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Zoeal stages of *Labidochirus anomalus* (Balss, 1913) (Decapoda: Anomura: Paguridae) obtained under laboratory conditions

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Abstract

Zoeal stages of the hermit crab *Labidochirus anomalus* (Balss, 1913) (Decapoda: Anomura: Paguridae) are described and illustrated from the larvae reared in the laboratory. The development included four zoeal stages following the typical pattern in the Paguridae. Morphological features of the larvae of *L. anomalus* are compared with those described for the related species *L. splendescens* (Owen, 1839). The larvae of both species share numerous zoeal characters and are similar as the species of one genus. At the same time, zoeae of *L. anomalus* have no dorsal carina on the carapace and long posterolateral carapace spines—key features of the larvae of *L. splendescens*. These zoeal characters considered as generic are not characteristic of only the genus *Labidochirus* but sporadically occur among *Pagurus* species. Main characters of zoeal stages allow assignment of both *Labidochirus* species to the Group A of *Pagurus* (the typical representative *P. bernhardus*).

Key words: Anomura, Paguridae, larva, zoea, Sea of Japan

Introduction

The development of a crab-like body form or carcinization is an important evolutionary tendency of transformation of hermit crab ancestors in heavily calcified, shell-less lithodids (“hermit to king hypothesis”) (Tsang *et al.* 2011; Bracken-Grissom *et al.* 2013). The large family Paguridae includes mostly non-carcinized hermit crabs. They have a weakly to moderately calcified carapace and a soft abdomen protected by a domicile, such as a gastropod shell or hard polychaete tube. Partly carcinized forms are known only in a few pagurid genera (Anker & Paulay 2013).

Benedict (1892) established *Labidochirus* as a subgenus of *Eupagurus* Brandt (= *Pagurus* Fabricius) for three pagurid species (*P. mertensii*, *P. parvus* and *P. splendescens*) and designated *P. splendescens* as the type species. McLaughlin (1974) restricted and raised subgenus *Labidochirus* to generic rank for two species formerly assigned to *Pagurus* Fabricius, *L. splendescens* (Owen, 1839) and *L. anomalus* (Balss, 1913). *Pagurus mertensii* and *P. parvus* are retained in the genus *Pagurus* (see McLaughlin & Haig 1973; WoRMS 2015). Both *Labidochirus* species have a heavily calcified carapace exclusive of the branchiostegites, asymmetrical uropods and reduced abdomen (McLaughlin 1974). They carry small gastropod shells that typically cover only their abdomen, while the cephalothorax remains exposed and calcified. These species occupy an intermediate position between typical pagurids and lithodids, confirmed by morphological and molecular data (Cunningham *et al.* 1992; Bracken-Grissom *et al.* 2013). Thereby, a shell-dwelling *Labidochirus*-like hermit crab may be considered as an ancestor to the crab-like lithodids. According the another hypothesis, a closely related tube-dwelling *Discorsopagurus*-like hermit crab is the precursor to the crab-like lithodids (Bracken-Grissom *et al.* 2013).

The larvae of *L. splendescens* have been reared in the laboratory and described (Nyblade & McLaughlin 1975). According to Nyblade & McLaughlin (1975), zoea and megalopa of *L. splendescens* were sufficiently distinct from typical *Pagurus* larvae substantiating the generic distinctness of *Labidochirus*.

In 2013, we found ovigerous females of the second *Labidochirus* species, *L. anomalus*, in Russian waters of the Sea of Japan. This species occurs from Tatar Strait to the southern Japan, at a depth of 15–270 m (Marin 2013). The larvae of *L. anomalus* were reared in the laboratory. Unfortunately, we obtained only four zoeal stages; no