

Rotifers of the Genus *Synchaeta* — an Important Component of the Zooplankton in the Coastal Waters of the Southern Baltic¹

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With 2 Figures

Abstract

Preliminary studies were intended to contribute to our knowledge of *Synchaeta*, a rotifer genus that is abundant in brackish waters, but rarely been investigated. In the coastal waters between Hiddensee island and the Darss-Zingst peninsula, at least 16 species were found. Remarks on food items, field preferences for temperature and salinity, and growth rates for some species are given. In addition to several kinds of algae, bacteria (incl. cyanobacteria) and ciliates were ingested by the investigated species. Routine sampling in the Darss-Zingst estuary revealed highest abundances of *Synchaeta* species in early spring and autumn. During early spring, *Synchaeta* account for most of the metazooplankton biomass (> 60%) and are able to consume a significant fraction of the spring peak of phyto- and protozooplankton production. Their use as a food source by higher trophic levels seems to be of minor importance. Much taxonomic and ecological work has to be done to improve our knowledge concerning the function of this important rotifer genus in coastal ecosystems.

Introduction

Despite the importance of *Synchaeta* in many estuaries of the boreal and temperate regions, only a few studies have dealt with their ecology (e. g. HOLLOWDAY 1949; SCHWARZ 1962/63; GIÈRE 1968; HERNROTH 1983; ROUSSELET 1902). The following presentation of our preliminary results on *Synchaeta* species from the Darss-Zingst estuary (southern Baltic) could perhaps stimulate further investigators to study this delicate and complex, but interesting rotifer genus.

Remarks on species determination

One important reason for our poor knowledge of *Synchaeta* ecology are the difficulties in species determination: 1) only living animals are suitable for this purpose (!); 2) practice is necessary to recognize the important morphological features; 3) morphological characteristics could vary between individuals of the same species; 4) generally more than two species coexist. Fig. 1 presents drawings of the unci of five *Synchaeta* species from the Darss-Zingst estuary. According to KOSTE (pers. comm.) the differentiation of *S. oblonga* and *S. littoralis* has yet to be clearly defined. Our population of *S. 'oblonga'* was more delicate and significantly smaller (uncus 15–20 µm length) than *S. 'littoralis'* (23–25 µm). Obviously unci of *S. oblonga* may differ from population to population (cf. DONNER 1965; POURRIOT, pers. comm.). In the Vistula lagoon, these two species also seem to cooccur (cf. ADAMKIEWICZ-CHOJACKA, pers. comm.



Fig. 1. Drawings of unci (trophi) of *Synchaeta* species from the Darss-Zingst estuary, southern Baltic. A: *S. 'littoralis'* (23–25 µm length); B: *S. vorax* (23–26 µm); C: *S. 'oblonga'* (15–20 µm); D: *S. cecilia* (9–10 µm); E: *S. curvata* (24 µm)

prep.). Although there are useful keys for determination of species (e. g. KUTIKOVA 1970; KOSTE 1978), there is a strong demand for thorough anatomical investigation (cf. KOSTE 1981). Due to the species diversity and high productivity, the Baltic could serve as an excellent study area for such purposes.

List of species

In the Darss-Zingst estuary (DZ) (own observations; 2–8°/° S) and a neighbouring body of water around Hiddensee island (Hi) (according to observations by SCHWARZ 1962/63; 7–11°/° S), at least 16 *Synchaeta* species (nomenclature according to KOSTE 1978) occur: *S. baltica* EHRB. (DZ, Hi), *S. cecilia* ROUSS. (DZ), *S. curvata* LIE-PETTERSEN (DZ, Hi), *S. grimpei* REMANE (Hi), *S. gyrina* HOOD (Hi), *S. lakowitziana* LUCKS (DZ), *S. 'littoralis'* ROUSS. (DZ, Hi), *S. monopus* PLATE (DZ, Hi), *S. 'oblonga'* EHRB. (DZ), *S. pectinata* EHRB. (DZ), *S. stylata* WIERZ. (DZ), *S. tavina* HOOD (Hi), *S. tremula tremula* (O. F. MÜLLER) (DZ), *S. t. kitina* (ROUSS.) (DZ), *S. triophthalma* LAUTERBORN (Hi), and *S. vorax* ROUSS. (DZ, Hi).

Remarks on ecology

Since knowledge concerning ecology of this important rotifer genus is very limited (e. g. CARLIN 1943; POURRIOT 1965, 1977; BERNER-FANKHAUSER 1983; JOHANSSON 1987; EGLOFF 1988), we present our preliminary results on the estuarine populations of the southern Baltic.

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Table 1. Food items of three species of *Synchaeta*

Species	Food organism	Feeding rate	Method
<i>S. vorax</i>	<i>Pseudomonas</i> sp.	3.5–14.2 ng dw · ind ⁻¹ · h ⁻¹	¹⁴ C
	<i>Microcystis aeruginosa</i> (single cells)	18800 ± 9700 cells · ind ⁻¹ · h ⁻¹	¹⁴ C
	<i>Chlorella vulgaris</i>	16100 ± 11300 cells · ind ⁻¹ · h ⁻¹	¹⁴ C
	<i>Scenedesmus quadricauda</i>	5000 cells · ind ⁻¹ · h ⁻¹	¹⁴ C
	<i>Monoraphidium contortum</i>	31600 ± 11600 cells · ind ⁻¹ · h ⁻¹	¹⁴ C
	<i>Chilodonella</i> sp. (ciliate, 20 × 30 µm)	0.5–3 cells · ind ⁻¹ · h ⁻¹	¹⁴ C
<i>S. 'littoralis'</i>	Centric diatoms (<i>Stephanodiscus</i> a. o.)		direct observations
	<i>Paramecium</i> sp. (ciliate, 135 × 40 µm)	0.2–0.4 cells · ind ⁻¹ · h ⁻¹	¹⁴ C and counting (BURCKHARDT & ARNDT 1987)
	<i>S. cecilia</i>	<i>M. aeruginosa</i>	significant egg production when offered as food in Laboratory cultures
<i>Peridinium</i> spp.			
<i>S. quadricauda</i>			
<i>S. acutus</i>			
<i>Ankistrodesmus falcatus</i>		no egg production	
<i>Dictiosphaerium ehrenbergianum</i>			
<i>Dunaliella salina</i>			
<i>Oscillatoria redekei</i>			
<i>O. agardhii</i>			
<i>Aphanizomenon flos-aquae</i>			

A) Feeding: Species of the genus *Synchaeta* are able to ingest particles ranging in size from bacteria (see Table 1) to rotifers (KOSTE, pers. comm.). We found that even the animals of one population (*S. vorax*) are able to consume bacteria, cyanobacteria, algae, flagellates and ciliates. According to our studies involving culture experiments with different food items and determination of feeding rates using ¹⁴C-labelled food, respectively, the food items given in Table 1 were consumed by *Synchaeta*. According to correlation analysis of field data

flagellates seem to be a generally useful food item for *Synchaeta*.

B) Temperature preferences: Under field conditions a distinction exists between species such as *S. 'littoralis'*, *S. 'oblonga'*, and *S. lakowitziana* which are generally found in cooler waters (< 10–15 °C) and those such as *S. cecilia*, *S. t. kitina*, and *S. triophthalma* found in warmer waters (> 15 °C). *S. vorax* seems to be a eurythermal species.

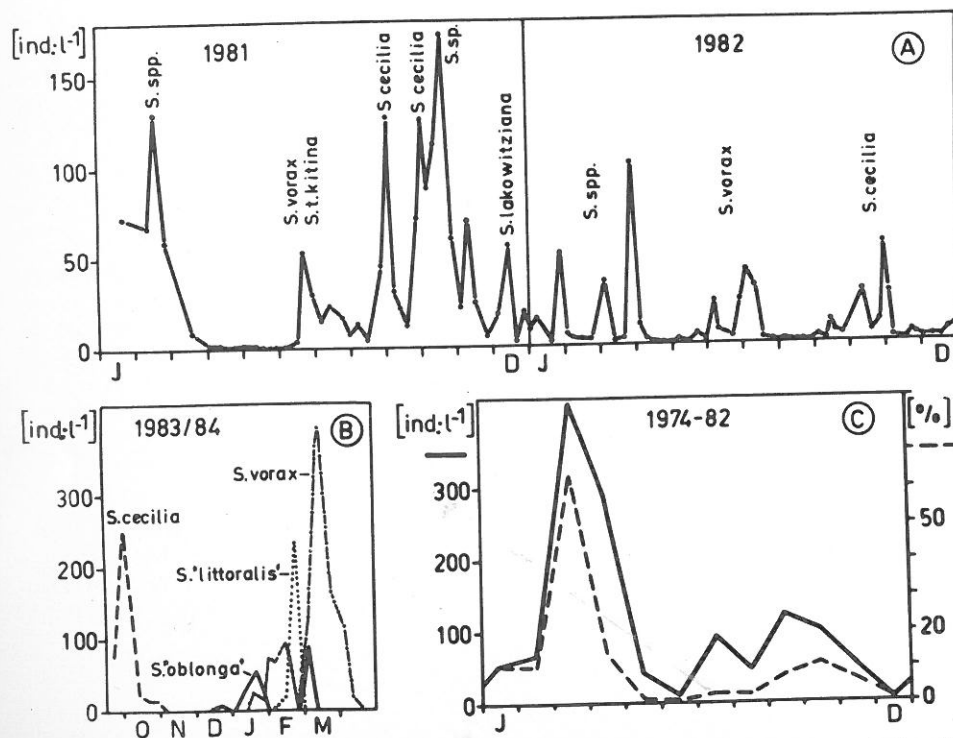


Fig. 2. Seasonal changes in abundances of *Synchaeta* spp. in the Darss-Zingst estuary at station Zingster Strom (3–7‰ S). A: Abundances and dominant species in 1981/82 (51-HYDROBIOS-sampler, 251 integrated samples, analysis of living and filtered fixed samples); B: Species succession in 1983/84 (living samples); C: Monthly mean abundances (—) for 9 years (1974–82, sedimented fixed samples) and percentage of *Synchaeta* as a part of total mesozooplankton biomass (---)

C) Salinity: In the Darss-Zingst estuary some of the marine *Synchaeta* species could be found at salinities down to 3‰: *S. cecilia*, *S. 'littoralis'*, and *S. vorax*. Some limnetic species tolerated salinities up to 5‰: *S. lakowitziana*, *S. 'oblonga'*, *S. t. tremula*, *S. t. kitina*.

D) Growth rates: Laboratory populations (22 °C) of *S. cecilia* reached r-values of up to $1.4 \cdot d^{-1}$ and a generation time of 2.2 days (cf. ARNDT et al. 1985), indicating a very high potential for growth under nearly optimal conditions. Analysis of field data revealed r-values for *S. cecilia* (Sept./Oct. 1983, 14 °C) and *S. vorax* (Feb./Mar. 1984, 2–3 °C) of 0.11 and $0.10 \cdot d^{-1}$, respectively, corresponding to values found by HERNROTH (1983). Such high values were also found in laboratory cultures by EGLOFF (1988).

Seasonal succession and importance in the food web

Routine sampling at the Zingster Strom station (Darss-Zingst estuary) revealed highest numbers of *Synchaeta* in early spring and a second peak of abundance in autumn (Fig. 2A–C). As SCHWARZ (1962/63) already reported there is an alternation of *Synchaeta* species which seems to be governed by changes in temperature, salinity, and abundance of food (e.g. flagellates). The short term succession of species points to significantly different ecological requirements among species. In early spring *Synchaeta* forms the major fraction of the zooplankton biomass (Fig. 2C). At this time *Synchaeta* species are able to consume a significant part of the primary (SCHRÖDER, unpubl.) and ciliate production (BURCKHARDT, unpubl.; ARNDT et al. 1989). In 1981 and 1982 *Synchaeta* species produced about 3.6 and 1.1 g fw $\cdot m^{-3} \cdot a^{-1}$, respectively (P/B estimates according to JOHANSSON 1983), but contributed less than 10 per cent to total annual zooplankton production (cf. ARNDT et al. 1984; ARNDT 1989). Little is known on *Synchaeta* as a prey organism for planktivores (e.g. HOLLOWDAY 1947, 1949). According to our own results, *Synchaeta* can serve as a food source for mysids in the Darss Zingst estuary, but during the mass occurrence of *Synchaeta* in early spring, gut content analysis of the main planktivores, smelt and herring, revealed that the fraction of *Synchaeta* production consumed by these predators is insignificant. Probably copepods act as predators (cf. EGLOFF (1988)). The most important function of *Synchaeta* in the food web of the Darss-Zingst estuary seems to be the remineralization of the early phyto- and protozooplankton peak in spring.

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