Acartia spp. (Copepoda: Calanoida) as model organisms to evaluate the toxicity of emerging contaminants: an ecotoxicogenomic approach

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Abstract

Copepods are small crustaceans of great ecological and ecotoxicogenomic importance. Among them, *Acartia tonsa*, invasive species in the Mediterranean Sea, is a model species in ecotoxicology. *Acartia clausi*, native of the Mediterranean, is a candidate alternative model species in this field.

In this PhD project, we compared physiological (naupliar immobilisation, egg hatching success, egg production, faecal pellet production, adult survival) and molecular (quantitative gene expression) responses of both copepod species exposed to nickel chloride ($NiCl_2$) and nickel nanoparticles (NiNPs), through ecotoxicological bioassays and RT-qPCR. A *de novo* transcriptome of *A. clausi* females exposed to elutriates of polluted sediments was also generated.

We were able to keep multi-generational cultures of *A. clausi*, fed the optimal diet of *Rhinomonas reticulata*, for up to four months, with 26 days from eggs to F2 generation.

Bioassays confirmed that nauplii of *A. clausi* were more sensitive than those of *A. tonsa*, approximately 6 (NiNPs) and 95 times ($NiCl_2$). Adults of both species were less affected by these toxicants, with mild effects mostly on egg production. Effects of both toxicants on egg hatching success was mainly due to Ni ions, which are continuously released from NiNPs.

The first *de novo* assembled transcriptome for *A. clausi* exposed to elutriates of polluted sediments revealed 1,000 differentially expressed genes (743 up-, 257 down-regulated). The response was mostly in up-regulation of proteolysis and detoxification, and down-regulation of ribosomal proteins.

Comparative gene expression in copepod females showed greater responses in *A. clausi*, especially with $NiCl_2$, mostly with a down-regulation of genes involved in detoxification, indicating an inhibition of molecular defences. For *A. clausi*, down-regulation of vitellogenin seems correlated with low egg production.

Overall, we provided novel information on the physiology and molecular biology of *A. clausi* and on NiNPs behaviour, which could threaten marine environment in the near future.