Chemosensory perception in copepods:

behavioral, physiological and molecular responses to biotic stimuli

Director of Studies: Ylenia Carotenuto

Department Integrative Marine Ecology

Seat:

Abstract

The Project Summary has to contain a brief description of the proposed activity (please use clear wording for dissemination on the media) the objectives and methodology (avoid any confidential information). It must clearly address in separate statements: 1) the intellectual merit of the proposed activity; 2) the broader impacts resulting from the proposed activity. Please consider that this is the abstract that will be announced in the public call for applications.

Mesozooplankton copepods, the most abundant metazoans in aquatic systems, act as trophic link between primary (phytoplankton, mainly diatoms) and tertiary (macrozooplankton, fish, mammals) producers in the food webs. Copepod secondary production (fecundity, larval development and population growth) depends on feeding and reproduction, behavioral and ecophysiological processes mediated by infochemicals (information-conveying chemicals). Chemoperception of prey and mate in animals occurs via sensory structures, where the transport, through chemosensory-binding proteins, of the chemical to the specific receptor protein takes place. A downstream signal transduction pathway is then activated, leading to the phenotypic response of the organism (prey ingestion/avoidance, mating, oviposition). The goal of the present PhD proposal is to characterize the chemosensory mechanism of algal prey and mate perception in copepods, using an integrated behavioral, physiological, and molecular approach. Among algal prey, we will select diatom species that produce lipid-derived bioactive molecules (oxylipins), that act as defensive infochemicals against copepod grazers, affecting their gene expression, food-searching behavior and reproduction. Oxylipin-producing diatoms, as well as pure oxylipins, will be tested on two target copepod species, *Temora stylifera* and *Acartia clausi*, dominant in the coastal area of the Mediterranean Sea and the Gulf of Naples, to evaluate their molecular and ecophysiology responses. A panel of chemosensory genes, recently identified by our team in several copepod transcriptomes, will be selected and their expression quantified in the target copepod species exposed directly and indirectly to the prey and the mate.

The objectives and methodology of the proposal will be:
BEHAVIOUR: evaluation of swimming, attraction/avoidance behavior, in *T. stylifera* and *A. clausi*, females and males, exposed to different phytoplankton diets, pure oxylipins and mates;
PHYSIOLOGY: measurements of ingestion rates in *T. stylifera* and *A. clausi*, females and males, exposed to different phytoplankton diets;
GENE EXPRESSION: quantitative expression analysis of selected chemosensory genes, in *T. stylifera* and *A. clausi*, females and males, exposed to different phytoplankton diets, pure oxylipins and mates.

The intellectual merit of the project resides in its interdisciplinary approach, involving the use of methodologies and competences from different lines of research, and novelty, assessing simultaneously for the first time, the molecular-level chemoperception in copepods and anchoring it to the functional diversity of the phenotypic responses to the cues.
In terms of broader impacts, the results of our study open new possibilities for the use of the chemosensory genes as biomarkers in chemical ecology studies on copepods, and in general for the assessment and management of healthy marine ecosystems.