FIRST ZOEAL STAGE OF THE HYDROTHERMAL VENT CRAB,
GANDALFUS YUNOHANA (DECAPODA, BRACHYURA,
BYTHOGRAEIDAE)

BY

KAORI NAKAJIMA¹), KATSUYUKI HAMASAKI¹,⁴), SHINJI TSHUCHIDA²),
RYUSUKE KADO³) and SHUICHI KITADA¹)

¹) Department of Marine Biosciences, Tokyo University of Marine Science and Technology,
Konan, Minato, Tokyo 108-8477, Japan
²) Marine Biology and Ecology Program, Extremobiosphere Research Center, Japan Agency for
Marine-Earth Science and Technology, 2-15 Natsushima, Yokosuka, Kanagawa 237-0061, Japan
³) School of Marine Biosciences, Kitasato University, Okkirai, Sanriku, Ofunato,
Iwate 022-0101, Japan

ABSTRACT

The first zoeal stage of Gandalfus yunohana (Takeda, Hashimoto & Ohta, 2000) is described and
illustrated based on laboratory-hatched material. This is the first time that this has been accomplished
for known species in the family Bythograeidae.

INTRODUCTION

Brachyuran crabs discovered at deep-sea hydrothermal vents on the Galapagos
Rift have unique characters such as reduced eye structure and a white or bone-
coloured body. Williams (1980) described this vent-endemic species as a represen-
tative of a new genus (Bythograea), new family (Bythograeidae), and new super-
family (Bythograeoida). Since that time, bythograeids have been discovered at a
variety of vents around the world and now include 14 species in 6 genera (Martin
& Haney, 2005; McLay, 2007; Ng et al., 2008).
Studies on the early life history of bythograeids are crucial to elucidate the mechanism of population maintenance at the hydrothermal vents with ephemeral, decade-long life spans (Haymon et al., 1993; Van Dover et al., 2002). Benthic postlarval crabs should have limited dispersal ability, so bythograeids are expected to disperse via planktonic larval stages. Indeed, *Bythograea thermydron* Williams, 1980 is suggested to have planktonic larval stages because the first stage zoeae and megalopae possess image-forming compound eyes (Jinks et al., 2002). Furthermore, Miyake et al. (2007) reported that the newly hatched larvae of the bythograeid *Gandalfus yunohana* (Takeda, Hashimoto & Ohta, 2000) have pigmented compound eyes.

Morphological descriptions of larvae facilitate field identification of the species in the plankton; this would advance early life history studies of bythograeids in the field. Moreover, descriptions of zoal stages, especially the first zoal stage, and the megalopan stage have been used to deduce or support phylogenetic relationships in several groups of crabs (e.g., Martin, 1988; Jeng et al., 2004; Ng et al., 2007). However, few larval descriptions have been reported, and no descriptions based on larvae hatched from identified females have been published for bythograeids yet. Van Dover et al. (1984) described and illustrated the first zoal stage attributable to the family Bythograeidae collected at a vent site; the zoa has numerous features, such as ornamentation of the carapace, abdomen, and telson, that distinguish it from other brachyuran larvae. Martin & Dittel (2007) detailed the descriptions of megalopan larvae of the genus *Bythograea* collected at vent sites and concluded that there are no salient unique features distinguishing the megalopae as being bythograeids.

We successfully reared a female of *G. yunohana* to hatching in a tank at atmospheric pressure. The purpose of this study is to describe and illustrate the first stage zoa of *G. yunohana*.

**MATERIAL AND METHODS**

*Gandalfus yunohana* specimens were collected on 26 May 2005 at Kaikata Seamount (26°42.607’N 141°04.457’E, depth 445 m) in the Izu-Ogasawara Arc using the ROV “Hyper-Dolphin” (Dive #418) of the Japan Agency for Marine-Earth Science and Technology, Yokosuka. Five males and 6 females were transported back to the laboratory at the Tokyo University of Marine Science and Technology (TUMSAT), Tokyo, and were kept in tanks at ~12-18°C. Spawning and hatching occurred in a female reared in the 15°C tank. Some first stage zoae were fixed with 5% neutral formalin for 1 day and then preserved in 70% ethanol solution. Eight first stage zoae were dissected for morphological examination.