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New Austrognathiidae (Gnathostomulida: Conophoralia) from Hong Kong and Japan: microscopic anatomy, ultrastructure and evolutionary implications

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Abstract

We describe two new species, *Austrognathia glandifera* and *Austrognatharia orientis* using observations on squeezed, live specimens as well as histological sections and transmission electron microscopy. The protonephridia of *Austrognatharia orientis* are composed of a terminal cell, a canal cell, and a nephroporus cell. The monociliated terminal cell constitutes the so-called filtration area. The canal cell harbors the lacunar system and the protonephridial duct, which is surrounded by six filamentous rods, which originate external to and in between the microvilli of the terminal cell and stretch along the entire length of the canal cell. The female copulatory organs of the investigated species are very different. *Austrognathia glandifera* has a bursa and a vagina whereas *A. orientis* only has a weakly defined bursal tissue and no detectable vagina. The bursa is divided into an anterior and a posterior part; at the anterior end a special area is formed by interdigitations of the cells of the bursal wall. The male copulatory organs in the Conophoralia are uniform, composed of an anterior, glandular portion consisting of a proximal part with medium-grained and a distal part with coarse-grained appearance and a penis that is delineated by a basal lamina and has an ejaculatory duct as well as a gonopore. Parenchymal cells are present and serve to embed the bursa and the male copulatory organ dorsolaterally. Our data on the fine structure of various tissues indicate that the Conophoralia are the "less derived" sister taxon of the Scleroperalia.

Key words: ultrastructure, protonephridia, sperm, bursa, male copulatory organ

Introduction

Gnathostomulida are marine, microscopic, acoelomate, hermaphroditic worms that slowly glide through the interstices of detritus-rich sand and mud by means of their monociliated epidermis. To date, 100 species have been described from shallow sandy bottoms, many with global or circumtropical distribution (Sterrer & Sørensen 2015); another 15 are awaiting description (Sterrer, in prep.).

Most striking (and name-giving) are their complex jaws, which are in stark contrast to the otherwise simple morphology of these animals. Due to their size (they are among the smallest metazoans) and slow movement, they are among the most recently discovered phyla of animals (Riedl 1969), the first description dating back to 1956 (Ax 1956). Because the first species found possessed a stylet and showed similarities in general features as well a 4d-cleavage pattern (Riedl 1969) gnathostomulids have been tied to platyhelminths (Ax 1956; 1960; 1985). However, subsequently described species lacked a stylet and based on features revealed by electron microscopy some authors (Rieger & Mainitz 1977; Sterrer *et al.* 1985; Ruppert 1991) suggested a position intermediate between "turbellarians" and gastrotrichs, implying that these groups are on a common line of evolution, with "turbellarians" being the most primitive. In contrast Ax (1984, 1985) placed the Gnathostomulida as sister group to all other Bilateria based on the monociliated epidermis and features of the protonephridia.

Furthermore, ultrastructural characters suggested a close relationship with other animals having complex jaws, namely the Syndermata (Acanthocephala + "Rotifera"; Ahlrichs 1995; Rieger & Tyler 1995). The name Gnathifera was introduced, and the subsequent discovery of the Micrognathozoa (Kristensen & Funch 2000), showing characters that would have been anticipated for a "missing link" between the two groups, further strengthened this hypothesis of relationship.

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