TEMPORAL AND SPATIAL DISTRIBUTION PATTERNS AND PRODUCTION OF HARPACTICOIDS (COPEPODA, CRUSTACEA) IN A SECOND ORDER MOUNTAIN BROOK

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Zusammenfassung: Zeitlich-räumliche Verteilungsmuster und Produktionsbiologie der Harpacticoida (Copepoda, Crustacea) in einem Gebirgsbach.- Dissertation, Universität Wien, 1990.

Summary:

* Eleven species of the family Canthocamptidae constitute the harpacticoid community of the Oberer Seebach (RITRODAT-study area). All species belong to the epigeian fauna and are well know from the Lunz area.
* In the average about 315 harpacticoids occur under the square decimeter down to a sediment depth of 70 cm (Ind./dm²). *Limnocamptus echinatus* (Mrázek) is the most dominant species with 212 Ind./dm² (grand mean, n = 80). Subdominant are *Bryocamptus zschokkei* (Schmeil) (67 Ind./dm²) and *Attheyella wierzejskii* (Mrázek) (28 Ind./dm²). *Limnocamptus echinatus* and *Attheyella wierzejskii* show high abundances between 15 and 45 cm sediment depth, while *Bryocamptus zschokkei* occurs between 5 and 25 cm depth in the bed-sediments of Oberer Seebach. All abundance data are based only on adults and copepodite stages. Because of serious methological difficulties, nauplii were not studied at all. Most of these developmental stages are lost during the sample processing.
* Like most benthic invertebrates, harpacticoid copepods are highly over-distributed in the bed-sediments of running waters. In all dominant species, the adults show the same distribution patterns like copepodit stages.
* The temporal distributional pattern shows two peaks, one in spring and one in late autumn. Although the peaks are very distinct they are not significant. Because of the long generation times, abundance increases are not caused by reproduction which occurs the whole year round. Nauplii grow extremely slowly in winter. With increasing temperature in spring, nauplii develop fast into copepodites and these were counted now for the first time. Thus, the inability to sample and to count nauplii properly creates the population peaks in spring. The autumn peak is the result of eggs produced in spring, which had to be much lower because there is no temperature-induced development prolongation in the warm summer months. Most

probably there are no significant abundance differences in time, in case that all stages are counted.

* Harpacticoid copepods penetrate the bed-sediments to a depth of 70 cm and locally sometimes deeper. Depth distribution is quite different within species. *Bryocamptus zschokkei* occurs in higher numbers down to a sediment depth of 35 cm only. *Limnocampus echinatus* and *Attheyella wierzejskii* mainly colonize the bed sediments between 15 and 45 cm depth. The influence of temperature and discharge-dependent parameters causes changes of the vertical distribution of *Limnocamptus echinatus* in time (Anova, $p < 0.0001$). Low temperatures and high discharge rates force the harpacticoid fauna to penetrate deeper into sediment layers.

* Within the horizontal distribution of running water communities the problem of scales becomes evident. On a large-scaled distribution most of the species show low abundances in riffle areas compared to the gravel bar and "pool" areas, like *Attheyella wierzejskii* and *Bryocamptus zschokkei*, while *Limnocamptus echinatus* occurs in high abundances in all strata. All dominant species show changes of the horizontal distribution (population peaks) in time. Low temperatures and high discharge rates force *Limnocamptus echinatus* to avoid riffle areas (Anova, $p < 0.0001$). The similarity of the distribution of species was tested, using a cluster analysis. It was possible to differentiate three groups of species. The first group (*Limnocamptus echinatus*, *Bryocamptus zschokkei*, and *Attheyella wierzejskii*), is characterized by high abundances and frequent occurrence in the whole study area. The second group shows low abundances and prefers mainly the gravel bar. *Canthocamptus staphylinus* and *Bryocamptus minutus* form the third group, because they have been found in single specimens only. With the same method the similarity of the samples was tested according to the number of species and their abundance. The lack of a meaningful result is probably caused by the extreme patchy distribution which marks a possible horizontal distribution on a smaller scale.

* The most dominant species *Limnocamptus echinatus* shows like *Bryocamptus zschokkei* and *Attheyella wierzejskii* completely overlapping cohorts. The average body length of adults is about 0.6 mm; the dry weight is about 0.7 μg. The total biomass recorded was 60 μg dw/dm^2.

* The mortality of nauplii is very high in cultures, while nearly all eggs hatch and 35 % of copepodites die in cultures only. But field data give the evidence of a lower elimination rate of nauplii stages.

* Development times are relatively long for the Seebach population of *Limnocamptus echinatus*: it takes almost half a year from egg to adult at 7.5 °C, a value that is near the average brook temperature of 6.8 °C. Most of the time is spent in the

copepodite stage during development. Only temperature influences development, because of permanent good food conditions.

* Developmental data were fitted to a generel model (semiquadratic-logarithmic equation). The growth increment method was chosen for the calculation of production per sample date, neglecting nauplii stages. Therefore, it has to be considered that the calculated production rate is correct in that order of magnitude only. Mean production per day is 0.6 μg/dm^2. The average annual production of *Limnocamptus echinatus* is about 220 μg dw/dm^2, and the P/B ratio equals 3.3. The production of *Limnocamptus echinatus* is very low in quantity, when compared to the production of six species of Chironomidae of the same brook.
* The *Limnocamptus echinatus*-population follows a complete different strategy compared to chironomids because of the extreme long-lived adults, continuous reproduction, long developmental times and low production rates.

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