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Aquatic hyphomycetes in streams of the Swiss National Park

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Background

Aquatic hyphomycetes (AH) play important ecological roles in forested streams as the dominant microbial decomposers of plant matter (mainly leaves and wood). Some studies suggest that their activity to perform these ecological roles depends on their biodiversity (species richness, composition, etc.). Despite their importance, AH biodiversity, biogeography, and sensitivity to environmental change including stressors are not well understood. AH biodiversity in high-altitude ecosystems and in springs has rarely been studied[but see 1] but might be particularly threatened due to the fast changes in climate/meteorology and forest composition. These knowledge gaps hinder effective conservation of AH biodiversity and their ecological functions.

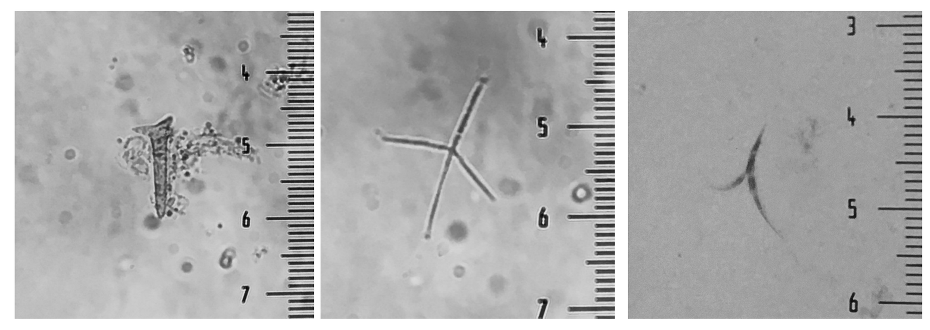
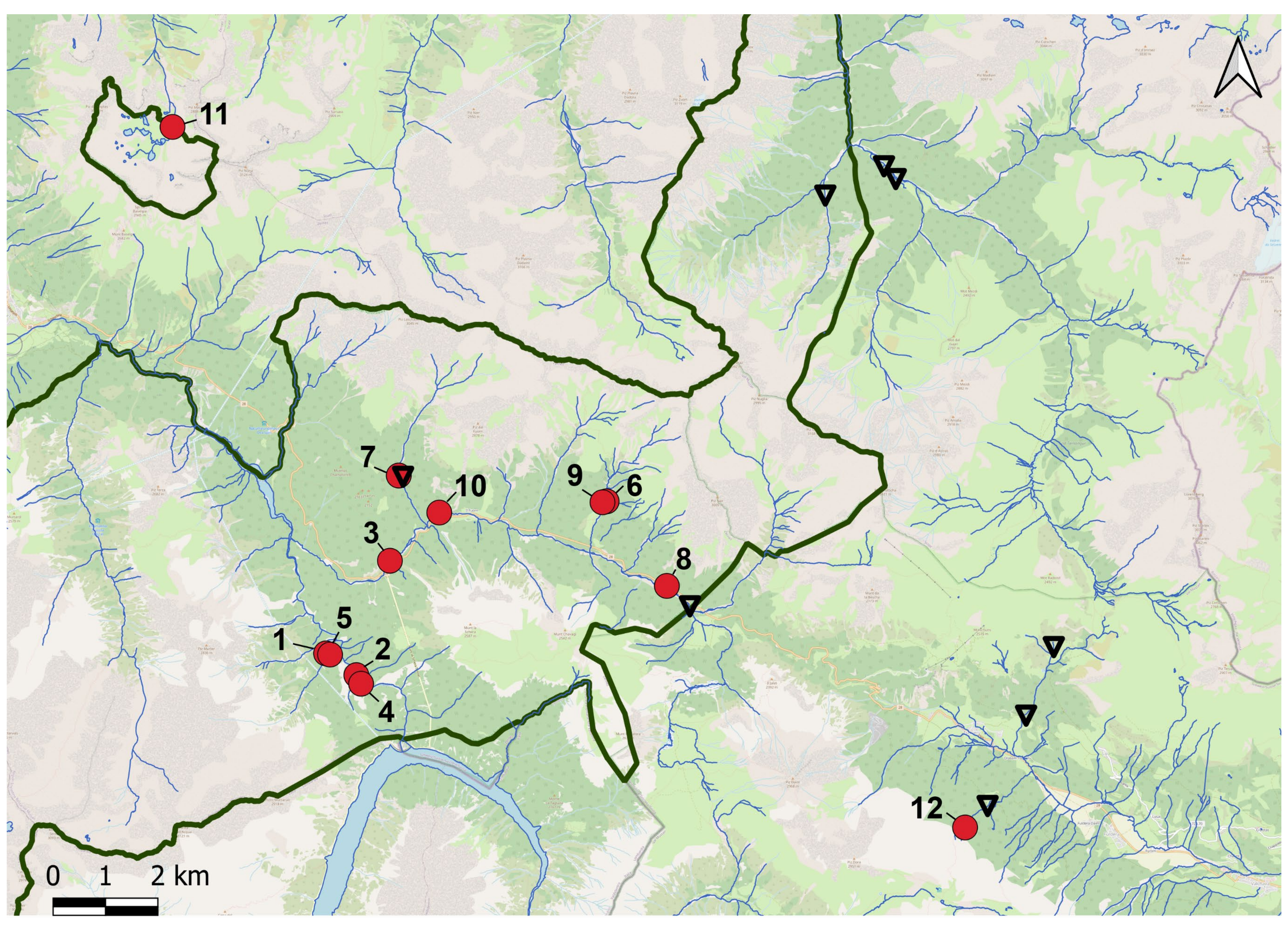


Figure 1: Conidia of AH species encountered (examples): *Neonectria lugdunensis*, *Alatospora acuminata*, *Ypsilina graminea* (from left to right).
One unit on the scale bar = 20 µm

Methods

- We performed a survey of AH biodiversity in the Swiss National Park and the Biosfera Val Müstair in streams ranging from small springs to the main rivers (Spöl, Ova dal Fuorn). This allowed us to sample very different ecosystem types and to test the role of environmental conditions on AH biodiversity in the region.
- We sampled each site once in autumn, which presents the most favorable conditions for AH reproductive activity.
- We applied traditional techniques to sample and identify AH based on the morphology of their conidia (Fig. 1): i) trapped in foam accumulating in the streams, ii) transported in the flowing water, and iii) generated by sporulating plant matter sampled from the sites.
- We measured environmental conditions at the sites or from water samples to correlate these conditions with AH species richness.



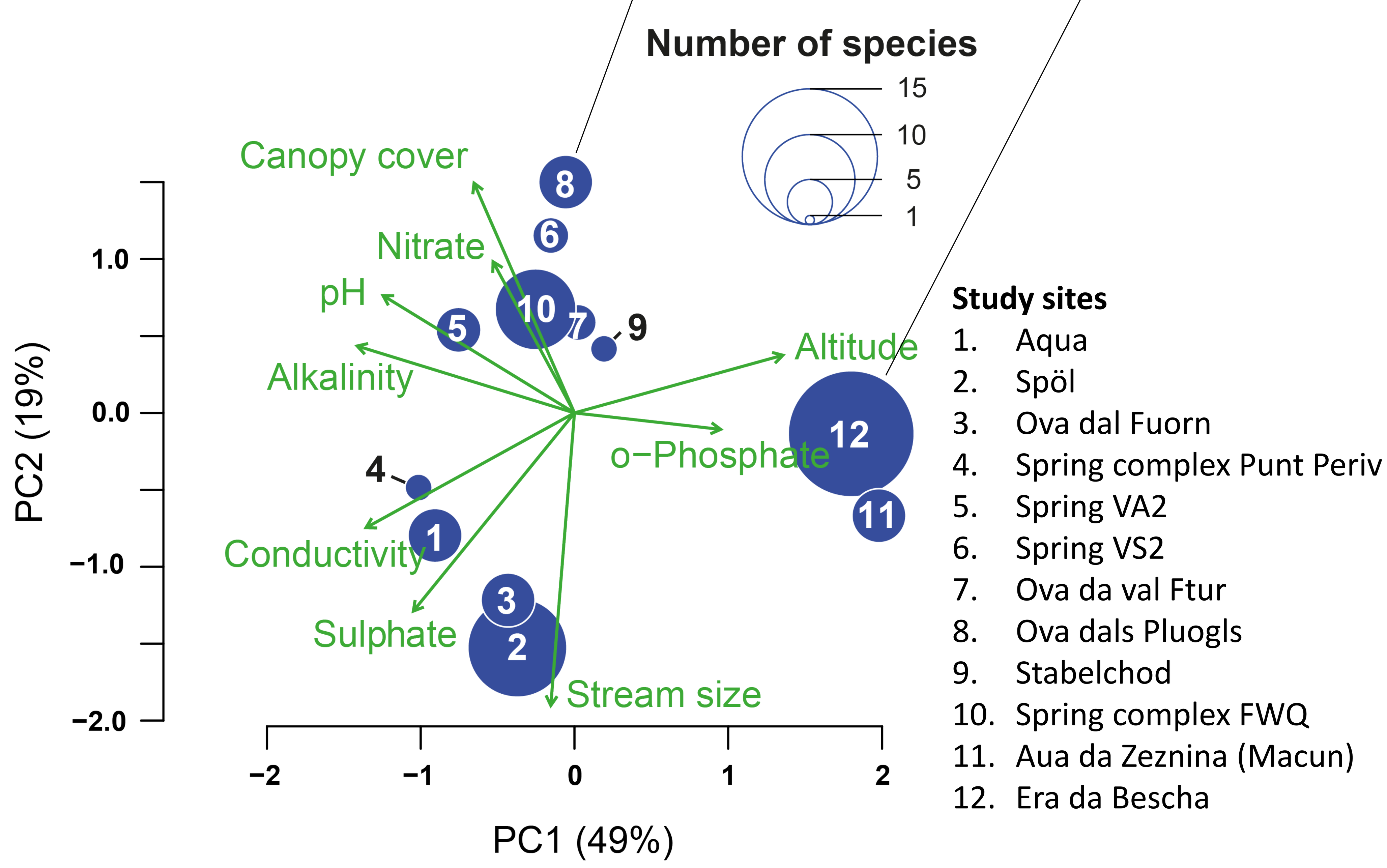


Figure 2: PCA of the environmental conditions of the study sites and their correlation with AH species richness. Numbers represent study sites, and the size of the blue balls is proportional to species richness.

Results

Overall, we detected 29 different AH species in the region based on all types of samples. Species richness per stream ranged from 3 in Stabelchod and in a spring complex at Punt Periv to 14 species in a small stream above the tree line (Era da Bescha). Community composition was similar in the different streams. Although the sampling sites differed markedly in environmental conditions (mainly altitude and geology), we did not detect correlations of species richness or community composition with environmental conditions (Fig. 2).

Discussion

AH species richness observed per stream was relatively low compared to studies performed with the same approach and at similar altitude in other regions in Switzerland[2], e.g., in Val Piora. Forest cover did not promote AH species richness, unlike in forests dominated by deciduous trees (in other studies). Also, other environmental parameters had no clear relationships with AH species richness or community composition. Communities were dominated by relatively common species (e.g., *Alatospora acuminata*, *Neonectria lugdunensis*; Fig. 1). However, the sites above the tree line had several uncommon species (which were however also reported from low-altitude sites in other studies). The relatively high species richness (incl. rare and uncommon species) of high-altitude sites emphasizes the importance of these sites and their communities in conservation planning for AH biodiversity. Springs on the other hand, don't seem to have particularly high AH biodiversity nor specialized species.

Outlook

Our study provided some first data on this important organism group. However, it is limited in the number of sites, the sampling occasions, and the methods applied. It is thus unlikely, that we discovered all the AH biodiversity in the region. In particular, molecular analyses could be useful to complement our dataset[3]. Moreover, the rare species encountered should be isolated and cultivated to study their sensitivity and derive DNA-sequences needed for studies based on molecular data[4].

We are currently developing the Biodiversa+ FUNACTION project (www.funaction.eu), which will also include sampling sites in the Swiss National Park and the Biosfera Val Müstair. The goal of FUNACTION is to provide a more complete picture of AH biodiversity and biogeography across Europe, and to use that for conservation planning that accounts for aquatic fungi.

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