ADVANCED LARVAL DEVELOPMENT OF PANDALOPSIS JAPONICA BALSS, 1914 (DECAPODA, CARIDEA, PANDALIDAE) REARED IN THE LABORATORY

BY

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ABSTRACT

The complete larval development of Pandalopsis japonica Balss, 1914, is described and illustrated in detail based on laboratory reared material. There are three larval stages, each showing advanced features. The first and third stages are referable to zoea and megalopa as strictly defined by Williamson (1969), but the second stage cannot be referred to any phase. The fourth and following stages are juveniles. The larval characteristics are compared with those of described congeners. The larvae of P. japonica are unique even among known pandalids' larvae in that they lack pereopodal exopods. The phylogenetic significance of larval morphology as it relates to developmental pattern is also discussed.

RÉSUMÉ

Le développement larvaire complet de Pandalopsis japonica Balss, 1914, est décrit et illustré en détail d'après un matériel élevé en laboratoire. Le développement comprend trois stades larvaires, chacun montrant des caractères évolués. Le premier et le troisième peuvent être rapportés à la zoéa et à la mégalope strictement définies par Williamson (1969), mais le second stade ne peut l'être à aucune phase. Le quatrième stade correspond aux juvéniles. Les caractéristiques larvaires sont comparées avec celles décrites chez d'autres espèces du genre. Les larves de P. japonica sont uniques parmi celles connues de pandalides en ce que les péréiopodes sont dépourvus d'exopodites. La signification phylogénétique de la morphologie larvaire dans son rapport avec le mode de développement est aussi discutée.

INTRODUCTION

The shrimps belonging to the genus Pandalopsis form an important fishery resource in the northern North Pacific together with the members of Pandalus (Holthuis, 1980; Baba et al., 1986). However, little is known about their life history, including larval development, since most of the species of the genus are oceanic or deep-sea inhabitants. Of 13 species in the genus Pandalopsis, none has been reared through all larval stages in the laboratory, though Berkely
(1930) described the first to third, and probably fifth, larval stages of *P. dispar* Rathbun, 1902, on the basis of plankton samples, and Kurata (1964) reported only the first stage larva of *P. coccinata* Urita, 1941, obtained by laboratory rearing. These two species show an advanced type of abbreviated post-embryonic development (Rabalais & Gore, 1985), and Haynes (1980) hypothesized that other members of *Pandalopsis* with large eggs have a similar pattern of development.

*Pandalopsis japonica* Balss, 1914, is a commercially important shrimp on the west coast of Hokkaido, but its biology is poorly known. In this paper, we give a description of the complete larval stages of *P. japonica* obtained by laboratory rearing, a comparison of larval characteristics with those of described congeners, and a discussion on the developmental pattern of this species.

**MATERIALS AND METHODS**

Fifteen ovigerous females were captured in late December 1986, using commercial shrimp traps off Matsumae, southern Hokkaido (Sea of Japan). The eggs were in a considerably advanced stage of embryonic development. The females were kept in a 500-liter tank with running sea water at the Hokkaido Institute of Marine Science.

The larvae began to hatch in early January 1987. Fifty individuals of newly hatched larvae were transferred into a 30-liter aquarium with aeration, and the water temperature was maintained at about 9°C. Frozen *Artemia* nauplii were used to feed the larvae. Water was changed every 3 or 4 days. Several larvae of each stage were fixed in buffered 10% formalin and then preserved in 75% ethyl alcohol. The specimens examined are deposited with the Faculty of Fisheries, Hokkaido University (HUMZ).

Drawings and descriptions were based on 5 specimens of each stage. All drawings were made with the aid of the WILD M-8 stereomicroscope with a camera lucida. The measurements were made with an OLYMPUS 202409 toolmaker’s microscope. The carapace length (CL) was measured following Mikurich & Ivanov (1983).

**RESULTS**

There are three larval stages before the molt to the first juvenile. As noted later in the discussion, the first and third stages are referable to zoea and megalopa respectively following Williamson’s (1969) definition, but the second stage cannot be assigned to any larval phase. The larvae hatched at a considerably advanced stage of development. They walked using their pereopods and sometimes swam using their thoracic exopods. At a water temperature of about 9°C, most of the newly hatched larvae molted into the second stage after about six to nine days, into the third stage (megalopa) after about 14 to 18 days, into