The phylogenetic position of Neogosspidae (Gastrotricha: Chaetognotida) and the origin of planktonic Gastrotricha

Tobias Kanneby 1  •  M. Antonio Todaro 2

Abstract. Planktonic forms of Gastrotricha have been known since the 1850s, despite the fact that they are rather uncommon and difficult to collect. They are characterized by a round sack-shaped body, an absence of fugal adhesive tubes, and a different distribution of the locomotory ciliation compared to epibenthic and periphytic gastrotrichs. Today, planktonic gastrotrichs are classified into the three taxa—Dasydyidae, Neogosspidae, and Unghela—but their origin and whether they share a recent common ancestor largely remain unknown. A long-held view is that planktonic taxa are derived from ben-thic ancestors related to Chaetognus (Zoocluattes), but the hypothesis has never been properly tested. Here, in order to elucidate the phylogeny and origin of planktonic Gastrotricha, we provide the first molecular data on the very rare genera Kizhana and Kosgozia, both members of the family Neogosspidae. We use Bayesian and maximum likelihood phylogenetics to analyze sequences of 18S rDNA, 28S rDNA, and CO1 mtDNA spanning 71 taxa in total. We find high support for a common origin of planktonic gastrotrichs, with monophyly of both Dasydyidae and Neogosspidae. Planktonic forms have evolved from epibenthic or periphytic ancestors, and the closest extant clade comprises members of Chaetognus (Zoocluattes) + Chaetognus heterocentrus Remane, 1927. These results further imply that the motile apost and underlying muscle patterns that control them in species of Dasydyidae are adaptations to the planktonic environment that evolved independently of those in other species of Gastrotricha.

Keywords. Melosoma • Freshwater • Planktonic • Phylogeny • Pseudociliata

Introduction

Gastrotrichs is a small phylum of aquatic acelomate animals with approximately 850 species (see Balsamo et al. 2009, 2013, 2014; Hammon and Todaro 2010; Klenke and Schmikl-Bhavsar 2014; Todaro et al. 2014; and references therein). The group is the common component of the meiofauna and is hypothesized to act as an important link between the microbial loop and larger invertebrate predators (Balsamo and Todaro 2002). The phylum is divided into the two orders Chaetognida and Macrohydria. Chaetognidae, present in both freshwater and marine habitats, are generally torpise-shaped with adhesive tubes confined to the posterior end and with the cuticle generally sculptured into various arrangements of scales and spines. Macrohydria, with few exceptions, are entirely marine and form a tube, with adhesive tubes not confined to the posterior end and with a smooth or sculptured cuticle.

Freshwater gastrotrichs within Chaetognidae are very small, ranging from 60 to 770 μm in total body length. Most species are not only epibenthic, periphytic, or interstitial but also have a planktonic lifestyle. The first records of planktonic gastrotrichs were those of Dasydyidae goosanus Gosse, 1851 and Dasydyidae sp. (now Neogosspidae antenniger) Gosse, 1851 (now Neogosspidae antenniger). In the years leading up to the twentieth century, several findings of new planktonic gastrotrichs were published, e.g., Chitonoderus longisetosus.