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Phylogeny of Eunicida (Annelida) based on morphology of jaws

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Abstract

Eunicida have a complex jaw apparatus with a fossil record dating back to the latest Cambrian. Traditionally, Eunicidae, Onuphidae, and Lumbrineridae were considered closely related families having labidognath maxillae, whereas Oenonidae with prionognath type maxillae were thought to be derived. Molecular phylogenies place Oenonidae with Eunicidae/Onuphidae, and Lumbrineridae as the most basal taxon. Re-evaluation of the jaw types based on morphology and ontogeny demonstrated that the labidognaths Eunicidae and Onuphidae have a closer relationship to the prionognath Oenonidae than was previously thought. Lumbrineridae are neither labidognath nor prionognath; therefore a new type, Symmetrognatha, is proposed. Homologies of jaw elements and considerations of functional aspects of the jaw apparatus are explored to present a hypothesis of the Eunicida phylogeny. The earliest fossils are of placognath and ctenognath types, lacking maxillary carriers. While the former are extinct, the latter are represented by the extant Dorvilleidae. The interpretation of relationships between the carrier-bearing families depends on whether the carriers are thought to have evolved once only or twice independently. The similarity of the carrier structure and their associated muscles suggests the former, placing the Lumbrineridae as sister to Eunicidae/Onuphidae and Oenonidae. However, the ontogeny of the eunicid/onuphid apparatus as well as its adult structure differ greatly from those of lumbrinerids, indicating that the lumbrinerid carriers may have evolved independently and earlier than in eunicids/onuphids and oenonids.

Key words: maxillae, mandibles, ontogeny, ctenognath, placognath, labidognath, prionognath, symmetrognath, fossils, scolecodonts

Introduction

A complex jaw apparatus consisting of ventral mandibles and dorsal maxillae is characteristic for polychaetes of the order Eunicida. The jaws are hardened cuticular structures, composed of calcium carbonate and/or scleroproteins. As a result of their durability they have a good fossil record. The earliest known eunicidan scolecodonts (isolated jaw pieces) are from the latest Furongian (latest Cambrian), but the Ordovician was the main period for their radiation, with more than 50 known genera belonging to 15–20 families (Hints & Eriksson 2007). The Recent fauna, in comparison, consists of about 100 genera in seven families (Paxton 2000).

Five different architectural types of maxillary apparatuses, based on their arrangement, number, and shape of elements, have been identified within the Eunicida (Paxton 2000: table 1.4). These types do not represent clades, but grades of evolution. The first two grades were named by Ehlers (1868) as Labidognatha (pincer-jaw) and Prionognatha (saw-jaw). Labidognatha was to include Eunicidae, Onuphidae, and Lumbrineridae, and was defined as having dissimilar maxillary elements on the two sides, and with the posterior two pairs of maxillae (MI and MII) of each side surrounded by a semicircle of smaller anterior elements. The position of Hartmaniellidae is unclear but has been

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