STRATEGIES OF CRUSTACEAN GROWTH

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SUMMARY

The various species of Crustacea display great differences in maximum size, and the means by which this is delimited have been investigated. Two distinct strategies of growth exist. Some species have indeterminate growth and continue moulting indefinitely. In these the percentage moult increment declines and the intermoult period increases with size, thereby limiting growth: the respective rates of decline and increase determine the final size. Others have determinate growth and eventually cease moulting, usually at the time of maturity: this termination of moulting stops growth, and in such species the percentage moult increment does not decline appreciably with size. The advantages and disadvantages of the two strategies of growth are discussed.

Introduction

There is great variation in maximum size both within the Crustacea as a whole, and within restricted taxa of the class. Thus within the Crustacea there is a range from small copepods with a length of the order of a millimetre to the giant Japanese spider crab *Macrocheira,* with a carapace length of 400 mm and a chelar span of nearly 4 m. Within the Brachyura sizes range from *Macrocheira* down to the ectocommensal *Dissodactylus* with a carapace length of 3 to 4 mm, or the males of some Hapalocarcinidae with a carapace length of only 1 mm. Within the Majidae there is a range from *Macrocheira* to species of *Eurynome, Pelia* and *Thoe* with carapace lengths of 10 to 12 mm. There is also variation in the relationship between maximum size and the size at sexual maturity. Some species become sexually mature and then continue moulting (and growing) for prolonged or indefinite periods afterwards. Others cease moulting and growth at the time when sexual maturity is achieved.

Clearly the Crustacea employ diverse strategies of growth, and two questions can be asked in relation to this diversity:

1. How are the strategies effected? What are the patterns of growth which produce the desired end results?
2. Why do the various strategies exist? What are the selective advantages of one strategy over another?

This paper is mainly directed towards answering the first of these questions, and consists essentially of an analysis of the patterns of growth. At the present it is not possible to say much concerning the more fundamental subject of the physiological mechanisms which underlie these patterns. The second of the questions is dealt with only briefly. As necessary prerequisites some further detail must first be provided on the form of growth, and on the components of which growth is composed.

The pattern of growth

Although tissue growth is essentially a continuous process in Crustacea, the accompanying increase in external dimensions is discontinuous. This proceeds by a series of moults or ecdyses, when the old integument is cast off and a rapid increase in size occurs before the new integument hardens and becomes inextensible. These moults are separated by intermoults, periods when the integument is hard and no external growth occurs. During periods of growth the intermoults are relatively short, and are termed diecdyses. Between two growing seasons there is a prolonged intermoult known as an anecdysis. If moulting ceases altogether the condition is a terminal anecdysis. There are three main variables in the pattern of crustacean growth: