On the Nutrition of Two Antarctic Acanthonotozomatidae (Crustacea: Amphipoda)  
Gut Contents and Functional Morphology of Mouthparts

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Received 11 April 1988; accepted 18 August 1988

Summary. Two species of Antarctic acanthonotozomatid amphipods (Echiniphimedia hodgsoni and Maxilliphimedia longipes) have been investigated in regard to their food preference. Examinations of food remains in foreguts and midguts indicate that Echiniphimedia hodgsoni feeds on sponges and Maxilliphimedia longipes ingests Cnidaria. These foregut analyses are supported by a study of the functional morphology of the mouthparts. The structure of the mandibles in particular can be interpreted as an adaptation to the presumed food source. The right mandible of Echiniphimedia hodgsoni bears a lacinia mobilis which works as an additional cutting edge. By means of this cutting mechanism Echiniphimedia hodgsoni should be able to bite out tough sponge material. The mandibular endites of Maxilliphimedia longipes are medially excavated, the incisors are regulary toothed and the molars vestigial. Such kinds of mandibles are adapted to cut large fragments of soft food, i.e. the mucous tissue of Cnidaria.

Introduction

Most of the vagile species of the Antarctic benthos are thought to be omnivorous or necrophagous due to an adaptation to the discontinuity of the phytoplankton cycle (Arnaud 1970, 1977). Earlier investigations on the ecology of the Amphipoda, which belong to the most abundant groups of the Antarctic macrozoobenthos, lead to the impression that they also are mainly omnivorous and necrophagous (Bone 1972; Rakusa-Suszczewski 1972; Richardson and Whitaker 1979; Stockton 1982; Bregazzi 1972, 1973). But only 10 of 500 known species and subspecies found in Antarctic and Subantarctic waters (Lowry and Bullock 1976) have been investigated with regard to their food preference. Constant and predictable environmental conditions as well as the high diversity (Knox and Lowry 1977) lead to an expectation of close niche adaptation and consequently the presence of many specialists. The highly specialized mouthparts of many Antarctic amphipods support the hypothesis of close niche adaptation to a preferred food source. For example, the amphipod family Acanthonotozomatidae, with its centre of distribution in the Antarctic (Just 1978), has conically bundled mouthparts. Barnard (1969) suspects these mouthparts to be adapted to piercing and sucking.

In the following investigation of foregut and gut contents and of the structure of the mouthparts, some adaptations to the preferred food source of two acanthonotozomatid amphipods shall be described, supported by arguments of functional morphology.

Material and Methods

The material has been collected during the Antarctic-expeditions 1982–1983 and 1984–1985 with the RV Polarstern with the help of an Agassiztrawl and preserved in 4% formalin solution.

Two frequently found species from the family Acanthonotozomatidae, which at first sight differ in the form of the mandible, have been chosen for investigations of the functional morphology of the mouthparts: Echiniphimedia hodgsoni and Maxilliphimedia longipes. The drawings have been made using a dissecting microscope (Wild M5) and a camera lucida. For microscopy the animals have been stained with Basic Blue and afterwards washed with freshwater. For histological investigations heads of the examined amphipods have been imbedded in Methacrylate (Technovit). Four micrometers horizontal sections of the mouthparts were made on a “Cambridge Autocut 1140” microtome and stained with Toluidine Blue. The photomicrographs were made with a Leitz-Vario-Orthomat photomicroscope.

Specimens for scanning electron microscopy were dehydrated through an alcohol series, critical point dried and sputter-coated with carbon then gold.

Very dirty specimens have been cleaned in an ultrasonic-bath after the dehydration in alcohol.

Results

Echiniphimedia hodgsoni (Walker, 1906)
Examination of Foregut and Gut Contents. The foregut and gut contents of five animals were investigated. Spiculae of sponges have been found in four specimens.
Fig. 1. A-D. SEM pictures of Chalinolebias hodgsoni. A. Broken up critical-point dried midgut with sponge spicules (x 245). B. Medial view of the right maxillipeds (x 249). C. Posterior side of the labrum (63); inset showing one of the slit-like pores which may be openings of mucus glands (x 68). D. Photomicrographs of a horizontal section of the labrum showing tubuli (arrowheads) (scale-bar 500 µm). hyp, hypopharynx; l, labrum; lm, lacinia mobilis; md, mandible; mge, midgut epithelium; mx1, maxilla 1; mx2, maxilla 2; per, peritrophic membrane; pe, proximal endite.