Spatial variability and germination potential of cyanobacterial akinetes in sediments of deep dimictic lakes

Jessica Ramm, Matthias Knie, Jacqueline Rücker & Brigitte Nixdorf
Brandenburg University of Technology Cottbus-Senftenberg, Department of Freshwater Conservation, Reserach Station Bad Saarow, Seestraße 45, 15526 Bad Saarow, Germany, ramm@b-tu.de

Introduction

- Resting stages (akinetes) of nostocalean cyanobacteria overwinter in lake sediments and germinate under reasonable conditions.
- Pelagic population mainly recruits from akinetes (Rücker et al. 2009).
- Sediments in shallow water areas are more important for recruitment than deep ones (Karlsson-Elfgren 2004).

Aim

- Determination of horizontal distribution of akinetes in surface sediments.
- To test if light and temperature conditions are feasible for germination in different water depths.

Hypotheses

i) Higher amount of viable akinetes in profundal sediments because of unfavorable germination conditions.
ii) Only part of total akinete pool contributes to recruitment of planktonic Nostocales population.

Study sites

Lake Scharmützelsee

Materials and Methods

- Winter 2009/2010 in transects across a depth gradient
- 0 - 1 cm surface sediment (pooled sample of 3 cores)

Microscopical analysis

- Abundance of akinete morphotypes

Results

Spatial variability

- Number of viable akinetes increased with increasing water depth (regression analysis, Fig. 2).

i) Hypothesis was confirmed

- Species composition of sediment akinetes differed in the basins of Lake Scharmützelsee although Nostocalean species were evenly distributed in the pelagic (NMDS analysis, Fig. 3).

ii) Hypothesis was confirmed

Potential inoculum size

- Higher potential inoculum size in Lake Scharmützelsee (2.8·10¹⁴ akinetes in 51 % of sediment surface, Fig. 5) than in Lake Stechlinsee (2.6·10¹³ akinetes in 30 % of sediment surface, data not shown).

Light and Temperature conditions

- SCH Germination is feasible in ≤ 9 m water depth and in ST ≥ 12 m (data not shown)

Estimation of potential inoculum

- 51 % of sediment area suitable for germination
- 20.5 % of total akinete pool

Acknowledgements

IGB

Research Station Bad Saarow, Seestraße 45, 15526 Bad Saarow, Germany, ramm@b-tu.de

Fig. 1 Bathymetric maps of lakes with transect points for sediment sampling and morphometric details of lakes.

Fig. 2 Linear regression model and confidence bands of viable akinete abundances in relation to increasing water depth of Lake Scharmützelsee and Lake Stechlinsee. Values were square root transformed.

Fig. 3 NMDS analysis of pelagic Nostocales biovolume (annual total 2005 – 2010) and sediment akinetes pooled according to akinete morphotypes of Lake Scharmützelsee.

Fig. 4 Water depth where light and temperature reach the assumed threshold for germination.

Lake Scharmützelsee

Lake Stechlinsee

Lake Scharmützelsee

ST

SCH

Nostocales species were grouped according to akinete morphotypes

Table 1: Occurring Nostocales species in Lake Stechlinsee and Lake Scharmützelsee, akinetes found in sediment sample [n±]

<table>
<thead>
<tr>
<th>Nostocales species</th>
<th>Akinetes</th>
<th>Akinete morphotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabaena affinis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena circinalis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena constricta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena flava-aquae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena marinae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena punctulata</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena syracusa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena oval</td>
<td></td>
<td>Anabaena oval</td>
</tr>
<tr>
<td>Anabaena cylindrica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabaena lemmanniana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphanizomenon flava-aquae</td>
<td></td>
<td>Aphanizomenon</td>
</tr>
<tr>
<td>Aphanizomenon griseus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphanizomenon nitroponus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylindrospermopsis radians</td>
<td>-</td>
<td>Cylindrospermopsis</td>
</tr>
</tbody>
</table>

Fig. 5 Akinetes per sediment area and sediment area at different water depths of Lake Scharmützelsee.

Fig. 6 Akinete abundances in surface sediment sampled at transect 1 for Lake Scharmützelsee and Lake Stechlinsee.

Literature


