



The complete larval development of *Pagurus maculosus* Komai & Imafuku, 1996 (Decapoda, Anomura, Paguridae) reared in the laboratory, and a comparison with sympatric species

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Abstract

The complete larval development of the hermit crab *Pagurus maculosus*, is described and illustrated based on specimens reared in the laboratory at 15°C and 33–35 PSU. Newly hatched larvae invariably passed through a short prezoal stage (10 minutes to 2 hours), four zoeal stages (each of 7 days,) and one megalopal stage (14 days). Distinct morphological features of each larval stage of the present study are compared with other closely related species in Japanese waters, and we found many differences in morphology and the duration of zoeal stages between them. We mentioned significant diagnostic characters separating this species from other congeners in Japanese waters that include the presence of red-yellowish chromatophores on the maxillipeds. This is the first report of complete larvae development of *Pagurus maculosus*.

Key words: larval development, prezoa, zoea, *Pagurus*, *P. maculosus*

Introduction

Pagurus maculosus Komai & Imafuku, 1996 is an intertidal hermit crab commonly found in the rocky shores of temperate regions of Japan. It was long considered as a color morph of *Pagurus lanuginosus* De Haan (1849) since they shared most of morphological characters except the color of chromatophores scattered on the ambulatory legs, which is white in *Pagurus maculosus* but black in *Pagurus lanuginosus* (Imafuku & Ikeda 1995). Later, Komai & Imafuku (1996) reported some subtle differences in morphological characteristics and pre-mating behavior of these two color morphs. Therefore, they described *P. maculosus* as a new species and referred the black-spot type to *P. lanuginosus* (sensu stricto).

Pagurus maculosus is one of important members of the intertidal hermit crabs community as well as in the sublittoral coastal ecosystem. Its larvae are an important part of the nearshore zooplankton community. Therefore, for accurate identification of the larvae, it is important to have knowledge on their larval developmental patterns and the detailed morphological features. Moreover, study of larval morphology may play a significant role in conducting ecological studies on recruitment of hermit crabs (Oba *et al.* 2006) as well as in constructing a morphology based phylogeny of Paguridae (Pohle & Marques 2000).

A significant number of studies on description of the larval of *Pagurus* (planktonic or reared specimens) from wide geographical regions have been conducted in the last several decades (Bookhout 1964, 1972; Goldstein & Bookhout 1971; Gore & Scott 1983; Hong 1969, 1981; Ivanov 1979; Konishi & Quintana 1987, 1988; Kurata 1964, 1968 a, b; Lee & Hong 1970; MacDonald *et al.* 1957; McLaughlin & Gore 1988, 1992; McLaughlin *et al.* 1988, 1989, 1991a, b, 1992, 1993; Nyblade 1970; Oba *et al.* 2006; Provenzano & Rice 1964; Quintana & Iwata 1987; Roberts 1970, 1973; Shenoy 1967; Tirmiz & Siddiqui 1980). However, studies on Japanese species are quite few and insufficient. A great step was taken by Kurata (1964, 1968a, b) followed by Konishi & Quintana (1987, 1988) and Quintana & Iwata (1987).

As suggested in our description, the length of the carapace and the relatively elongated body, smooth first pleomere, the consistent number of telson process (7+7), five plumose setae on antennal exopodite throughout all zoeal stages, and the number of setae on coxal and basial endites of maxilla could be possible distinguishing morphological characters of *P. maculosus* larvae in the zoeal stage. The mandibular palp and its setation on the distal lobe, the number of plumose setae on the scaphognathite of maxilla, the number of plumose setae on the posterior margin of the uropod in megalopal stage could be distinguish *P. maculosus* from similar species. Morphological features of the cheliped, such as spine pattern on the merus and dactylus, number of marginal scales and spines on the mouthparts and color pattern could be important to distinguish species at crab 1 stage.

Considering several evidences of differences in larval characters between the *P. lanuginosus* and *P. maculosus*, it is shown that they are two distinct species. This result is consistent with the previous statement of Imafuku & Ikeda (1995). However, to know their phylogenetic relationship to other species of the genus, a molecular-based study would be ideal. The larval morphological characters described by this study could be useful distinguishing characters for the planktonic larvae of *P. maculosus*.

Acknowledgments

The authors are indebted to all staff of SMBL for their kind assistance and advice during the experiment and two anonymous referees for their valuable comments to improve the contents. This study was supported by a grant from the Sato Yo International Scholarship Foundation for the private Asian student.

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