Do reproductive and dispersal strategies shape the diversity of mycobiont-photobiont association in lichens?

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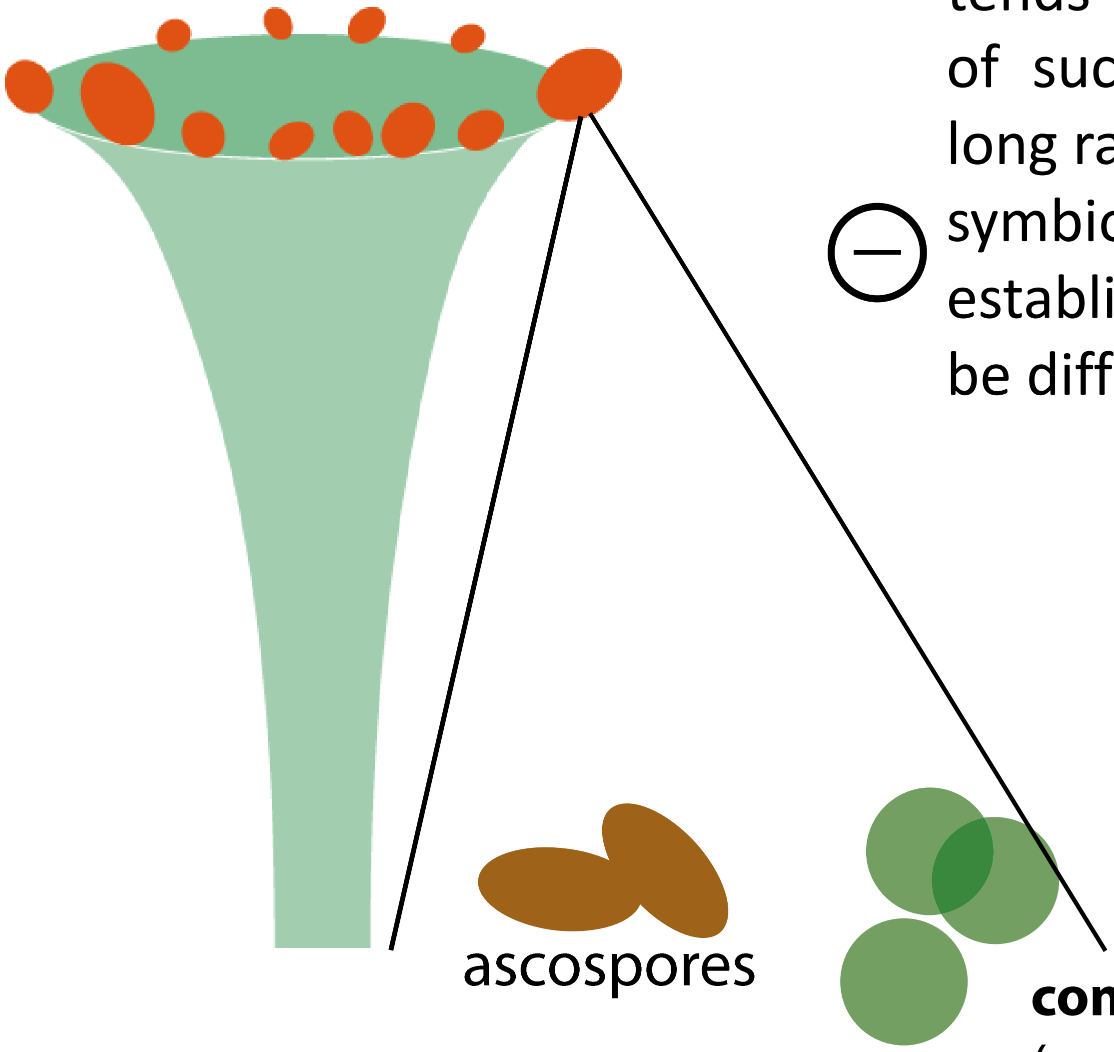
What factors may influence the choice of photobiont?

1. Mycobiont and photobiont specificity
2. Environmental conditions (climate, altitude, (micro)biotope, rain vs. sun exposure)
3. Photobiont availability at the locality
4. Geography
5. Reproductive strategy ?

Sexual reproduction – by fungal spores → fungal spores must obtain a compatible partner



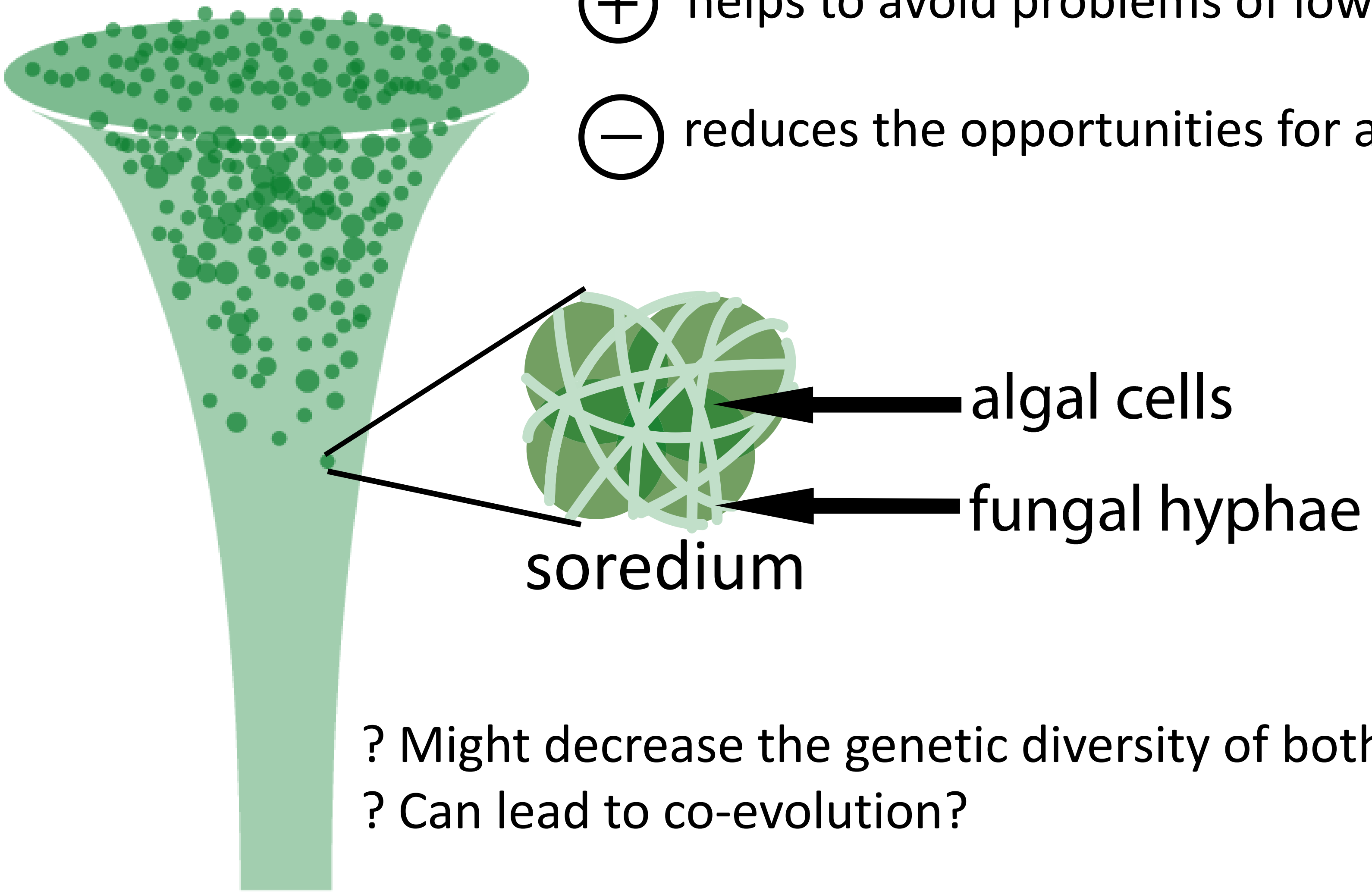
⊕ produces new genotypes and tends to increase the likelihood of successful dissemination by long range dispersal

⊖ symbiosis must be always established de novo – it might be difficult to find a partner

Asexual mode of reproduction - both partners simultaneously dispersed within specialised asexual propagules (e.g. soredia, isidia)

⊕ helps to avoid problems of low partner availability

⊖ reduces the opportunities for adaptive evolution

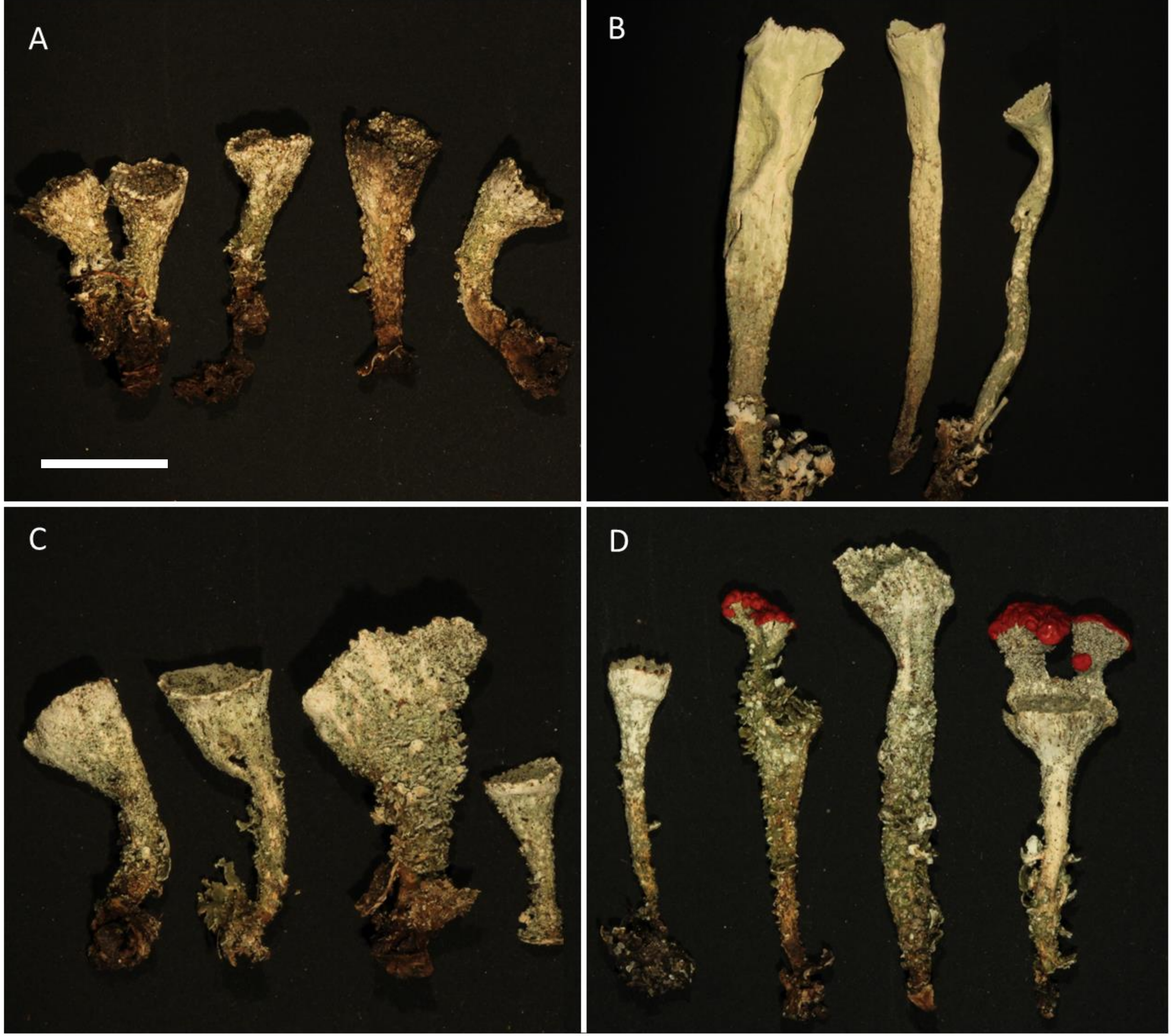


? Might decrease the genetic diversity of both partners?

? Can lead to co-evolution?

Zeorin-containing red-fruited *Cladonia* species

- similar chemical pattern – production of usnic acid and zeorin
- 5 species:
  - ***Cladonia coccifera*** (L.) Willd.
  - ***C. deformis*** (L.) Hoffm.
  - ***C. diversa*** Asperges ex. S. Stenroos
  - ***C. pleurota*** (Flörke) Schaer
  - *C. sinensis* S. Stenroos & J. B. Chen (SE Asia only)
- **size, shape and location of vegetative propagules**: most important diagnostic characters – **sorediate and esorediate species**



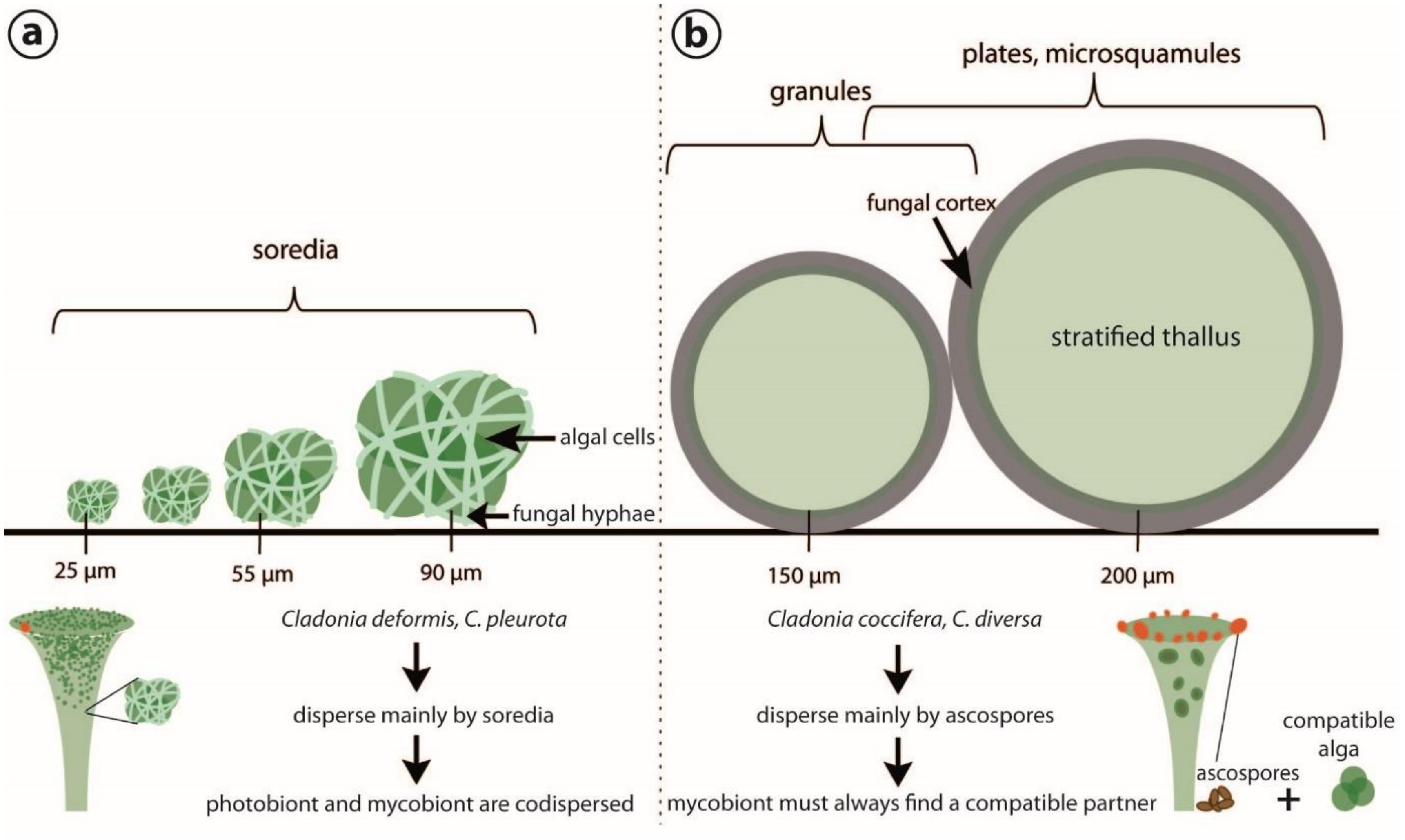
(A) *C. coccifera*,

(B) *C. deformis*,

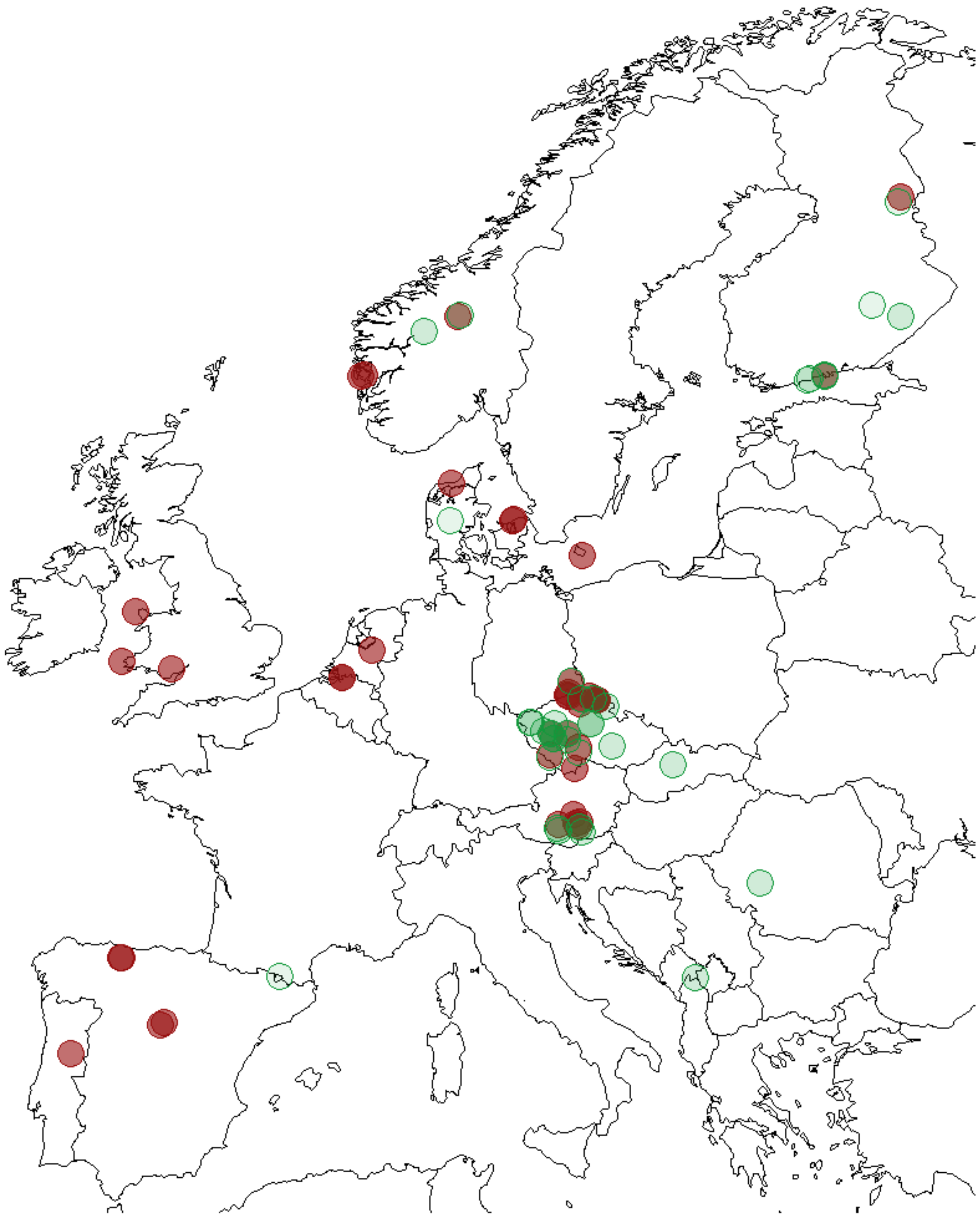
(C) *C. pleurota*,

(D) *C. diversa*.
Scale is 1 cm.

Zeorin-containing red-fruited *Cladonia* species: two sorediate and two esorediate taxa differing by the extent of the sexual reproduction and the type of vegetative propagules



Sampling



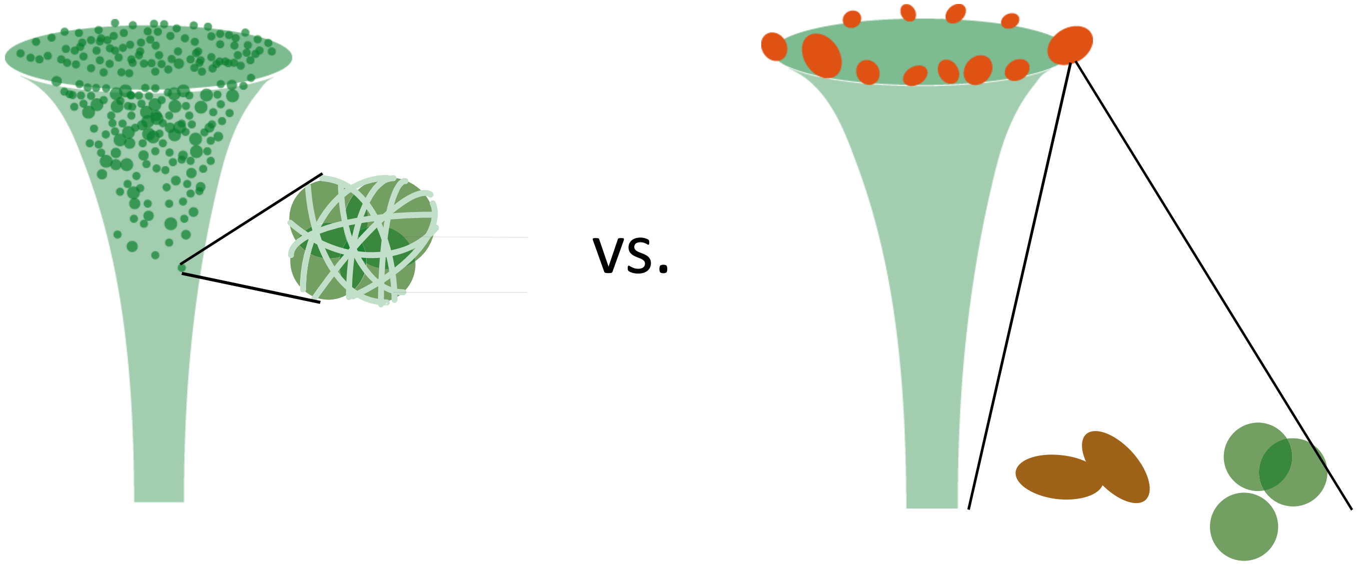
Sorediate taxa (*Cladonia deformis* + *C. pleurota*)

Esorediate taxa (*Cladonia coccifera* + *C. diversa*)

- esorediate and sorediate taxa collected several times at the same site.

Is photobiont diversity of zeorin-containing *Cladonias* influenced by the distribution strategy?

- 43 sorediate (*C. deformis* and *C. pleurota*) and 42 esorediate (*C. coccifera* and *C. diversa*) samples from Europe

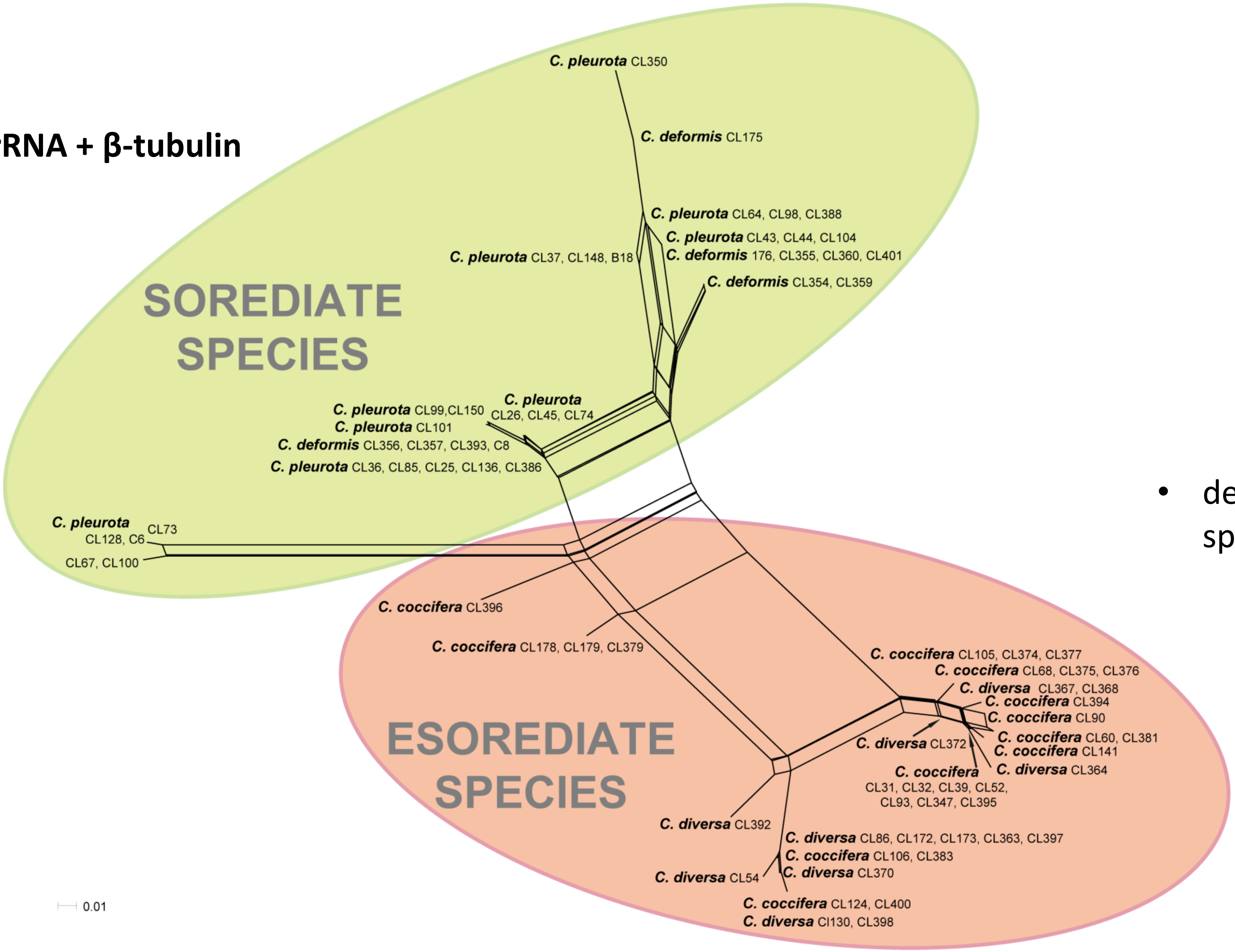


- Algal internal transcribed spacer region (ITS) and partial actin I
- Fungal internal transcribed spacer region (ITS) and β-tubulin

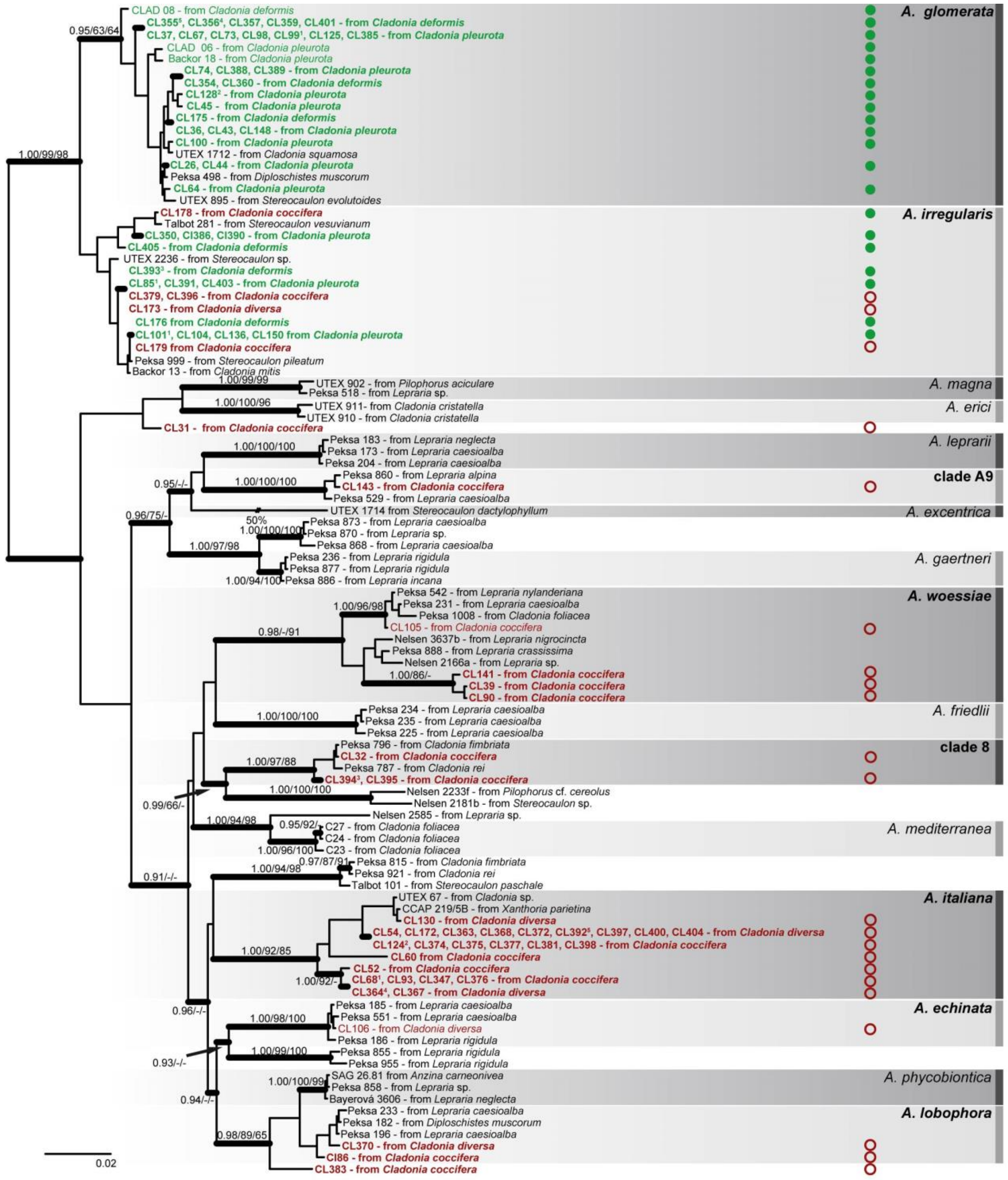
- → comparing photobiont diversity, mycobiont specificity

Fungal molecular diversity

ITS rRNA + β-tubulin



- delimitation of individual species not supported



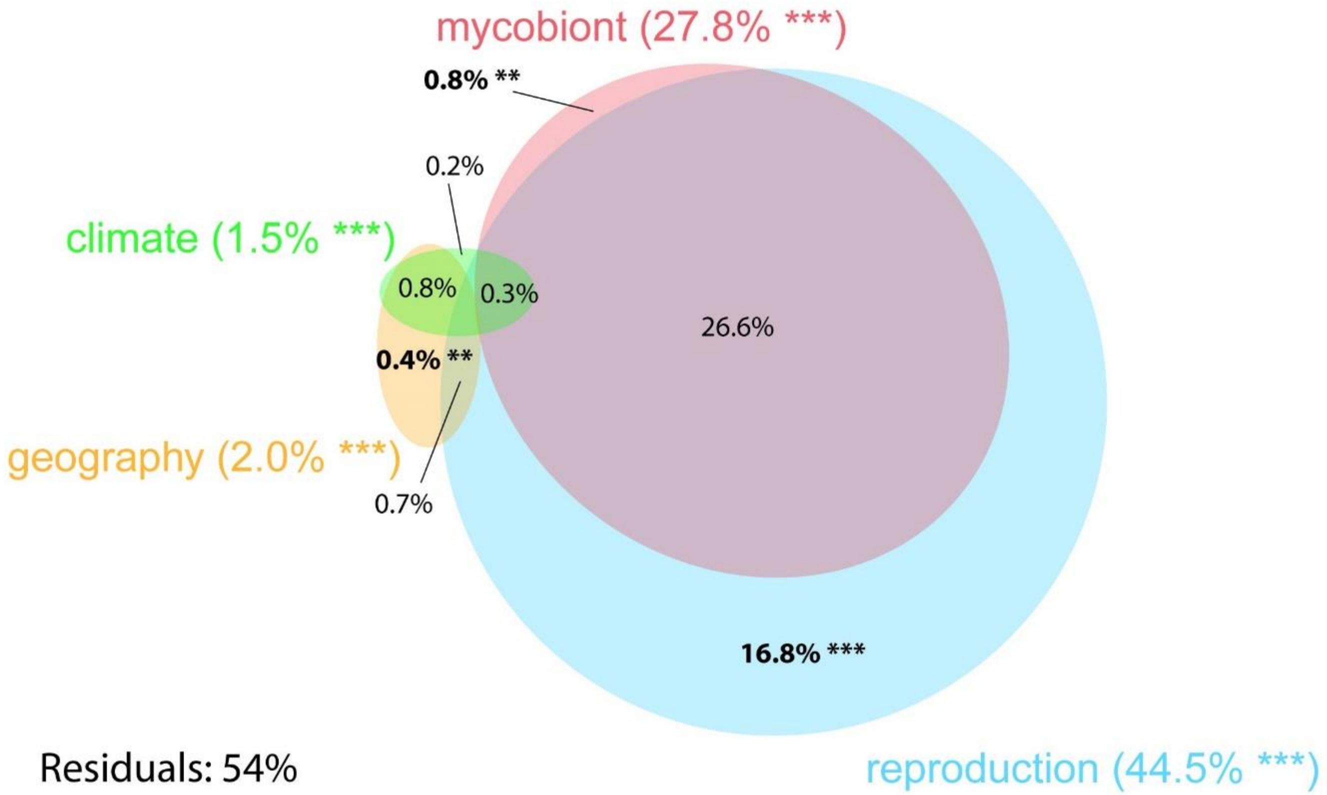
soirediate taxa

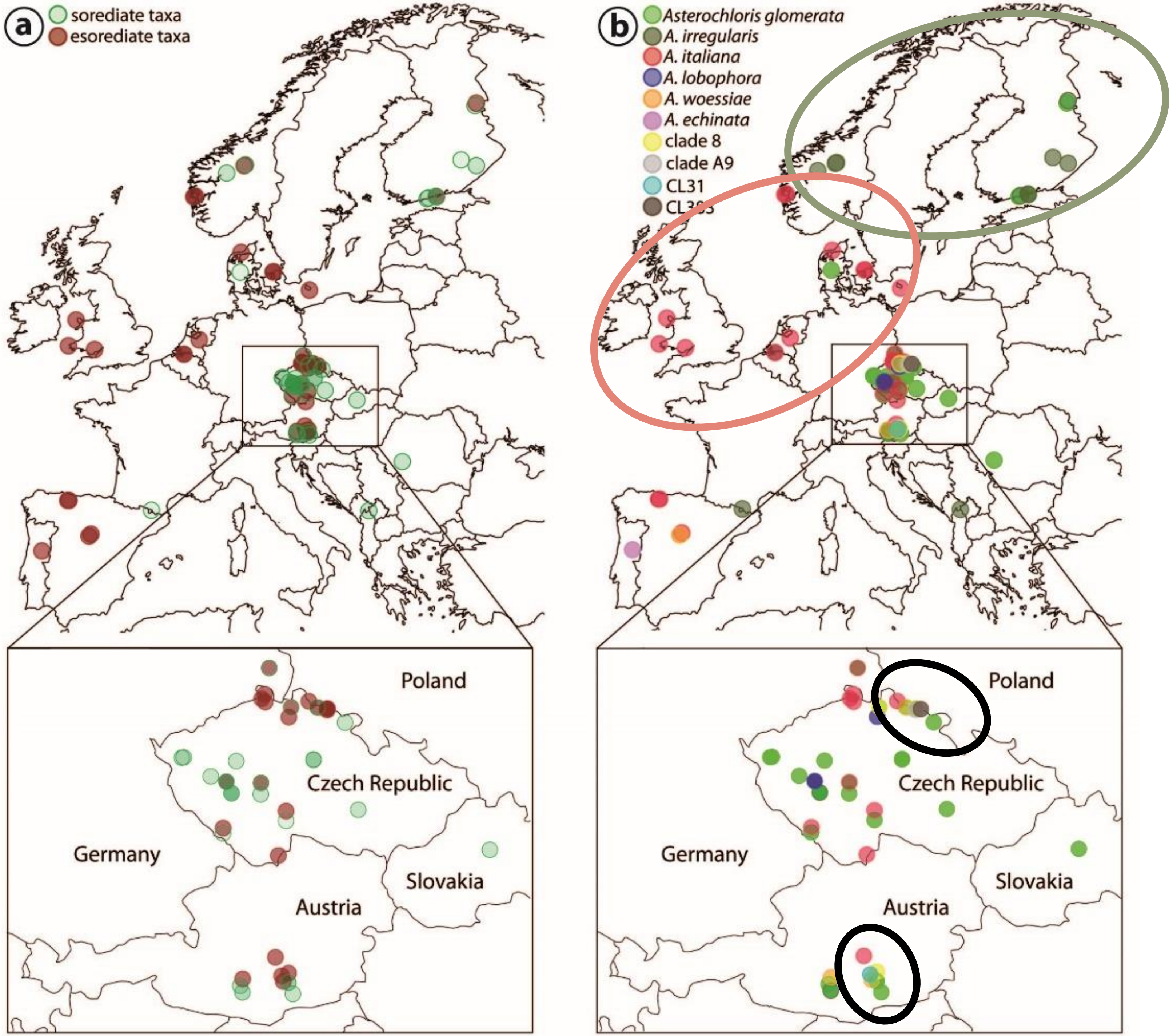
esorediate taxa

Sorediate taxa associated with **2 algal lineages** wheras **esorediate taxa** contained **7 photobiont species**.

Esorediate and sorediate taxa contained different photobiont at the same locality

- **variance partitioning** to describe and to partition variance in photobiont genetic diversity
- the **photobiont genetic distance matrix** - response matrix
- **genetic distance of the mycobionts, geographic, climatic and reproductive distances** - explanatory matrices





two main patterns of *Asterochloris* diversity across Europe:

1. **wide geographic areas dominated by only one or two *Asterochloris* species**
2. **high *Asterochloris* diversity within relatively small geographic regions**

oceanic parts of Europe: sorediate species are very rare – are they limited by the local environmental conditions not suitable for the physiological optimum of their preferred photobionts *A. glomerata* and *A. irregularis?*

Conclusions

- **Reproduction strategy influences the photobiont diversity in zeorin-containing red-fruited *Cladonia* species** – lichens reproducing mainly by ascospores showed lowed level of specificity towards *Asterochloris* species compared to lichens producing soredia

- At the same sampling site sorediate and esorediate species contain different photobiont species

- **Might photobiont availability influence the lichen distribution?**

(*C. deformis* and *C. pleurota* lacking in areas dominating by *A. italiana*??)

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