

Part I
Systematics and Distribution

1 Characterization of the Unionoida (= Naiads)

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1.1 Introduction

This chapter will be a short introduction for a non-specialist to the order Unionoida (= naiads). These large mussels live exclusively in freshwaters all over the earth (Chaps. 2, 10, 15, this Vol.). A problem for the people dealing with this group is its systematic classification (Chaps. 3, 4, 14, this Vol.). This problem is due to the low number of adult characters which may be used for systematics (Chaps. 4, 14, 15, this Vol.). Though there are some 1000 species, naiads have radiated very little in basic structure. Furthermore, a high degree of plasticity (Chaps. 5, 7, this Vol.) renders characters like shell morphology or size unreliable for classification. New biochemical methods (e.g. immunoelectrophoretic or DNA sequence analyses) may be a way out of this dilemma, and most contributions in this book (e.g. Chaps. 5, 13, 15, this Vol.) therefore follow the classification proposed in Chapter 14 (this Vol.). The order Unionoida comprises two superfamilies: Etherioidea (with the families Mycetopodiidae and Iridinidae) and Unionoidea (with the families Hyriidae, Unionidae and Margaritiferidae). Very little is known about the Etherioidea, which are confined to the tropics of America and Africa (Chap. 6, this Vol.). However, the data so far suggest that their life history is quite similar to that of the Unionoidea.

1.2 Phylogeny

Naiads evolved from an as yet unidentified marine group by at least the Triassic (Chap. 15, this Vol.). Due to different types of larvae (Chaps. 6, 14, this Vol.) there have been speculations that the group is polyphyletic (Chap. 15, this Vol.). However, a parasitic mode of larval development common to all naiads and new biochemical data (Chap. 14, this Vol.) argues for a monophyletic origin, but an early divergence between Unionoidea and Etherioidea.

1.3 The Adult Stage

Naiads are characterized by a semi-infaunal mode of life. They dig with their foot into the substrate such that they are usually buried to the posterior edge of the shell.

The soft part groundplan is very uniform. The foot, a tongue-like organ in the middle of the anterior part of the animal, is used for digging. On each side of the foot there are two large and morphologically complex gills which have some important functions besides oxygen uptake. All naiads are filter feeders. Cilia on the gills and on the mantle create a water current and transport mucus to the mouth in front of the

animal. The mucus, together with small particles trapped from the water, is eaten. Furthermore, the gills are used as marsupia for the developing eggs and larvae. The different gill and marsupial morphologies are treated in Chapters 2, 3, 5, 14, (this Vol.). Two symmetrical mantle flaps enclose the whole body. They secrete the two-piece shell and at the posterior end form an inhalent and exhalent aperture for the water current, but never a siphon as in many marine taxa.

Mussels have lost their head and therefore most of the sense organs have withdrawn completely from the anterior end. The margin of the mantle, particularly at the posterior end, is now the site of contact with the environment and carries light-sensitive spots and tactile organs. Within the animal, paired osphradia near the attachment of the gills perceive chemical stimuli.

Naiad shells consist of two principal aragonitic layers: outer prismatic and inner nacreous. On the outside, the shells are covered by periostracum, a protein-like substance preventing dissolution of the shell (Chaps. 5, 21, this Vol.). Due to cessation of growth during winter, in temperate climates the periostracum usually shows concentric winter lines (annuli), which may be used to estimate the age of the animal (Chaps. 2, 5, 7, 13, 18, 21, this Vol.).

The earliest part of the shell is the beak or umbo. The hinge, that portion of one shell that is connected to the other, may show a variety of teeth which interlock the shells when closed by the two adductor muscles (Chaps. 3, 8, 15, this Vol.).

1.4 Larvae and Larval Development

There are a variety of sexual and brooding strategies, as described in Chapters 2, 5, 8, 13 (this Vol.). Apart from very few exceptions (Chap. 6, this Vol.) naiad larvae have to pass through a parasitic phase on a fish host to metamorphose into the young mussel. The larvae are produced in large numbers. They are small (0.05–0.4 mm), short-lived and not able to swim actively (Chaps. 6, 11, this Vol.). There are three different types of larvae: the glochidium among the Unionoidea (Hyriidae, Unionidae, Margaritiferidae), the lasidium among the Mycetopodidae and the haustorium among the Iridinidae. The tremendous differences in the morphology of these types and in their development are treated extensively in Chapter 6 (this Vol.).

1.5 Summary

The large freshwater mussels Unionoidea (= naiads) evolved by at least the Triassic. Presumably, they are a monophyletic group. The adults are semi-burrowed filter feeders whereas the larvae have to contact a fish host on which they pass through a parasitic phase.