Exploring lampenflora of Resavska Cave, Serbia

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INTRODUCTION

The transformation of a natural cave habitat implies a lot of changes, first of all, the introduction of artificial light means one more possible threat to the cave environment: the appearance of phototrophs. Phototrophic microorganisms that develop and proliferate around artificial light form one specific microorganism community called lampenflora. Usually these new inhabitants compete successfully to occupy this new ecological niche. The most common photosynthetic organisms in the lampenflora communities are algae and Cyanobacteria, but very often mosses, lichens, and sometimes even ferns and higher plants can also be present. Lampenflora can cause undesirable changes in caves that range from aesthetic to serious ones. The serious impact of lampenflora mostly refers to physical and/or chemical biodeterioration of the stone substrate or consequences regarding fauna in caves [4]. If caves are neglected and if lampenflora proliferation occurs, it should be treated by different methods. However, if possible, preventive measures should be taken to hinder excessive development of lampenflora and one of them is certainly monitoring that should be performed regularly so it could be intervened in time if necessary.

Types of biofilm: left – biofilm rich in mosses (down) and endolithic biofilm rich in Chlorophyta (up); middle – epilithic biofilm rich in Cyanobacteria; right – epilithic biofilm rich in Chlorophyta

RESULTS AND DISCUSSION

For the purpose of this work, monitoring was done in one of the most visited show caves in Serbia – Resavska Cave, directly before and after the main season in 2021, in March and November. Lampenflora was localized and developed mainly near artificial light, further parts of the cave were not affected. Different sampling sites (twelve in total) regarding type of artificial light and type of biofilm were chosen for lampenflora sampling. Two biofilm types were recognized in situ: epilithic/endolithic ones dominated by algae and/or Cyanobacteria and moss dominated biofilms. Analysis of phototrophic microorganisms revealed the presence of Cyanobacteria, Chlorophyta and Bacillariophyta. The highest diversity was found in Cyanobacteria where genera *Aphanocapsa*, *Eucapsis*, *Gloeocapsa* and *Leptolyngbya* were recorded during both samplings, *Nostoc* and *Synechocystis* in March, *Hassalia*, *Oscillatoria* and *Pseudocapsa* only in November. Chlorophyta were represented with *Chlorella*, *Desmococcus*, *Klebsormidium*, *Mesotaenium*, *Stichococcus* in March and the same taxa except *Klebsormidium* in November. *Humidophila* was the most widespread diatom in fresh biofilm samples. Aside from higher diversity, Cyanobacteria were sporadically found in samples except on two sampling sites where *Aphanocapsa* cf. *muscicola* and *Hassalia* sp. were abundant. Chlorophyta dominated in samples, which is in accordance with many other studies. Ecological parameters – temperature, relative air humidity, light intensity, substratum moisture and substratum pH were also determined and related to degree of colonization and community composition.

Parameter	March	November
T (°C)	9.7-10.6	10.3-12.2
RH (%)	63-78	68-86
LI (Lux)	62-1379	72-1755
SM (%)	11.5-37	10.1-98
pH	5.8-6.4	6.9-7.22

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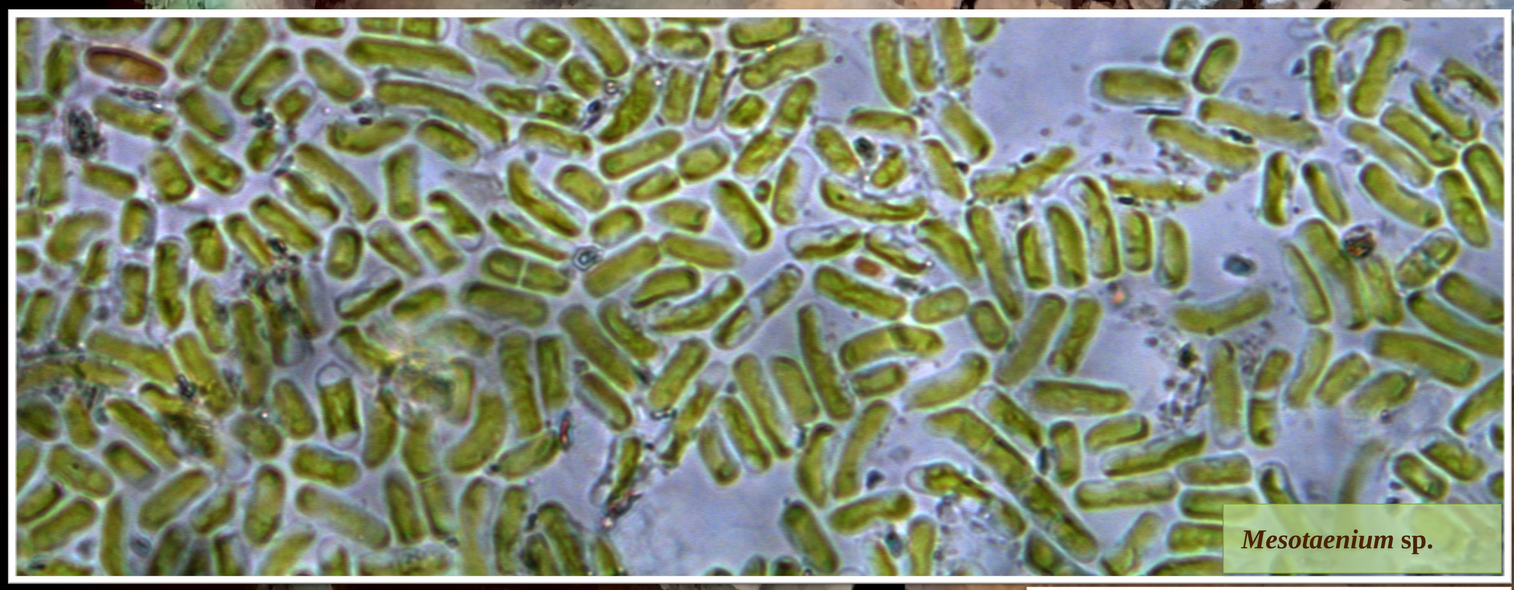
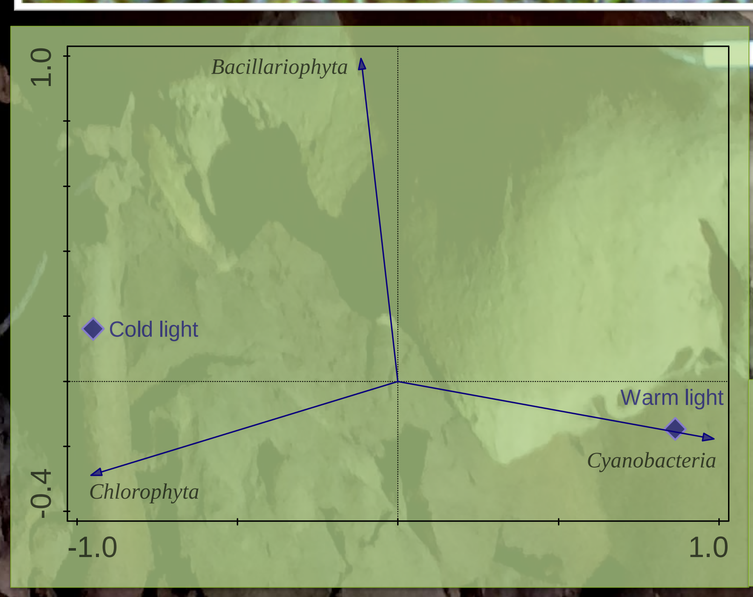
Aphanocapsa* cf. *muscicola

***Hassalia* sp.**



***Mesotaenium* sp.**



PCA of phototrophic taxa organized in divisions related to type of lamps that are present in cave