



Larval development of the land hermit crab *Coenobita violascens* Heller, 1862 (Decapoda, Anomura, Coenobitidae) described from laboratory-reared material

SAORI KATO¹, KATSUYUKI HAMASAKI^{1,3}, SHIGEKI DAN² & SHUICHI KITADA¹

¹Graduate School of Marine Science and Technology, Tokyo University of Marine Science and Technology, Konan, Minato, Tokyo 108-8477, Japan

²Tamano Laboratory, National Research Institute of Fisheries and Environment of Inland Sea, Fisheries Research Agency, Chikko, Tamano, Okayama 706-0002, Japan

³Corresponding author. E-mail: hamak@kaiyodai.ac.jp

Abstract

The zoeal and the megalopal stages of the land hermit crab *Coenobita violascens* Heller, 1862 are described and illustrated from laboratory-reared material, and compared with larvae of nine other described coenobitid species. The larvae developed through four planktonic zoeal stages to the megalopal stage. *Coenobita violascens* had characteristics of zoeal pleomeres and megalopal antennules typical of those found in other *Coenobita* species, excluding *C. brevimanus*.

Key words: terrestrial hermit crab, zoea, megalopa, morphology

Introduction

The terrestrial hermit crabs belong to the family Coenobitidae Dana, 1851, which is composed of only two genera; the land hermit crab genus *Coenobita* Latreille, 1829, with 16 species (McLaughlin *et al.* 2010) and the coconut crab genus *Birgus* Leach, 1816, with only one species, *B. latro* (Linnaeus, 1767). The terrestrial hermit crabs mainly occur in subtropical and tropical coastal regions (Hartnoll 1988). *Coenobita* species and *B. latro* have been exploited as an ornamental animal (Nakasone 2001; Pavia 2006) and for human consumption (Brown & Fielder 1991), respectively.

Although adult coenobitid crabs are fully terrestrial, their eggs hatch into the sea and their larvae develop through several planktonic zoeal stages to the megalopal stage (Hartnoll 1988). After settlement, the megalopae recognize and co-opt gastropod shells. They then migrate onto land and metamorphose to the first crab stage (Reese 1968; Harvey 1992; Brodie 1999; Hamasaki *et al.* 2011). The morphology of zoeal and megalopal stages has been described and illustrated from laboratory-reared material for nine coenobitid species: *C. brevimanus* Dana, 1852 (Hamasaki *et al.* 2014), *C. cavipes* Stimpson, 1858 (Shokita & Yamashiro 1986; Nakasone 1988a), *C. clypeatus* (Fabricius, 1787) (Provenzano 1962), *C. compressus* H. Milne-Edwards, 1836 (Brodie & Harvey 2001), *C. purpureus* Stimpson, 1858 (Nakasone 1988a), *C. rugosus* H. Milne-Edwards, 1837 (Shokita & Yamashiro 1986; Nakasone 1988a), *C. scaevola* (Forskål, 1775) (Al-Aidaros & Williamson 1989), *C. variabilis* McCulloch, 1909 (Harvey 1992) and *B. latro* (Linnaeus, 1767) (Reese & Kinzie 1968).

Coenobita violascens Heller, 1862 is widely distributed in the Indo-West Pacific (Nakasone 1988b), inhabiting the beach and vicinity, near mangroves (Nakasone 1988b; Hamasaki *et al.* pers. obs.), but little is known about its life history. We successfully reared larvae of this species from hatchling to juvenile crabs under laboratory conditions. The present study describes and illustrates the zoeal and megalopal stages of *C. violascens* from laboratory-reared material, and compares them with those of other coenobitid species.

References

- Al-Aidaros, A. & Williamson, D.I. (1989) Larval development of the land hermit crab *Coenobita scaevola* (Forskål, 1775) (Crustacea: Anomura: Coenobitidae) reared in the laboratory. *Journal of Natural History*, 23, 111–128.
<http://dx.doi.org/10.1080/00222938900770071>
- Brodie, R.J. (1999) Ontogeny of shell-related behaviors and transition to land in the terrestrial hermit crab *Coenobita compressus* H. Milne Edwards. *Journal of Experimental Marine Biology and Ecology*, 241, 67–80.
[http://dx.doi.org/10.1016/S0022-0981\(99\)00068-4](http://dx.doi.org/10.1016/S0022-0981(99)00068-4)
- Brodie, R. & Harvey, A.W. (2001) Larval development of the land hermit crab *Coenobita compressus* H. Milne Edwards reared in the laboratory. *Journal of Crustacean Biology*, 21, 715–732.
<http://dx.doi.org/10.1163/20021975-99990169>
- Brown, I.W. & Fielder, D.R. (1991) Project overview and literature survey. In: Brown, I.W. & Fielder, D.R. (Eds.), *The Coconut Crab: Aspects of Birgus latro Biology and Ecology in Vanuatu. ACIAR Monograph No. 8*. Australian Centre for International Agricultural Research, Canberra, pp. 1–11.
- Hamasaki, K. (2011) Early life history of coconut crabs inferred from culture experiments. *Cancer*, 20, 73–77. [in Japanese]
- Hamasaki, K., Sugizaki, M., Sugimoto, A., Murakami, Y. & Kitada, S. (2011) Emigration behaviour during sea-to-land transition of the coconut crab *Birgus latro*: effects of gastropod shells, substrata, shelters and humidity. *Journal of Experimental Marine Biology and Ecology*, 403, 81–89.
<http://dx.doi.org/10.1016/j.jembe.2011.04.007>
- Hamasaki, K., Kato, S., Hatta, S., Murakami, Y., Dan, S. & Kitada, S. (2014) Larval development and emigration behaviour during sea-to-land transition of the land hermit crab *Coenobita brevimanus* Dana, 1852 (Crustacea: Decapoda: Anomura: Coenobitidae) under laboratory conditions. *Journal of Natural History*, 48, 1061–1084.
<http://dx.doi.org/10.1080/00222933.2013.861941>
- Hartnoll, R.G. (1988) Evolution, systematic, and geographical distribution. In: Burggren, W.W. & McMahon, B.R. (Eds.), *Biology of the Land Crabs*. Cambridge University Press, New York, pp. 6–54.
- Harvey, A.W. (1992) Abbreviated larval development in the Australian terrestrial hermit crab *Coenobita variabilis* McCulloch (Anomura: Coenobitidae). *Journal of Crustacean Biology*, 12, 196–209.
<http://dx.doi.org/10.2307/1549075>
- McLaughlin, P.A., Komai, T., Lemaitre, R. & Rahayu, D.L. (2010) Annotated checklist of anomuran decapod crustaceans of the world (exclusive of the Kiwaoidea and families Chirostylidae and Galatheidae of the Galatheoidea) Part I—Lithodoidea, Lomisoidea and Paguroidea. *The Raffles Bulletin of Zoology Supplement*, 23, 5–107.
- Nakasone, Y. (1988a) Larval stages of *Coenobita purpureus* Stimpson and *C. cavipes* Stimpson reared in the laboratory and survival rates and growth factors of three land hermit crab larvae (Crustacea: Anomura). *Zoological Science*, 5, 1105–1120.
- Nakasone, Y. (1988b) Land hermit crabs from the Ryukyus, Japan, with a description of a new species from the Philippines (Crustacea, Decapoda, Coenobitidae). *Zoological Science*, 5, 165–178.
- Nakasone, Y. (2001) Reproductive biology of three land hermit crabs (Decapoda: Anomura: Coenobitidae) in Okinawa, Japan. *Pacific Science*, 55, 157–169.
<http://dx.doi.org/10.1353/psc.2001.0016>
- Pavia, A. (2006) *Hermit Crab: Your Happy Healthy Pet*. Wiley Publishing Inc., Hoboken, NJ, pp. 1–127.
- Provenzano, A.J. Jr. (1962) The larval development of the tropical land hermit crab *Coenobita clypeatus* (Herbst) in the laboratory. *Crustaceana*, 4, 207–228.
<http://dx.doi.org/10.1163/156854062x00355>
- Reese, E.S. (1968) Shell use: an adaptation for emigration from the sea by the coconut crab. *Science*, 161, 385–386.
<http://dx.doi.org/10.1126/science.161.3839.385>
- Reese, E.S. & Kinzie III, R.A. (1968) The larval development of the coconut or robber crab *Birgus latro* (L.) in the laboratory (Anomura, Paguridea). *Crustaceana Supplement*, 2, 117–144.
<http://dx.doi.org/10.1163/156854077x00106>
- Shokita, S. & Yamashiro, A. (1986) Larval development of the land hermit crabs, *Coenobita rugosus* H. Milne Edwards and *C. cavipes* Stimpson reared in the laboratory. *Galaxea*, 5, 267–282.
- Wang, F.-L., Hsieh, H.-L. & Chen, C.-P. (2007) Larval growth of the coconut crab *Birgus latro* with a discussion on the development mode of terrestrial hermit crabs. *Journal of Crustacean Biology*, 27, 616–625.
<http://dx.doi.org/10.1651/s-2797.1>