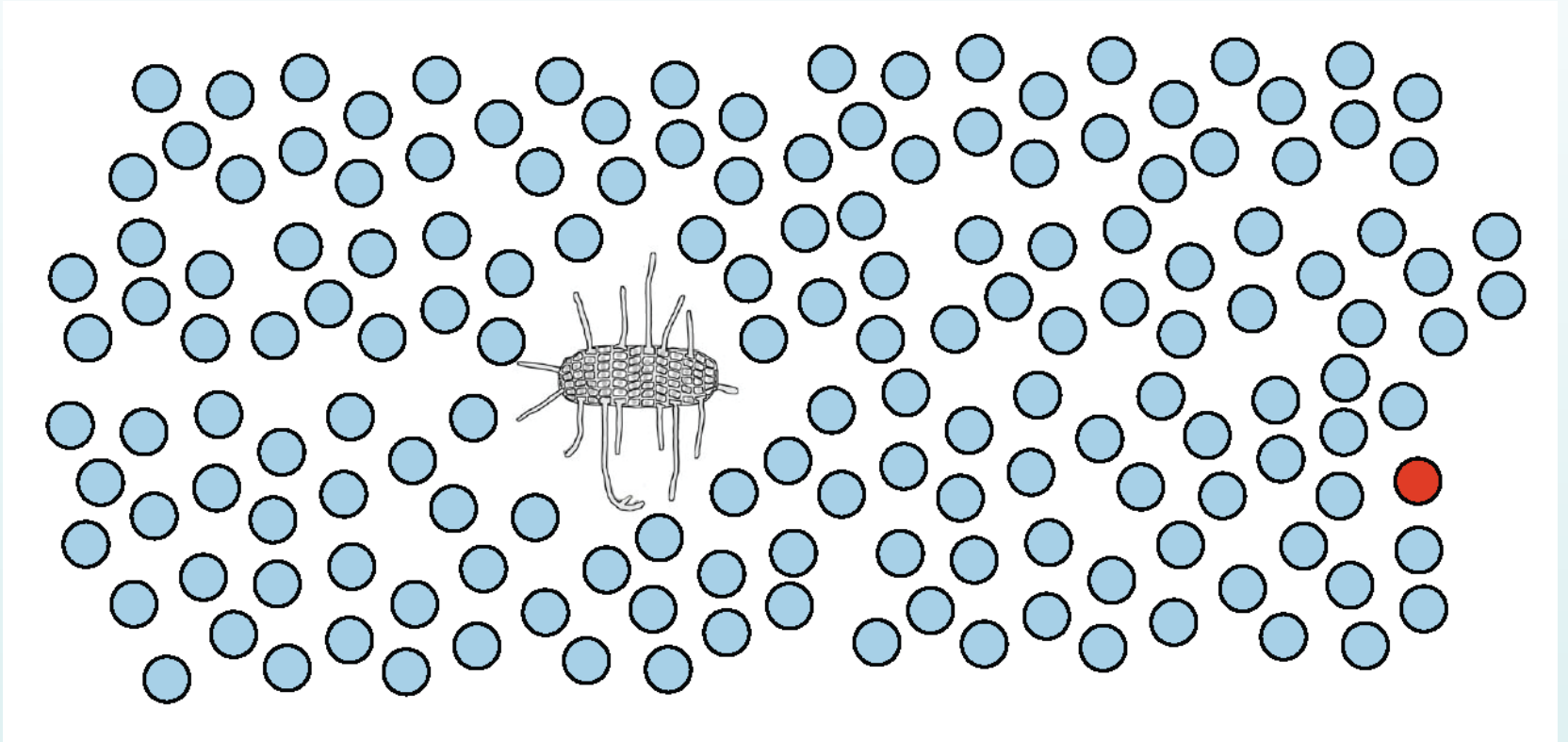
Pannonia NGS soil



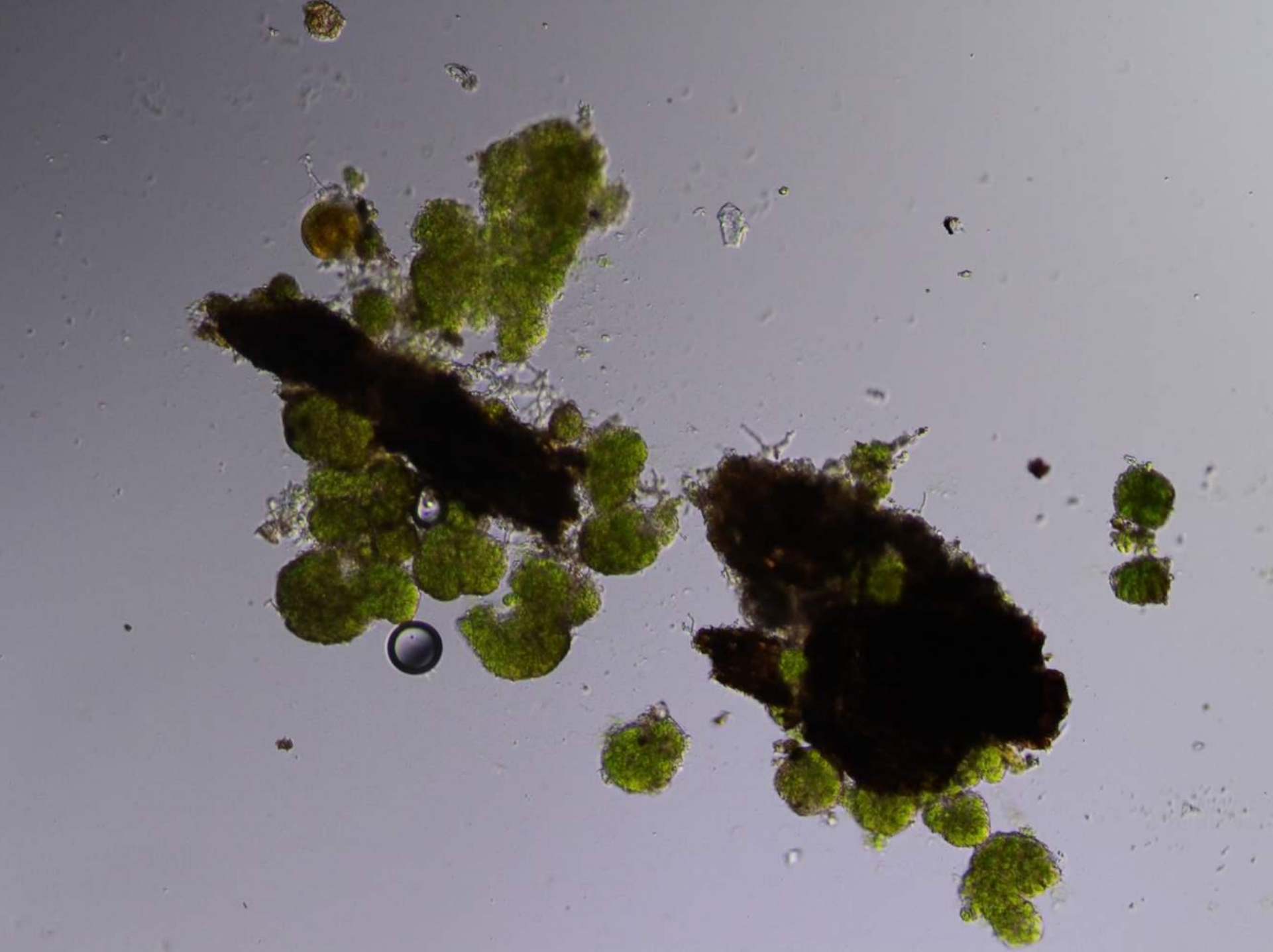
Oceanic NGS soil

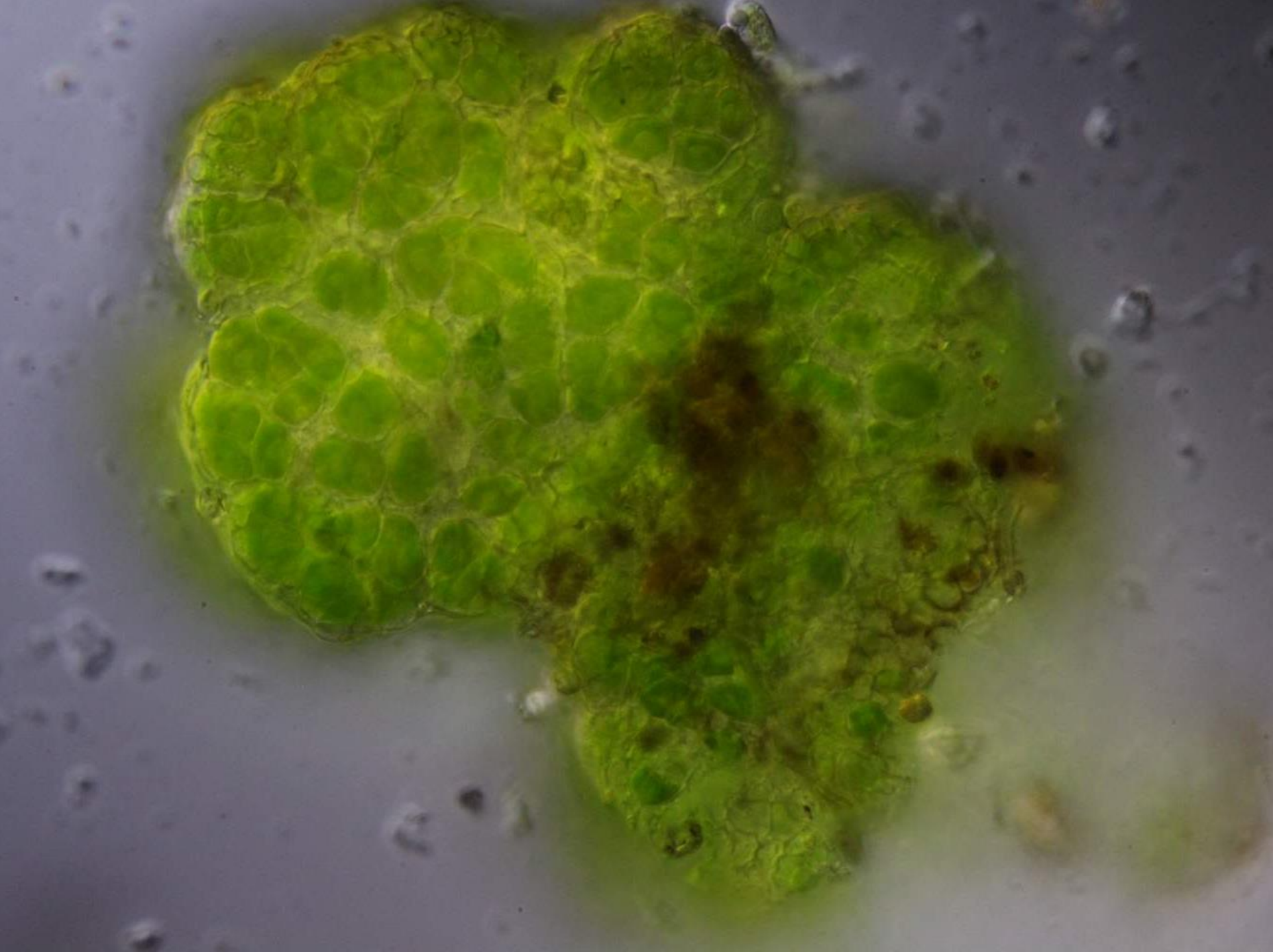


# *Strong selectivity of fungal partners?*

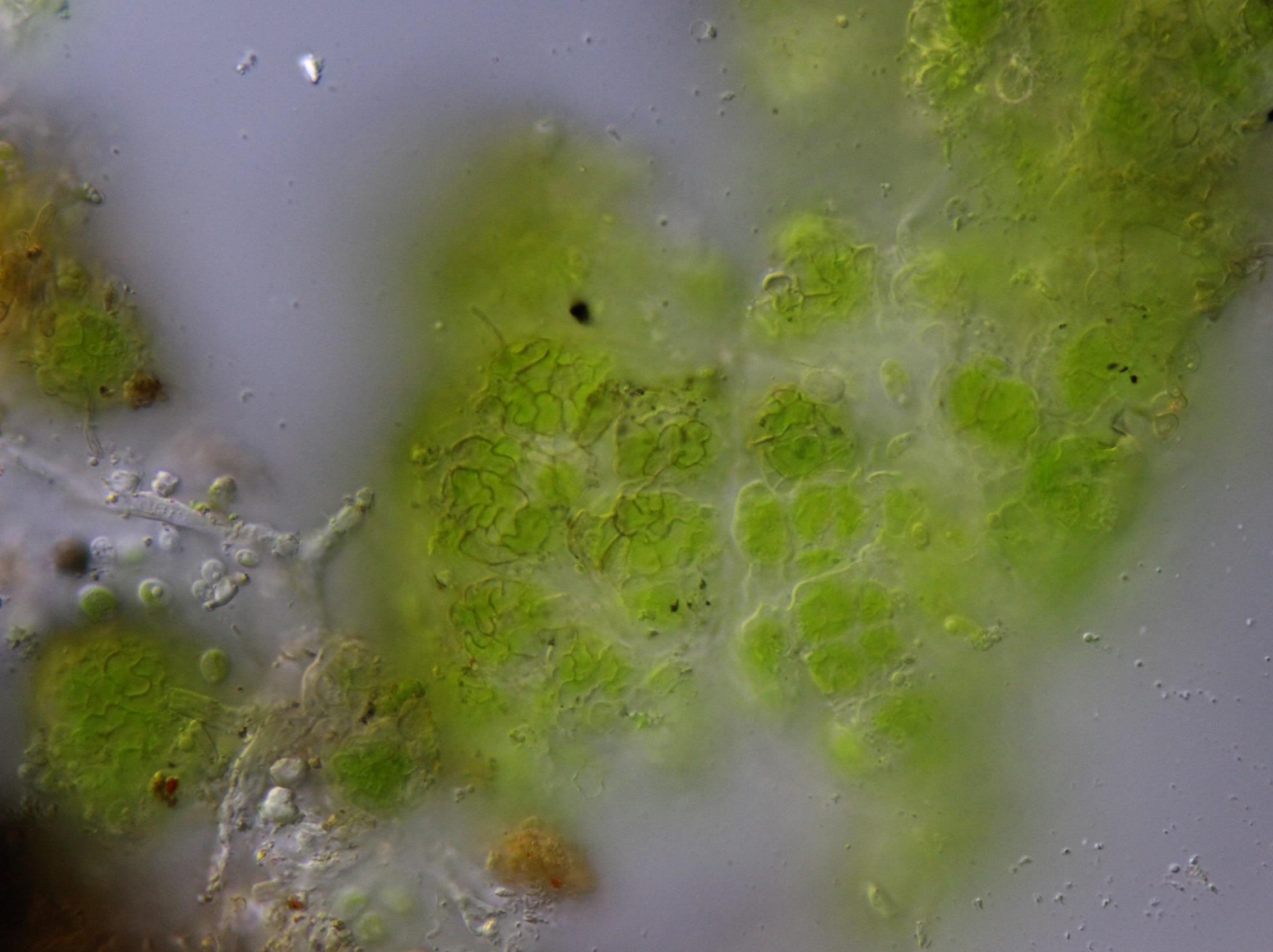






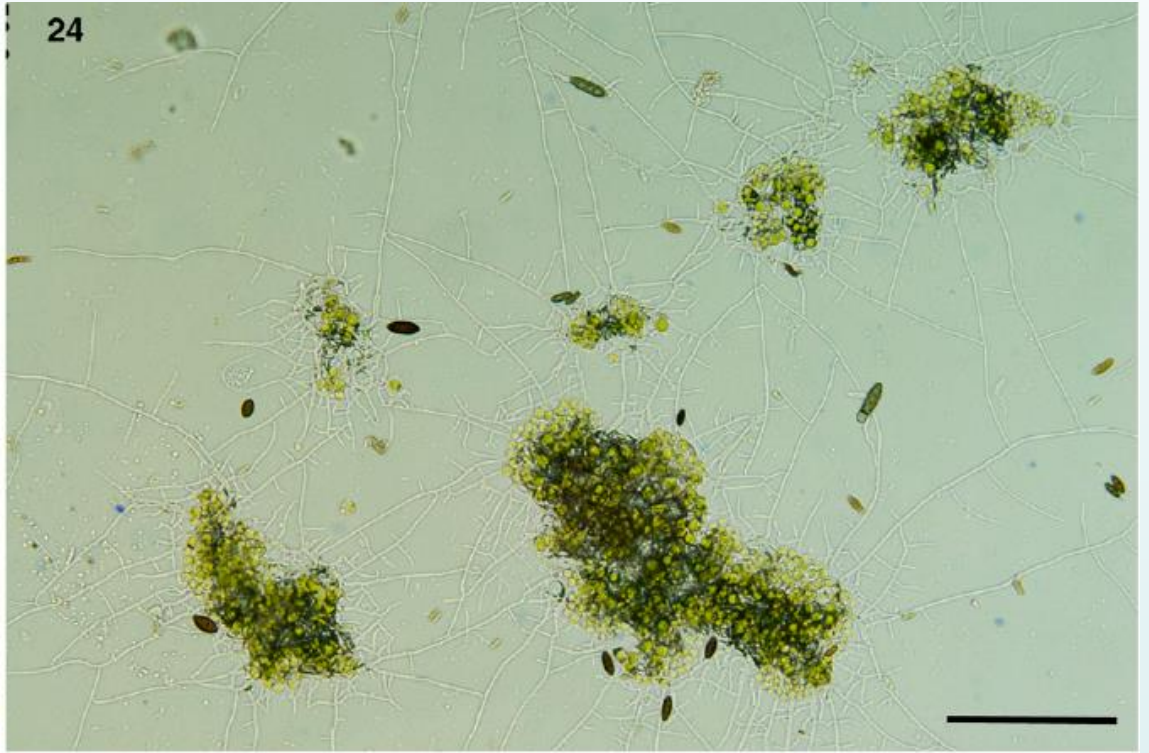
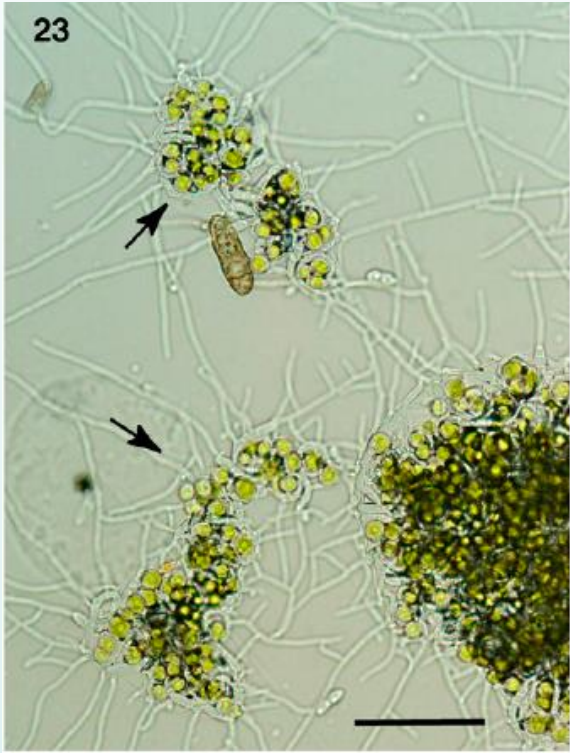




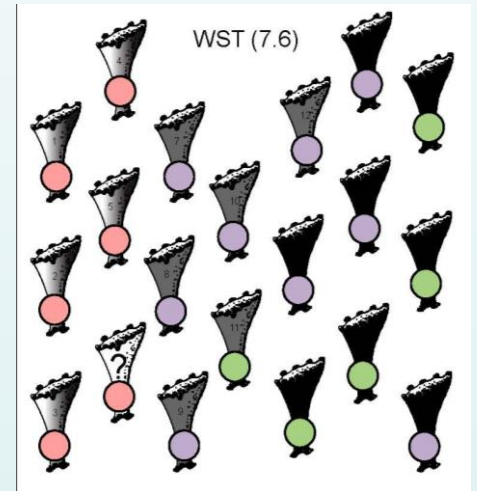
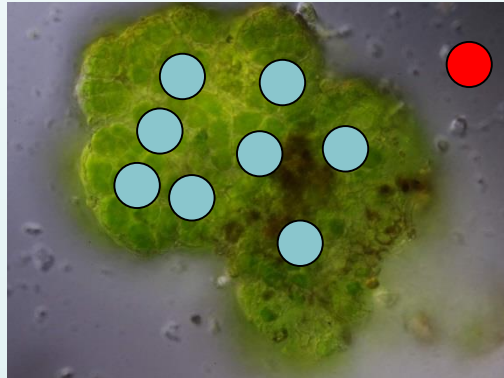
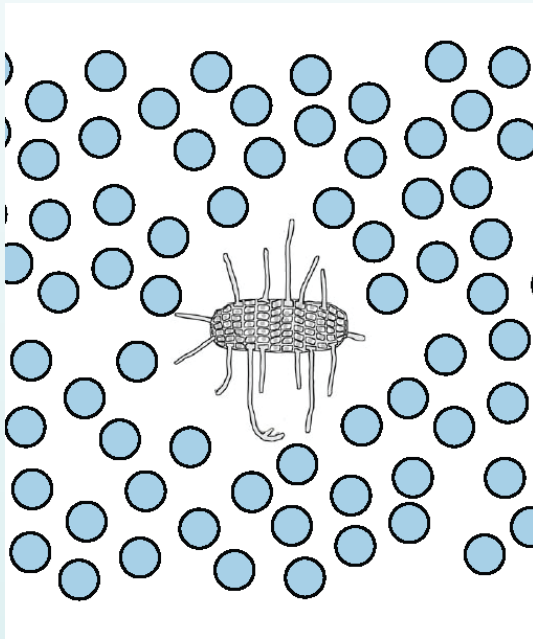




*Neither soredia, nor areolae*



*Specific, yet unknown microscopic lichen stages?*





**Thank you for your attention**



**CHARLES UNIVERSITY**

**Primus Research  
Programme**