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Meiofaunal Polychaetes

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Abstract

Meiofauna are the group of organisms whose size ranges fall between the macrofauna and microfauna. All fauna that passes through the coarse sieve of 500µm but are retained by the fine sieve mesh of 63µm are considered as the meiofauna. These ubiquitous animals are not only found in and on soft sediments but also on the biofilms of hard substrata. In general they are a cosmopolitan species that has become a useful tool for ecotoxicological assessments, particularly for its use in toxicity testing with sediment pore waters.

Key words: *biomineralization, toxicological assessment, sediments, metazoans*

Introduction

Meiofauna are ubiquitous animals which are not only found in and on soft sediments but also on the biofilms of hard substrata (Giere, 2009). It is estimated that a minimum of about 55,000 - 13, 00,000 meiofauna individuals are found in the silty sand of the sublittoral sediments (Gerlach, 1971). They are regarded to be microbial feeders or grazers of microalgae being involved in detrital decomposition (Gee, 1989).

From the past studies it can be inferred that meiobenthic fauna have following importance viz. facilitating biomineralization of organic matter and thus enhancing nutrient regeneration (Coull, 1999), along with serving as food for higher trophic levels (Olafsson and Moore, 1990; Coull, 1999; Danovaro, 2007). This is believed to provide 15% of the biomass of a food chain in the sublittoral zone whereas its standing stock is merely 3% of the macrobenthos (Gerlach, 1971). The high sensitivity of these animals with reference to physio-chemical factors, makes this group to be studied to understand anthropogenic activities (Coull, 1999; Giere, 2009). Structural and functional features of benthic realms of meiofauna state that it has its own importance in the trophic (Warwick, 1989). Owing to its short life-span, the effect of a pollutant on biota can be well studied in their life history within a short duration (Coull, 1999). The meiofaunal groups are as follows: nematodes, harpacticoids, polychaetes, turbellaria, foraminifera, and ostracods are in abundant, whereas, oligochaetes, kinorhyncha, gastrotrichs, tardigrada, lamellibranchs and crustacean larvae are lesser known ones (Fig. 1).

Polychaetes belonging to the Phylum Annelida, are one of the most abundant taxa in the benthos. They play a significant role in moulding the structure of the benthic community by means of bioturbation because of their burrowing and feeding activities (Hutchings, 1998; Aller, 1983; Rhoads, 1985). Apart from being good indicators of species richness and community patterns of benthic invertebrate assemblages (Olsgard and Somerfield, 2000; Sparks-McConkey and Watling, 2001; Van Hoey et al., 2004), polychaetes are also considered to be one of the best indicators of environmental disturbances (Gambi and Giangrande, 1986; Samuelson, 2001), because of their sensitive and tolerant nature to environmental variables (Pocklington and Wells, 1992). Any imbalances in the benthos population should be reflected in the polychaetes presence also, because of its chronic exposure to the causative agent (Papageorgiou et al., 2006).

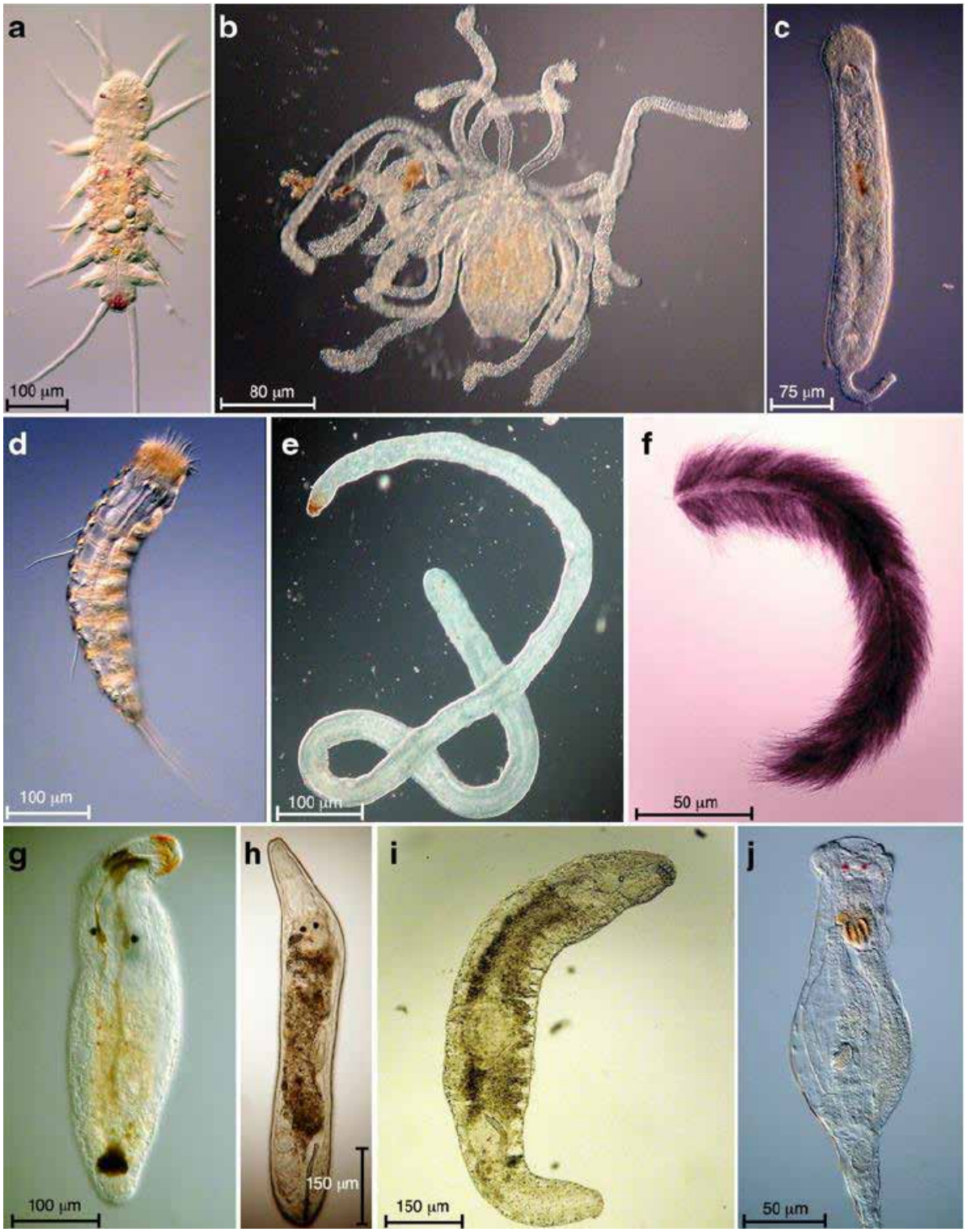

Fig 1 Representative meiofauna

A vast number of literature is available on macrofaunal polychaetes in both international (Kohn and Llyod, 1973; Bagheri and McLusky, 1982; Nordheim, 1989; Hylleberg and Nateewathana, 1991; Cardell et al., 1999; Diaz and Harris, 2004; Elias et al., 2006; Struck, 2006; Frojan et al., 2009) and national (Banse, 1959; Tampi and Rangarajan, 1964; Rao, 1972; Day, 1973; Hartman, 1974; Soota and Rao, 1977; Soota et al., 1980, 1981; Misra et al., 1983; Jouin and Rao, 1987; Kumar, 2002; Sarkar et al., 2005; Patel and Desai, 2009; Rajasakeran and Fernando, 2009, 2011; Musaale and Desai, 2011; Gopal et al., 2015; Bandekar et al., 2017; Lakra et al. 2018) scenario.

On the contrary, studies on meiofaunal polychaetes are less. Meiofaunal polychaetes are defined as the maximum size ranges reaches within the 500µM during their life cycle. Meiofaunal polychaetes are of euryoecious nature and are one of the most abundant meiofaunal taxa (Villora-Moreno, 1997) in the marine realm. Such polychaetes display unique features for adapting to meiofaunal life within the interstitial spaces by having very few segments (*Nerillidium*), reduced and non-protuding parapodia (*Protodrilus*), reduced chaetae (*Polygordius*), often ciliated for gliding locomotion (*Dinophilus*), absence of circular musculature and hence peristaltic movements (Giere, 2009).

International Scenario

Zonation patterns of meiofaunal polychaetes were initially studied in the sandy beaches of Mediterranean Sea by Westheide (1972), Indian coast of Bay of Bengal by Rao (1972) and Galapagos Islands by Westheide (1974, 1977). It was inferred that all meiofaunal polychaetes show same pattern of zonation in the sandy beaches of temperate and tropical seas (Westheide, 1991). Later, Villora-Moreno et al. (1991) used meiobenthic polychaetes to discriminate sandy beaches with and without macrophytic cover. Their study suggested lower number of polychaetes meiofauna in beaches without macrophytic cover compared to the ones with macrophytic cover. Villora-Moreno (1997) also found more diversity and abundance of meiofaunal polychaetes in the submerged sediments than in the exposed sediments of the same mid-littoral pool and suggested water content to be a major factor for such differences.

Most of the sediment-dwelling meiofaunal polychaetes are representatives from macrofauna families, including Acrocirridae, Dorvilleidae, Goniadidae, Hesionidae, Orbiniidae, Paraonidae, Pholoidae, Phyllodocidae, Pisionidae, Questidae, Sabellidae, Sphaerodoridae, Spionidae, and Syllidae (Worsaae and Kristensen, 2005). Vorobyova et al. (2008) carried out distributional studies of meiobenthic polychaetes in Northwestern Black Sea and recorded twenty polychaete species belonging to 11 families, the Phyllodocidae, Nephtyidae, Polynoidae, Sigalionidae, Nereidae, Syllidae, Hesionidae, Protodrilidae, Spionidae, Capitellidae and Ampharetidae.

Since meiofaunal polychaetes are interstitial dwellers, sensitive to contaminants and easy to culture, they were used by Nipper and Carr (2003) for eco-toxicological assessment test. A cosmopolitan meiofaunal polychaete species, *Dinophilus gyrociliatus* was used as a tool for chronic life-cycle toxicity test method. It was inferred that sub-lethal toxicity test along with *Dinophilus gyrociliatus* can be efficiently used for chronic contamination test for benthic communities. Westehide et al. (2003) used specimens of *Ctenodrilus serratus*, a cosmopolitan species, from North Atlantic to prove it as an Amphi-Atlantic species by the help of RAPD-PCR and sequencing of the internal transcribed spacers (ITS1, ITS2) and 5.8S DNA. The species *C. serratus* came into the attention of Westheide for the above examination because of its asexual reproductive character (Peters, 1923; Korschelt, 1931). Finally, it was concluded that some meiofaunal species, despite lacking the ability to produce larvae, somehow manage to disperse through huge oceanic distances.

National Scenario

Westheide and Rao (1977) did a distributional study of the genus *Hesionides* (Polychaeta, Hesionidae) from the sandy beaches of India, and came across five species of *Hesionides,* of which two have already been recorded earlier in the Indian coast (*H. arenaria* and *H. gohari*) and three new mesopsammic species were recorded from the Andaman archipelago and the south-east coast of Indian mainland (*H. minima, H. peculiaris* and *H. indooceanica*). Rao and Misra (1983) from their distributional studies, concerned about the meiofauna inhabiting the coralline

sediments of Lakshwadeep Islands, reported 25 species of meiofaunal polychaetes belonging to 16 genera and representing 8 families viz. Goniadidae, Hesionidae, Nereidae, Orbiniidae, Polynoidae, Palmyridae, and Syllidae.

Conclusion

It can be insinuated from all the studies mentioned above, that although there had been many research pertaining to meiofauna in general and macrobenthic polychaetes in particular, but there is still a knowledge gap in case of meiofaunal polychaetes. Meiofaunal polychaetes are having their specific ecological roles; such as food for higher trophic levels, bioturbation of sediments, utilization as environmental pollution and toxicity indicating species, yet they had not been studied in enough detail. The families or species of polychaetes belonging to permanent meiofaunal group are not yet well mentioned. The unique physical adaptations of meiofaunal polychaetes and its variation from one species to the other are not defined properly. Thus, to fill these information gaps, researchers should be focus upon the distribution, diversity and taxonomic features of meiofaunal polychaetes solely.

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