CHAPTER 71-17

LARVAL SYSTEMATICS OF BRACHYURA¹)

BY

PAUL F. CLARK AND JOSÉ A. CUESTA


INTRODUCTION

Brachyuran larval stages were in the 18th century initially described as new species. Linnaeus (1767) described Cancer germanus, a megalopa from the Atlantic Ocean. Slabber (1778: 36, pl. 5 figs. 1-2) illustrated one brachyuran zoea named by him as Monoculus taurus. Bosc (1802) named Zoea pelagica for an unidentified crab zoea collected in the Atlantic. Finally, Leach (1817) named and figured two megalopae, Megalopa montagui (cf. Leach, 1817, pl. XVI figs. 1-6) and Megalopa armata (cf. Leach, 1817, pl. XVI figs. 7-9). The latter, according to Williamson (1915), was actually the megalopa of Cancer pagurus (Cancridae) although the term “megalopa” was previously established by Leach (1814) to include the planktonic stages described as Cancer granarius by Herbst (1783) and Fabricius (1793), as well as Cancer rhomboidalis by Montagu (1804). Thompson (1828) was the first to relate all these planktonic “species” with larval stages of brachyuran crabs, and asserted that decapods undergo a metamorphosis. A detailed history of these first works can be found in Edmondson (1933) and Ingle (1991).

Aikawa (1929, 1933, 1937, 1941) was among the first to examine brachyuran zoae and assign them to groups, i.e., “Grapsizoeae” and “Inachizoeae”. He was succeeded by Gurney (1939, 1942) and Rice (1980). The main difficulty with all of these studies, however, was the lack of good descriptions of reliably identified larvae, a problem still

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evident today. There are a number of notable regional studies of brachyuran larvae and among these are Lebour (1927, 1928a, b, 1931, 1934, 1944) for the Plymouth, U.K. area, Bourdillon-Casanova (1960) for the Mediterranean, and Ingle (1991) for the northeastern Atlantic. In spite of these studies and, as highlighted by Rice & Williamson (1977), it is still extremely difficult or impossible to assign many plankton-caught brachyuran larvae to particular taxa.

Many institutions have invested in laboratory facilities for rearing decapod larvae and success in rearing all developmental stages is now commonplace. This is a significant advance for descriptive studies that lay the foundation for many aspects of research from correct identification of planktonic samples to reconstructing phylogenetic relationships (Clark & Webber, 1991; Marques & Pohle, 1995; see below). The advantages of laboratory rearing, other than positive identification of the species, include the collection of all life cycle stages in a relatively short period of time and the provision of sufficient specimens for detailed morphological studies. Maintaining larvae from laboratory-hatched eggs to post larval stage nevertheless requires effort and logistical support. After completing this difficult task, many larval taxonomists unfortunately produce poor descriptions of the larvae, typically missing increasing numbers of characters as the zoeae develop into megalopae and juvenile crabs. Clark (1980, 1983), for example, showed that the setation of inachid larvae was conservative and not as variable as previously reported. Few recent workers have attained or superseded the high standard set by Christiansen (1973) and little changed following the plea made by Rice (1979) for improved standards for describing crab zoeae. Many descriptions are still inadequate and the use of larval characters in decapod systematics, therefore, has been hindered. Rice (1980) acknowledged that previous attempts to classify brachyuran zoeae had used unsuitable characters, but Christiansen (1973) and Clark (1980, 1983, 1984) demonstrated that zoeae of congeneric species are typically inseparable on the basis of setal characters. The corollary of this is that differences in setation counts within genera can be interpreted as evidence of phylogenetic non-homogeneity. Accurate descriptions are essential, a point illustrated by the study of Clark & Webber (1991) on the phylogenetic relationships of Majoidea (sensu Guinot, 1978). Details of larval appendages were known at that time for 47 majoid genera, but only 10 genera could be used in their phylogenetic study due to the inadequacy of most descriptions. Sorochan et al. (2015) more recently described the zoeae of Cancer oregonensis (now Glebocarcinus oregonensis) from laboratory-reared material. They used their study to distinguish this species from other published descriptions of cancrid zoeae recorded from the Salish Sea, British Columbia, including Cancer antennarius (now Romaleon antennarium), Cancer gracilis (now Metacarcinus gracilis), Cancer magister (now Metacarcinus magister), and Cancer productus. Such work relies heavily on the correct identification of adults, accuracy of previous descriptions, and assumes that characters were not overlooked and all the studies were undertaken to modern-day standards now required.

DNA evidence and larval morphology have combined in recent years to provide a valuable diagnostic tool for brachyuran taxonomy, i.e., in both systematic and phylogenetic studies (see below). For example, DNA barcoding has facilitated the identification of larval material directly from the plankton to species level with the subsequent description