

Feeding of *Acartia tonsa* Dana (Copepoda, Calanoida): predation on nauplii of *Canuella perplexa* T. et A. Scott (Copepoda, Harpacticoida) in the sluice-dock at Ostend

M. Tackx¹ & P. Polk

Ecology and Systematics Laboratory, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium

¹ Present address: Delta Institute for Hydrobiological Research, Vierstraat 28, 4401 EA Yerseke, The Netherlands

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Abstract

Feeding experiments in which the zooplankton fraction of the Sluice-dock smaller than 200 μm is offered to *Acartia tonsa*, the dominant calanoid of this biotope, show that it feeds on the nauplii of *Canuella perplexa*, the dominant benthic harpacticoid. The ecological implications of this carnivorous feeding, occurring in the presence of natural phytoplankton concentrations, are briefly discussed.

Introduction

The carnivorous feeding of marine copepods has recently received increasing attention (e.g. Hodgkin & Ripplingale 1971; Ambler & Frost 1974; Corner *et al.* 1976). It has become more and more evident that animal prey can contribute substantially to the food of many marine copepod species. One of the most intensively studied in this context is *Acartia tonsa* (Anraku & Omori 1963; Petipa 1978; Lonsdale *et al.* 1979). The data obtained all lead to the conclusion that the amount an omnivorous copepod such as *A. tonsa* consumes of a certain species of animal prey varies from biotope to biotope. Anraku & Omori (1963) state that *A. tonsa* can be completely herbivorous as well as completely carnivorous.

Accepting the optimal foraging theory (Emlen 1966; review by Pyke *et al.* 1977), it is obvious that this variable feeding behaviour should be studied in terms of a cost-benefit analysis considering all possible prey types (phytoplankton and detritus as well as animals) present in the biotope. So, to study the feeding of an omnivorous copepod and to understand its role in any given biotope, the first step is to determine which organisms in this biotope can be preyed upon by the copepod.

In a shallow lagoon, the Sluice-dock at Ostend (1.5 m deep and covering an area of 86 ha), *A. tonsa* is the dominant planktonic species during the summer (Leloup & Polk 1967). Its consumption of phytoplankton and detritus has been studied to some extent (Daro & Cromboom, unpublished), but the possibility of carnivorous feeding in this biotope has not yet been considered.

The present paper gives the results of a series of feeding experiments carried out to determine if zooplankton organisms contribute to the food of *A. tonsa* in the Sluice-dock.

Materials and methods

The zooplankton fraction smaller than 200 μm was concentrated and resuspended several times in equal volumes (10 to 100 ml) of Sluice-dock water filtered through a 50 μm net. Since the phytoplankton of the Sluice-dock is mainly nanoplankton (Mommaerts-Billiet *et al.* 1974), this procedure produced diets composed of the natural phytoplankton and detritus on which the copepods can feed, together with the zooplankton fraction most likely to contain preyaible organisms. A number of *Acartia* adults (5 to 50 according to the volume)

were added to half of these replicates. After an incubation period of 14 hours, the animals were collected on a 50 μm net, fixed in 4% formalin and counted. A Mann-Whitney test was used to detect significant differences between control and experimental bottles (Campbell 1974).

Results

The composition of the diets tested and the results of the feeding experiments are given in Table 1.

Predation was detectable on the total of zooplankton organisms when the majority were nauplii of *Canuella perplexa* (Copepoda, Harpacticoida) (case 1 to 4), but not when nauplii of *Acartia* were abundant (case 5 and 6). Each species counted separately (case 7) again reveals predation on *Canuella*, not on *Acartia* nauplii. Cases 8 and 9 indicate that there is no predation on rotifers (unidentified species) and larvae of *Polydora ciliata* (Polychaeta, Sedentaria) but the number of tests performed with these organisms is too small to allow definite conclusions.

Table 1. Feeding experiments: composition of the diets expressed as a percentage. Only dominant species in each case were used for the calculation of percentages.

	%NC	%NA	Pol.	Rot.	n	Uc	Uex	Significance
1	90	10	-	-	7	49	0	+
2	90	10	-	-	4	16	0	+
3	87	13	-	-	8	63.5	0.5	+
4	75	25	-	-	6	36	0	+
5	27	75	-	-	4	8	8	-
6	2	98	-	-	4	20	6	-
7	27				6	36	0	+
		73			6	18	18	-
8	-	-	-	100	4	15	1	-
9	-	-	100	-	4	4	12	-

NC: nauplii of *Canuella perplexa*.

NA: nauplii of *Acartia tonsa*.

Pol.: larvae of *Polydora ciliata*.

Rot.: rotifers.

n: number of replicates.

Uc: U-value for control, Uex: U-value for experimental bottles.

Significance +: significant at 5% level.

- : not significant at 5% level.

Discussion

Our results are in agreement with those of Lonsdale *et al.*, (1979), who measured significantly higher predation by *A. tonsa* on nauplii of *Scottolana canadensis* (Copepoda, Harpacticoida) and *Oithona colcarva* (Copepoda, Cyclopoida) than on its own nauplii.

The nauplii of *Canuella perplexa* swim by means of 'paddle' strokes of the antennae and the mandibles (Vincx & Heip 1979). This primitive locomotion probably makes them an easy prey for *Acartia*. *Canuella perplexa* is the dominant benthic copepod in the Sluice-dock, present throughout the year (Thielemans & Heip 1977).

Figure 1 gives the density of *Canuella* nauplii in the water column during the day in the summer of 1980. It varies from 100 ind./50 l to 6500 ind./50 l. Thus, at least one zooplankton organism proved to be consumed by *Acartia* in the presence of natural phytoplankton and detritus concentrations is always present in considerable but varying densities. This fact throws a different light on the interpretation of existing grazing data (in preparation).

The predation on *Canuella* nauplii by *Acartia* also represents an interaction between the benthos and the plankton that has to date not been considered in calculations of ecometabolic budgets of the Sluice-dock (Podamo 1975).

Both *Canuella* and *Acartia* perform vertical migrations (Hauspie & Polk 1971; Daro 1974). This behaviour should also be considered in future de-

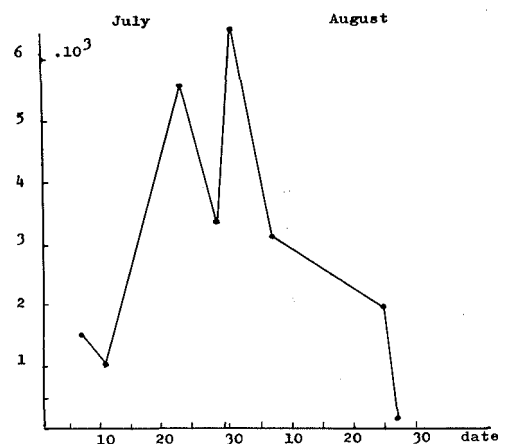


Fig. 1. Density of *Canuella perplexa* nauplii during the summer of 1980, expressed as number/50 l.

terminations of the relative importance of different prey types in the food of *Acartia*.

Summary

A. tonsa from the Sluice-dock at Ostend feeds on nauplii of *C. perplexa* in the presence of natural phytoplankton concentrations. This predation represents an interaction between the dominant zooplankton and benthic organisms of this biotope, and may be of ecometabolical importance.

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