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Macroecological and environmental patterns of urban algal biodiversity in Central Europe

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Urban microflora

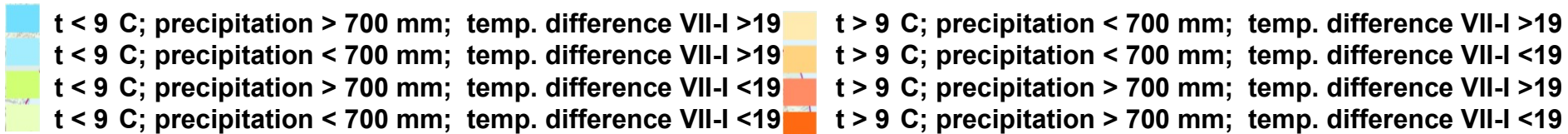
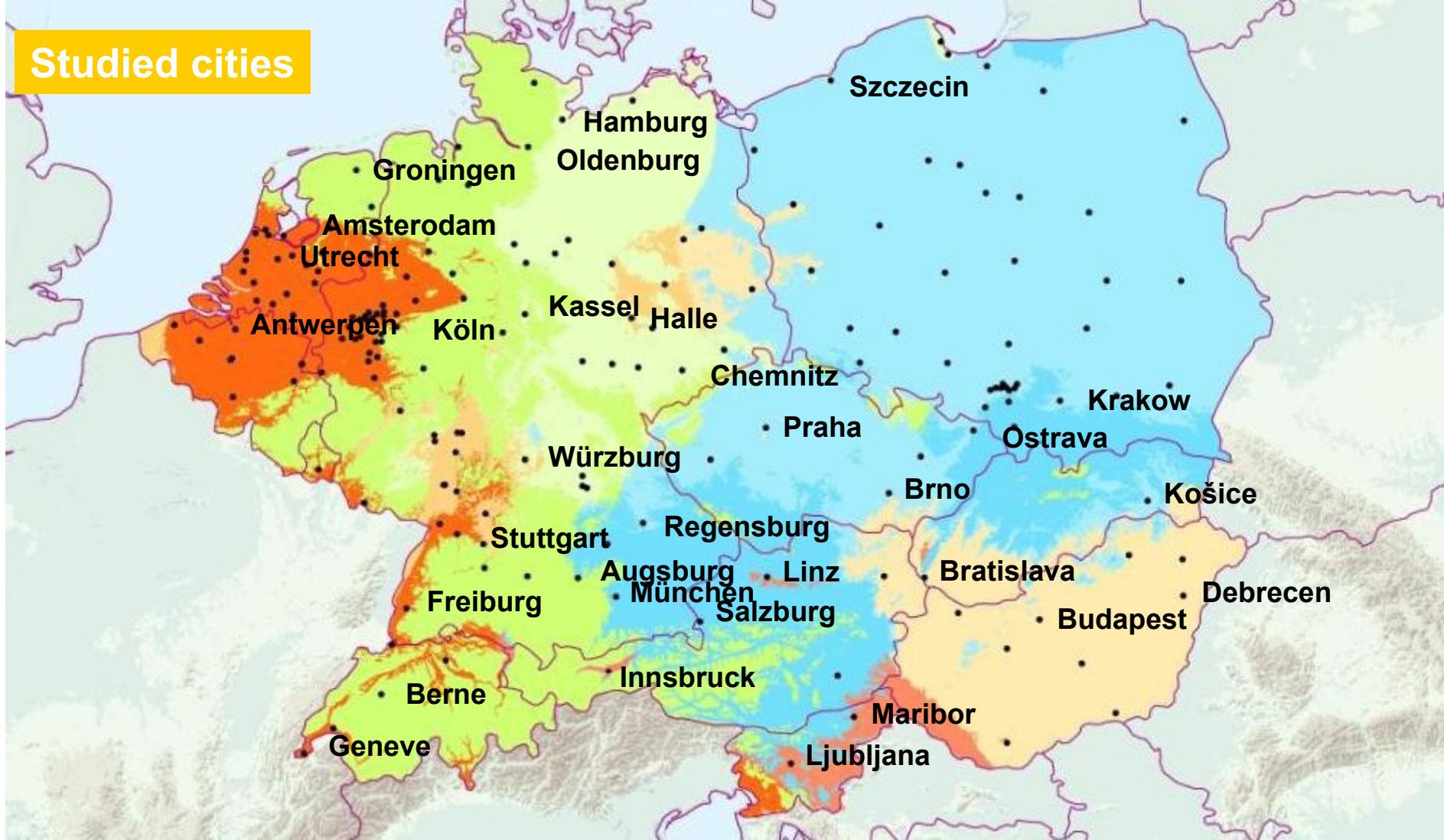
European urban microfloras are at the periphery of scientific interests in phycology...

Our question

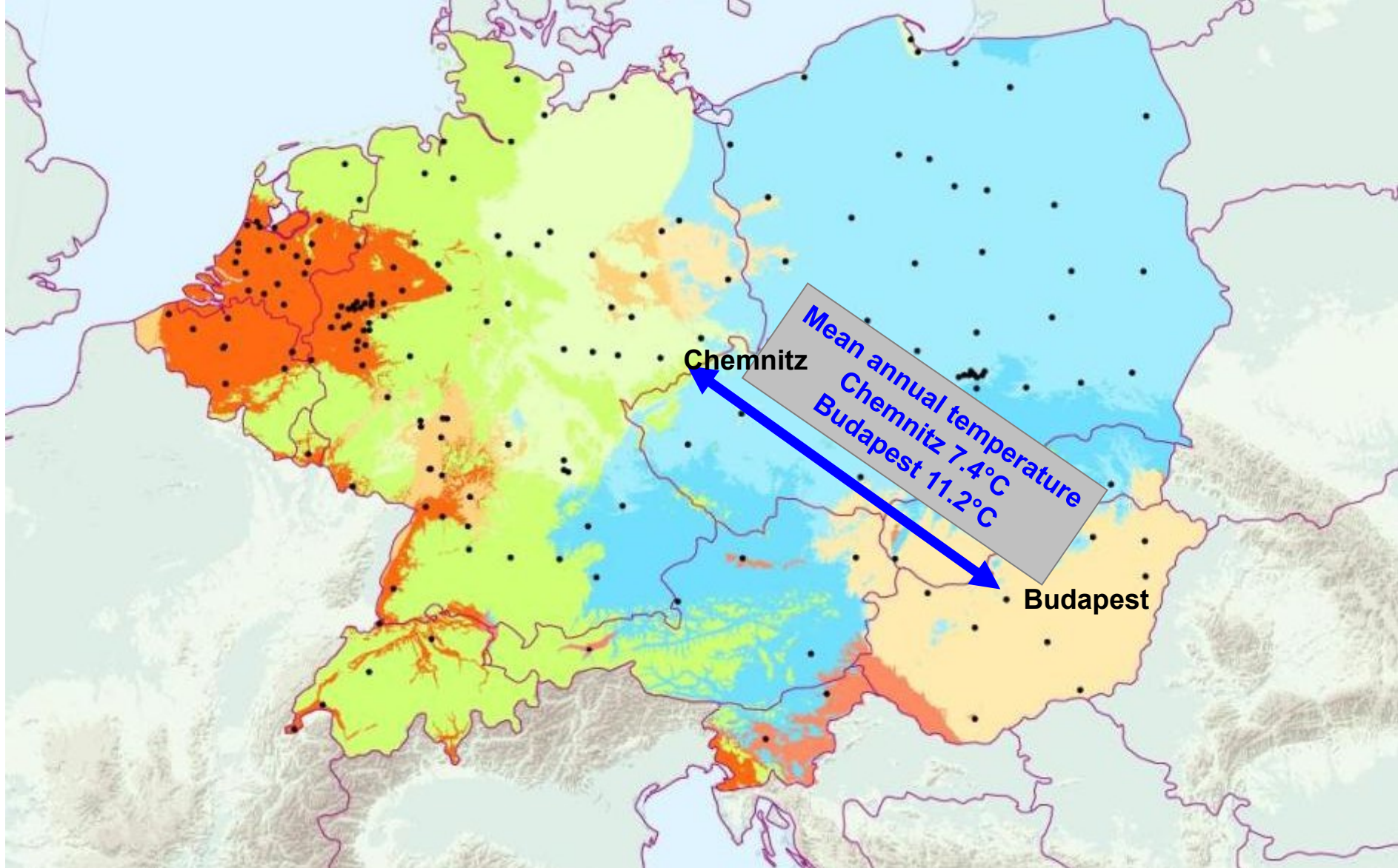
Are species richness, diversity and composition in Central European cities more strongly controlled by habitat, substrata or climatic conditions?

Which species of microalgae are diagnostic for assemblages in Central European cities?

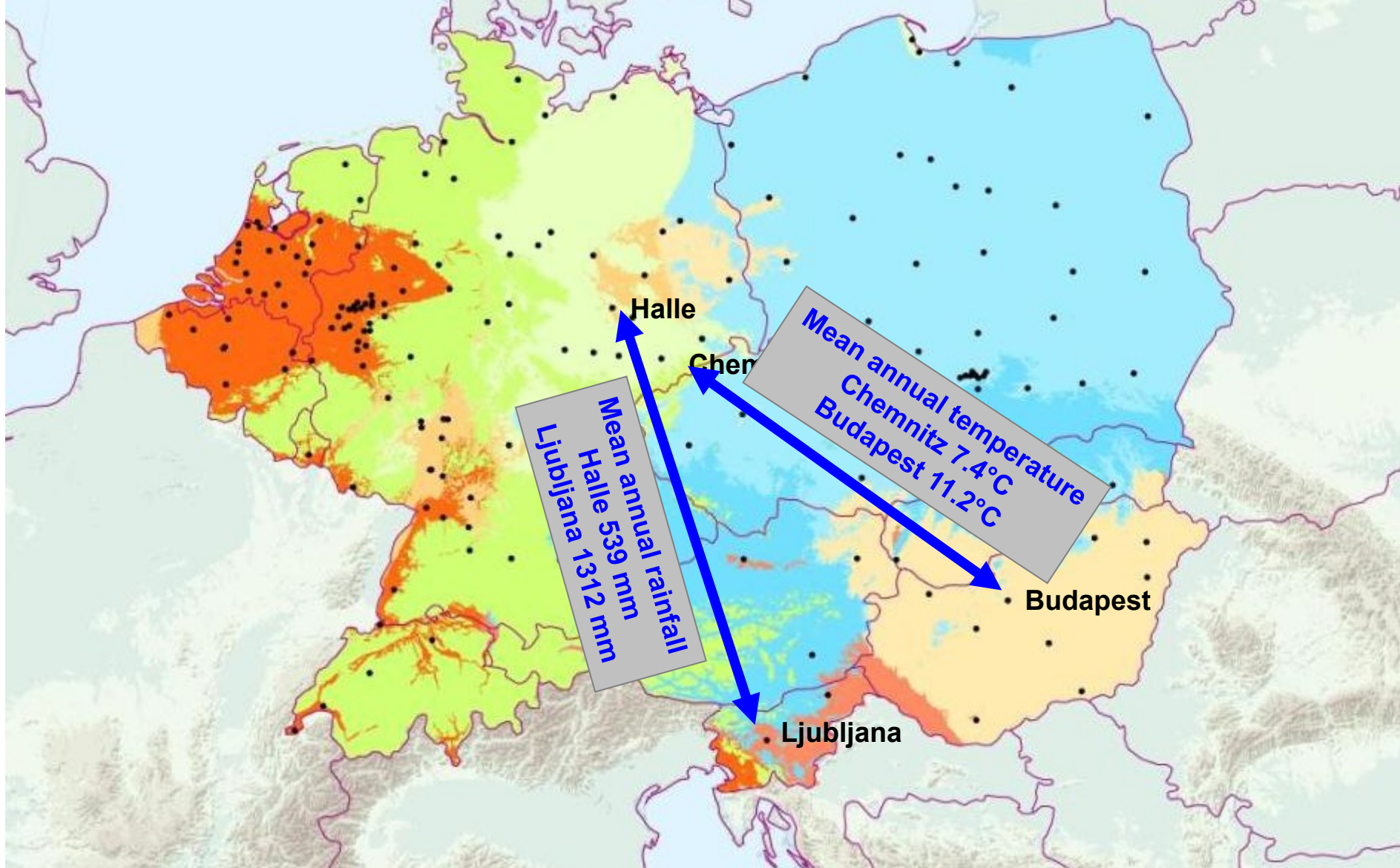
Studied cities

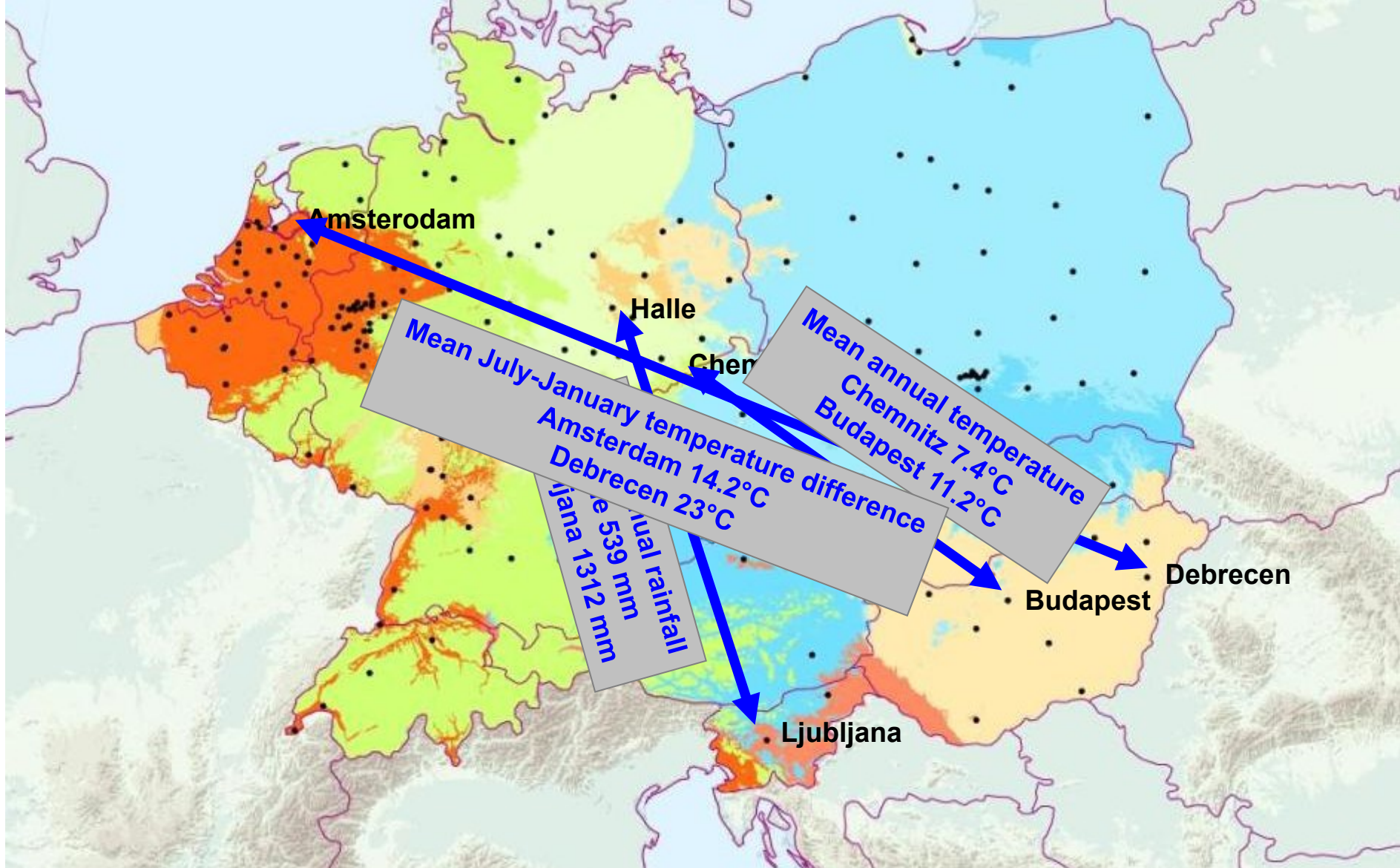


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Sampling design

June–August; 2007–2009

four different urban habitats (centre - tree bark, park - tree bark, centre - sandstone, park - sandstone)

1 m above the ground

presence/absence data

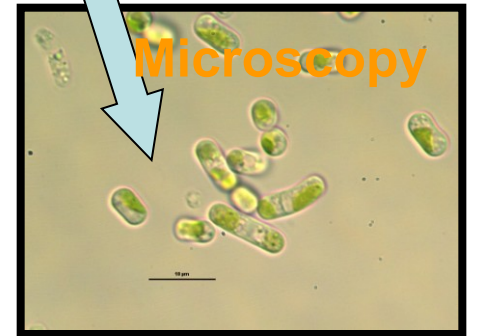
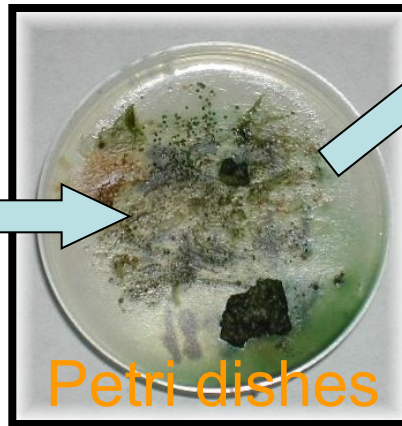
species were characterized according to their taxonomy and autecology (7 taxonomic groups)

Cultivation

Media BBM, Z and bi-phase (water-soil)

Statistical analysis

CANOCO version 4.5, JUICE



Centre



Centre - bark



Centre - sandstone



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City park

City park – bark



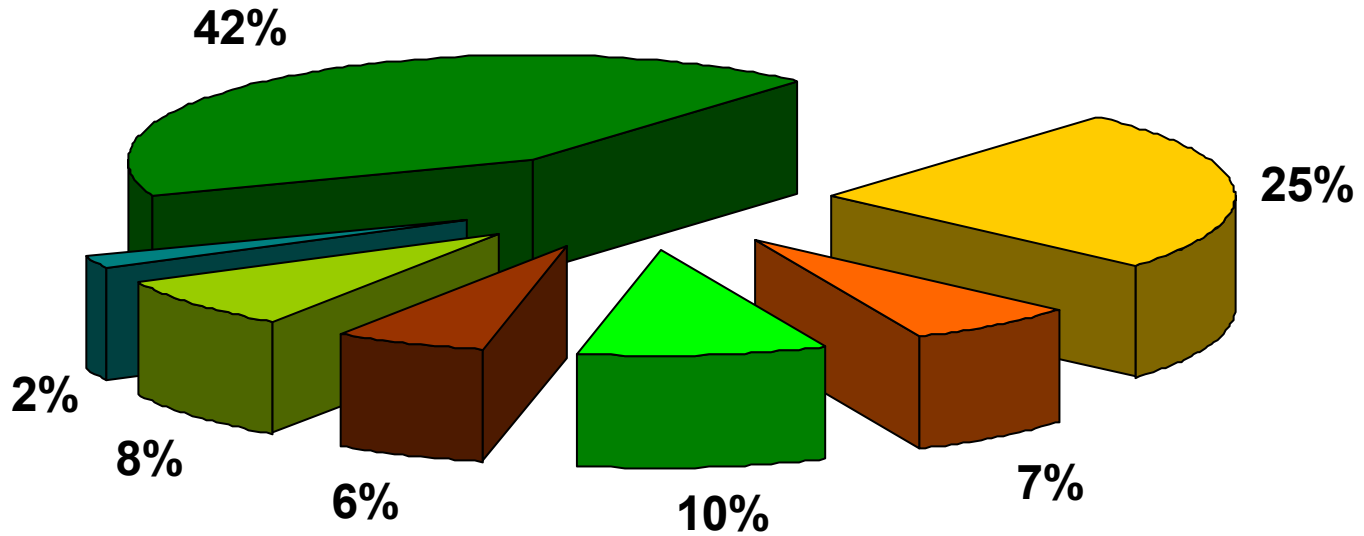
City park - sandstone



RESULTS

- Total species richness: 129 taxa
- Frequency of species: 0-55 Centre (mean 10), 0-56 Bark (mean 17)
- All habitats: min 9 max 53 (mean 28)
- Habitat Centre: min 9 max 41 (mean 20)
- Habitat Park: min 19 max 53 (mean 35)

Ratio of each algal class in urban habitats



■ Chlorophyceae

■ Xanthophyceae

■ Cyanophyceae

■ Trebouxioephyceae

■ Bacillariophyceae

■ Trentepohliophyceae

■ Klebsormidiophyceae

Explained variation in species composition

climate

urban habitat type
(substrate+environment)

9.3

11.7

all species

8.5

14.9

Trebouxiophyceae

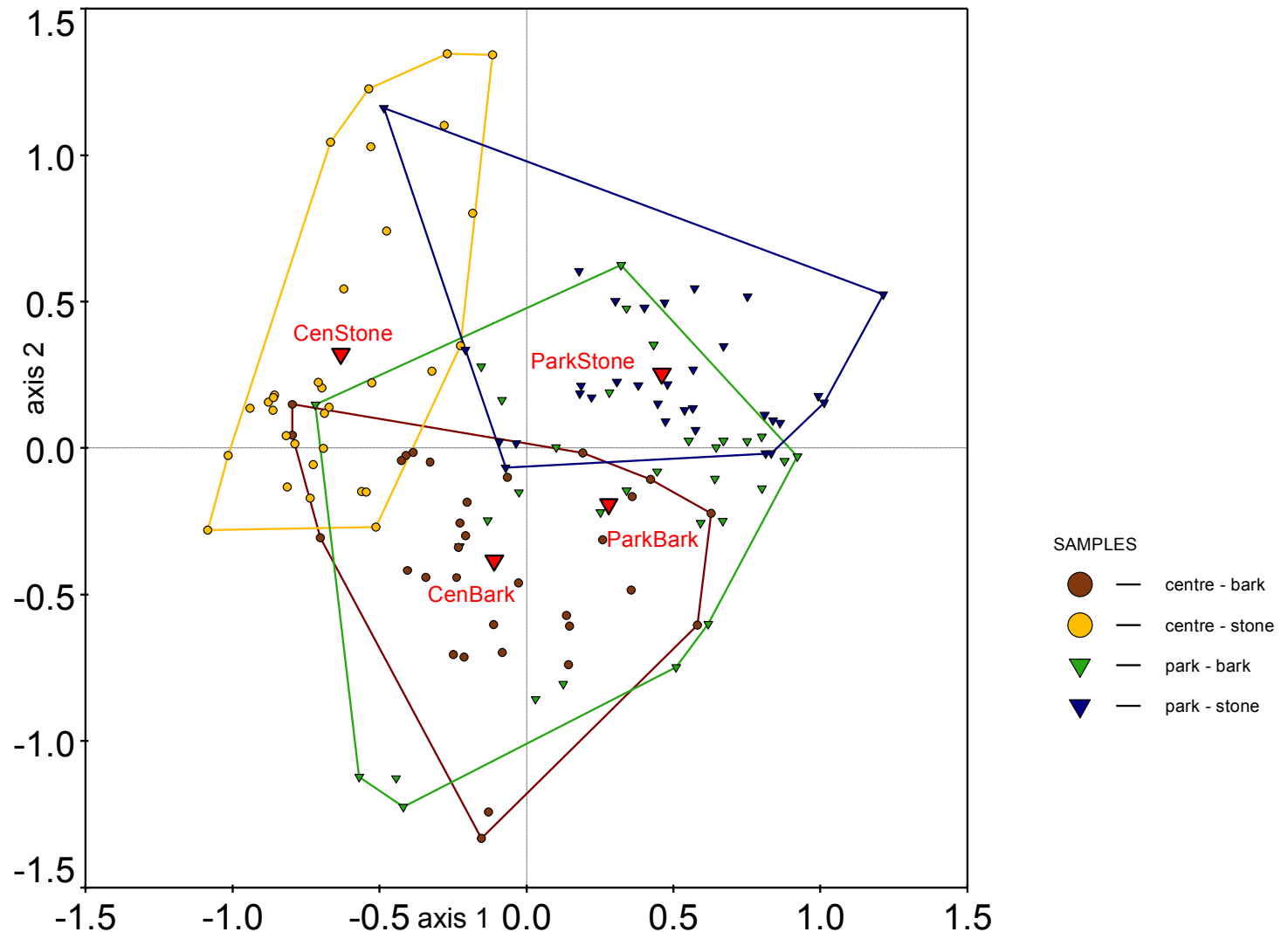
12.1 Klebsormidiophyceae

11.4

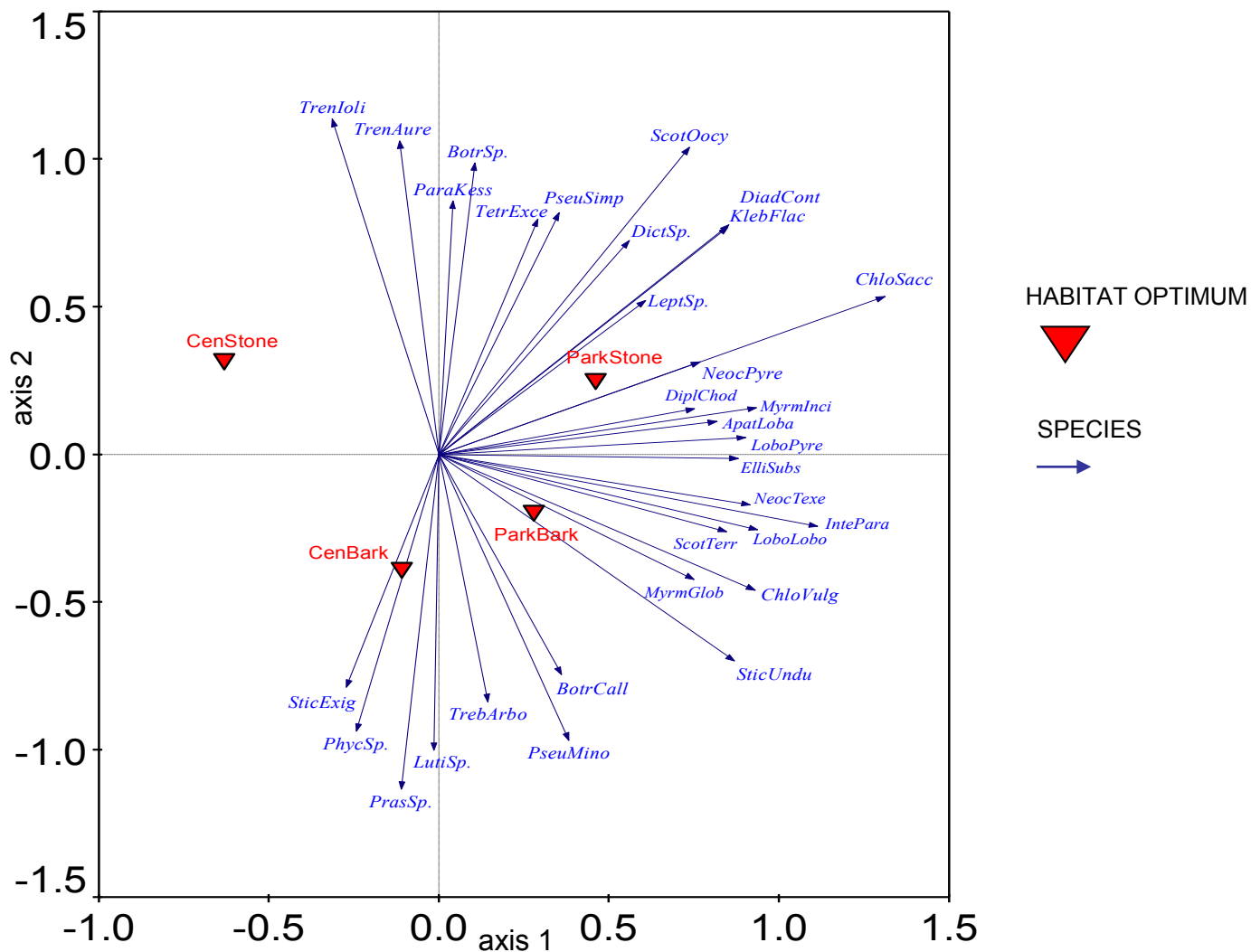
RDA analysis

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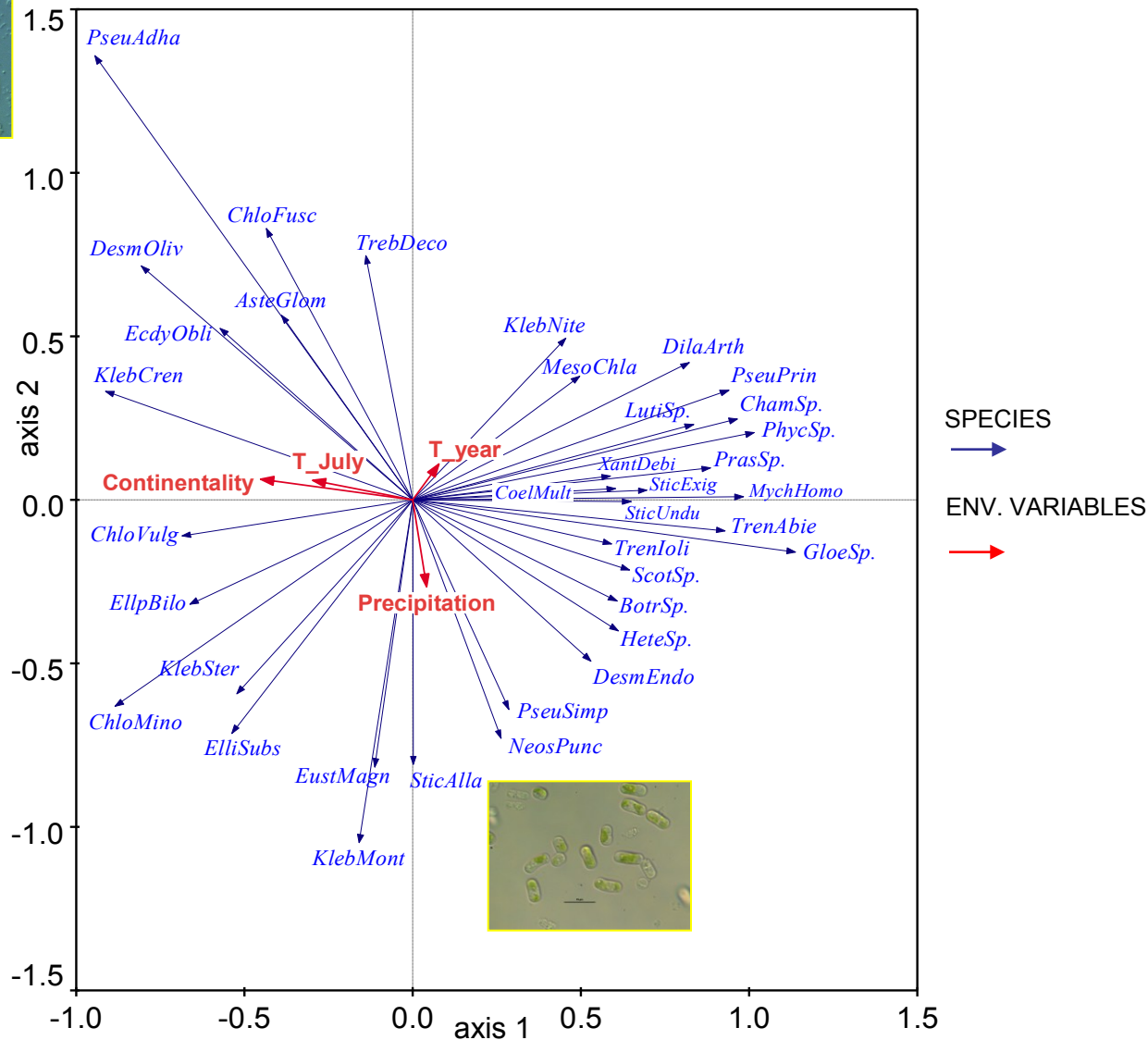
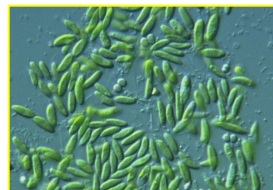
Ordination by partial PCA, with habitat types used (substrate+environment) as passively projected variables and climate data as covariables



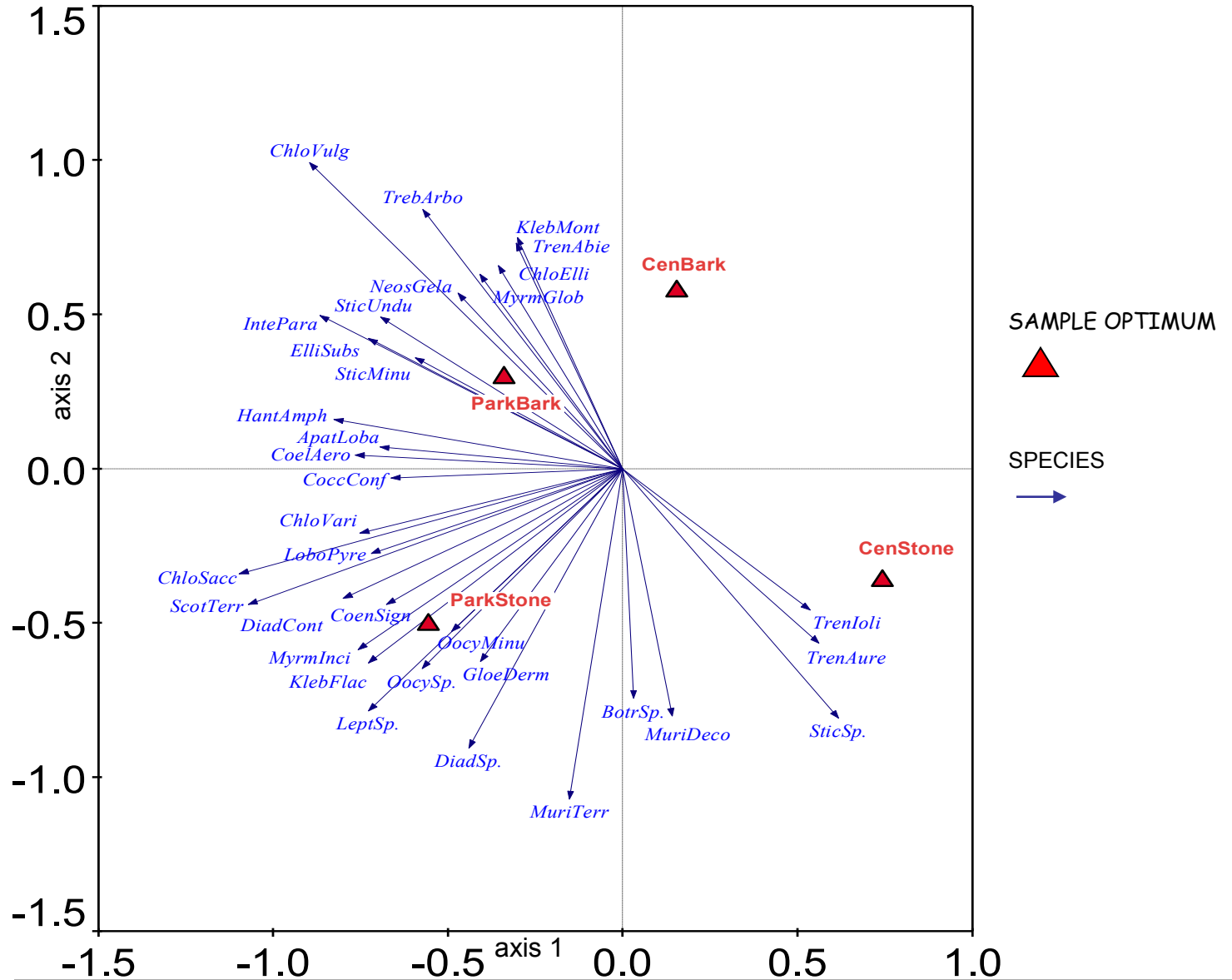
Ordination by partial PCA, with habitat types used as passively projected variables and climate data as covariables



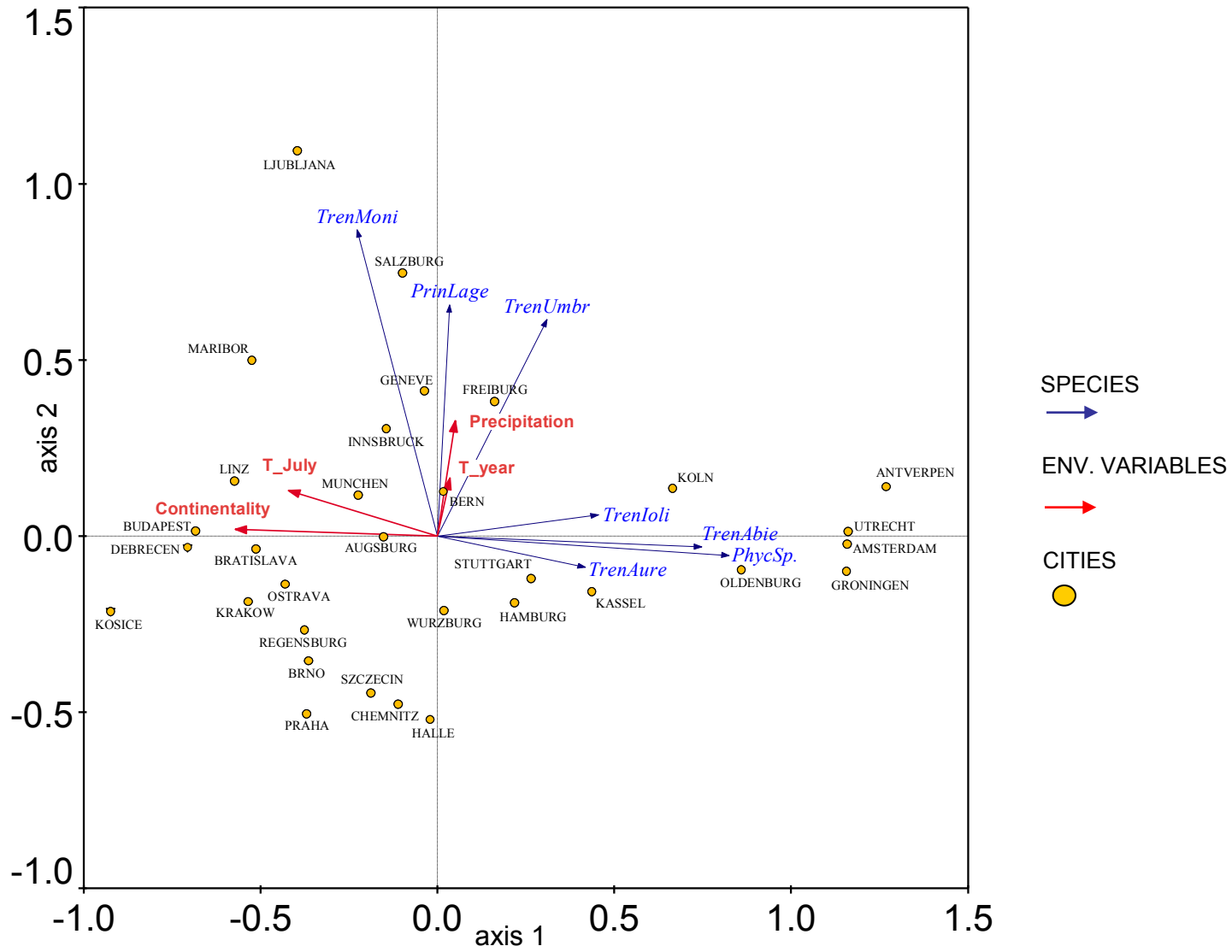
RDA analysis, for species and climate



RDA analysis, for species and habitat types



RDA analysis, for Trentepohliophyceae and climate with cities

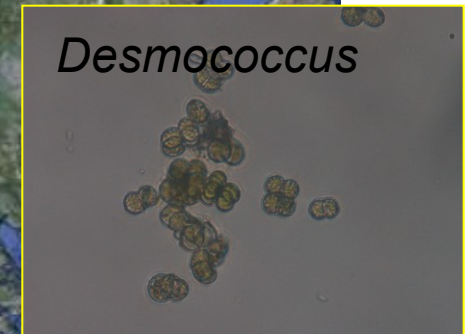
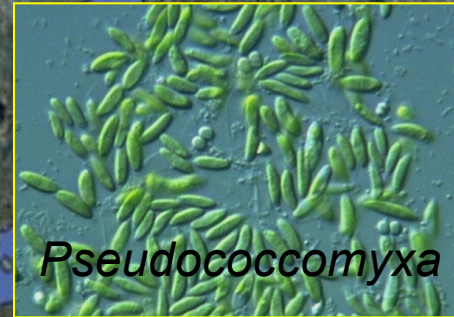


DIAGNOSTIC SPECIES OF URBAN MICROALGAL ASSEMBLAGES (JUICE - Cluster analysis)

- Synoptic table with 129 taxa
- 8 clusters
- Interpretable only clusters 6, 7 and 8
- Cluster 6 – Park habitat in eastern part of Central Europe
- Cluster 7 – Tree Bark in western part of Central Europe
- Cluster 8 – Sandstone in western part of Central Europe

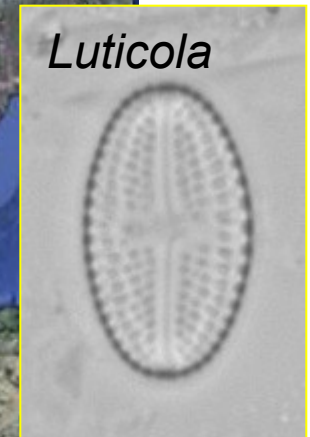
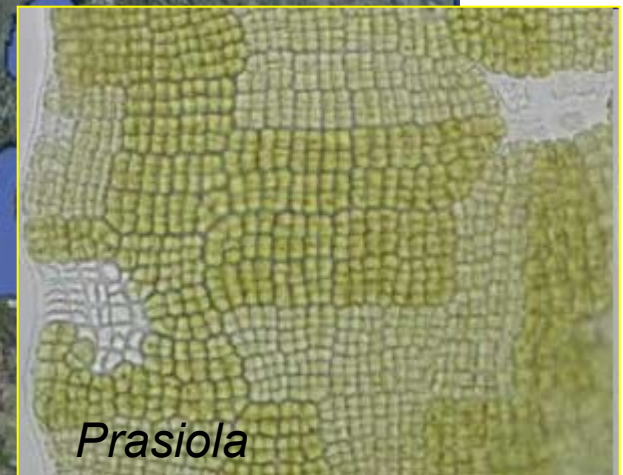
Continental climate, in Park habitat - Diagnostic species

- *Pseudococcomyxa adhaerens*
- *Desmococcus olivaceus*
- *Tetracystis excentrica*
- *Xanthonema pascheri*
- *Tetracystis sarcinalis*
- *Chlorella fusca*
- *Neochloris pyrenoidosa*



Oceanic climate in Park on Bark - Diagnostic species

- *Prasiola* sp.
- *Luticola* sp.
- *Pseudendoclonium printzii*
- *Dilabifilum arthropyreniae*
- *Chamaepinnularia* sp.
- *Botrydiopsis callosa*
- *Spongiochloris* sp.
- *Stichococcus exiguus*
- *Klebsormidium nitens*
- *Mesotaenium chlamydosporum*
- *Phycopeltis* sp.



Oceanic climate, in Park on Sandstone - Diagnostic species

- *Trentepohlia aurea*
- *Trentepohlia iolithus*
- *Parachlorella kessleri*
- *Botrydiopsis* sp.



Conclusions

- **Differences among urban habitats and substrata cause the most important changes in species composition and diversity of urban phycoflora (except class Trentepohliophyceae – climatic conditions)**
- **The climatic conditions (continentality) are important predictors for significant differences in microalgal assemblages**
- **Diagnostic species were found only for three interpretable assemblages because of suboceanic gradient across Central Europe**

Acknowledgements

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Thanks for your attention



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