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Redescription of the early larval stages of the pandalid shrimp *Chlorotocus crassicornis* (Decapoda: Caridea: Pandalidae)

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Abstract

The first four larval stages of the pandalid shrimp *Chlorotocus crassicornis* (A. Costa, 1871) are described and illustrated from laboratory-reared material obtained from ovigerous females collected in the southwestern Spain and south Taiwan. The second to fourth larval stages of this species are reported for the first time to science. Detailed examination of the first larval stages reveals that previous description misidentified some key larval characters which have prevented its identification in plankton samples. It is found that the zoeal morphology of *Chlorotocus* is not very different from other pandalid larvae, and in fact closely resembles *Plesionika* and *Heterocarpus*.

Key words: *Chlorotocus crassicornis*, Pandalidae, zoea, taxonomy, larval morphology

Introduction

Pandalidae Haworth, 1825 is one of the most diverse caridean families, accounting around 189 recognized species (De Grave & Fransen 2011). Worldwide distributed and inhabiting shallow and deep waters below 4000 m depth, they occupy an intermediate trophic position in both benthic and pelagic food webs. This group includes many species of high economic value (Holthuis 1980) that has motivated an intense research effort to understand their biology and fishing feasibilities, for example *Pandalus borealis* Krøyer, 1838 in the North Atlantic (Bergström 2000). However, there are still significant lack of knowledge on the phylogeny and larval morphology of pandalids. Li *et al.*'s (2011) molecular analysis based on five nuclear genes supports the monophyly of pandalid family, but more investigations are needed to understand its phylogeny and biogeographical relationships amongst the different genera (Matzen da Silva *et al.* 2012). Regarding the larval morphology, there is only information on 9 out the 23 currently accepted genera of this family (i.e. *Pandalina* Calman, 1899, *Pandalus* Leach, 1814, *Pandalopsis* Bate, 1888, *Dichelopandalus* Caullery, 1896, *Stylopandalus* Coutière, 1905, *Plesionika* Bate, 1888, *Heterocarpus* A. Milne-Edwards, 1881, *Chlorotocela* Balss, 1914 and *Chlorotocus* A. Milne-Edwards, 1882). Moreover, some of the available larval descriptions are based on plankton collected samples with doubtful identities and/or do not follow the current standards of larval morphology proposed by Clark *et al.* (1998).

Currently, the genus *Chlorotocus* includes two species, *C. crassicornis* (A. Costa, 1871) and *C. novaezealandiae* (Borradaile, 1916). The only larval description for this genus was provided by Heegaard (1969) and is based on the first zoeal stage of *C. crassicornis* obtained in laboratory conditions from ovigerous females. According to this description, zoea I of *C. crassicornis* can be distinguished from other first stages of caridean larvae (at least from European waters) by the presence of six abdominal somites and segmented antennal scales (dos Santos & González-Gordillo 2004). Nevertheless, more developed zoeal stages of this species was not known.