Title: The contribution of meiofauna to evolutionary ecology

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Recent technological advances have dramatically enhanced our understanding of the morphology, phylogeny and ecology of meiofauna species. Scanning and transmitted electron microscopy, together with confocal laser scanning microscopy, increased the amount of external and internal morphological information. These advances in microscopy have allowed us to improve the descriptions of species, as well as to understand the morphological adaptations of meiofauna taxa along the evolutionary history. In ecology, the characterization of molecules, such as stable isotopes and fatty acids at the level of populations, have permitted us to infer the trophic position of meiofauna species and enhance our understanding of its functional role in the ecosystem. In parallel, advances in molecular DNA techniques have allowed us to quantify with much higher accuracy population structures, genetic variability within and between species and the phylogenetic position of target meiofauna species. Additionally, techniques on RNA have been used to describe the metabolic response of meiofauna species to environmental changes. Despite these significant methodological advances, techniques have been mainly used within its “knowledge” domains (i.e. taxonomy/systematics, ecology and phylogeny) and there is a need for more interdisciplinary studies. An important step towards interdisciplinarity is to be aware of the challenges and limitations inherent to biodiversity assessments and to each methodological approach, in particular. Interdisciplinary studies face the challenges of improving sampling protocols and preservation methods in order to establish direct relationships between the different datasets. Given the diversity and omnipresence of meiofauna taxa across the globe and environmental conditions, interdisciplinary studies on the group have to be hypothesis oriented and, therefore, based on a clear theoretical framework. In that respect, we introduce the conceptual framework of the evolutionary ecology theory. This framework recognizes that species interactions, environmental filtering, dispersion and drift are the main drivers promoting species coexistence and at the same time speciation and extinction. It is clear that working at the interface between phylogeny, ecology and morphology imposes several challenges and will require creative approaches, but well designed studies making the use of these new methodologies will certainly be at the cutting edge of biological sciences.