

Studies on the structure and function of planktonic bacteria in two small West German streams

Abstract

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From July 1973 to August 1974 investigations were carried out on the structure and function of planktonic bacterial populations of two small, unpolluted streams in hills up to 500 m high. One, the Rohrwiesenbach (Rwb), is a woodland stream, the other, the Breitenbach (Btb), is an open grassland stream. Both are situated near the town of Schlitz which lies about 100 km to the northeast of Frankfurt.

The quantity of bacteria was estimated by a membrane filter technique (direct count by a phase contrast microscope). The uptake of dissolved organic compounds, especially of glucose, was determined by the use of carbon-14-labelled substances. So, among other measurements, V_{\max} , the maximum uptake velocity, was taken.

The Rohrwiesenbach has a high input of allochthonous organic matter (coarse particulate organic matter: $634 \text{ g C/m}^2 \cdot \text{y}$), the primary production is low ($22 \text{ g C/m}^2 \cdot \text{y}$; no macrophytes). The estimated total primary production of macrophytes and algae in the Breitenbach is 80 to $210 \text{ g C/m}^2 \cdot \text{y}$, the input of coarse particulate organic matter was $47 \text{ g C/m}^2 \cdot \text{y}$. The concentration of dissolved organic substances is mostly within the range which is known from oligotrophic lakes. In the Rohrwiesenbach the concentration increases with increasing flow of water.

The numbers of planktonic bacteria are similar to those known from eutrophic lakes, and only sometimes lower (Rwb: average: 3.1×10^6 bact./ml, range: $0.4\text{--}9.2 \times 10^6$; Btb: 1.2×10^6 bact./ml, $0.5\text{--}2.7 \times 10^6$). Clear relationships between the number of bacteria and temperature and between the number of bacteria and water flow were observed. The glucose uptake potential (V_{\max}) is similar to that in eutrophic lakes (Rwb: $0.1\text{--}3.0 \mu\text{g glucose/l} \cdot \text{h}$, Btb: $0.1\text{--}1.1 \mu\text{g glucose/l} \cdot \text{h}$). Increasing temperature as well as increasing numbers of bacteria per ml lead to an increase of V_{\max} . In autumn, at the time of leaf fall, adaption of bacterial populations to organic compounds which were dissolved from freshly fallen leaves was observed. The decrease of V_{\max} caused by decreasing temperatures was thus delayed. This effect was much more distinct in the Rohrwiesenbach than in the Breitenbach.

Strong allochthonous influence over the structure and the function of the planktonic bacterial populations could clearly be shown. This influence was much stronger in the Rohrwiesenbach than in the Breitenbach, where the autochthonous primary production is of much more importance.

The reported results are taken from the following thesis: MARXSEN, J., 1976: Untersuchungen zu Struktur und Funktion der Bakterienpopulationen der fließenden Welle in Mittelgebirgsbächen. Kiel, 306 pp. The complete results will be published in *Archiv für Hydrobiologie*.

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