Immunaqua: Anti-infectious immune effectors in marine invertebrates: characterisation and application for disease control in aquaculture; an European project

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Introduction

As world aquaculture is facing economical losses due to infectious diseases, collaborative work is currently developed in the frame of the EC INCO-DEV program, Immunaqua (ICA4-CT-2001-10023), to provide new data and new tools for the control of diseases in mollusc and shrimp aquaculture.

Difficulties for control of diseases in marine invertebrate aquaculture comes from the etiological diversity of pathogens that affect them (namely, bacteria, viruses, fungi or protozoans) during different stages of their development. These pathologies reduce larval production and lead to profitability problems due to stock mortalities. Until recently, to overcome such problems, a common practise in hatcheries was based on the intensive use of antibiotics, which have fostered the development of drug-resistant bacteria. Discharged with wastewater, these bacteria can have harmful consequence for environment. Thus, new alternative treatments need to be developed.
In the long term, the most effective way for sustainable aquaculture production will certainly rely on the production of selected animals for resistance to diseases. So far, selection programmes have been based on the criteria of growth or resistance to one specific pathogen, for which the risk of development of new pathogens on such selected strains is not eliminated. An alternative way is to select animals with increased non specific resistance to pathogens or increased health status.

Research on the immune systems of marine invertebrates with economical interest give new insights into the management and durability of aquaculture. In particular, antimicrobial peptides, naturally produced in all living organisms, present this dual potential interest for application in the control of diseases.
- First, according to their spectrum of antimicrobial activity and biological properties, these natural bioactive compounds, assayed for their potential beneficial effect on larvae quality and protection against infections, are studied as substitutes to conventional and chemical drugs.
- Second, quantitative analyses of anti-infectious gene expression must be considered as tools for monitoring the health status of animals and as criteria to be investigated for

developing alternative selective breeding programmes. Such approach fit with the identification of new traits for genetic selection, which could confer an enhanced immune capacity or a form of non-specific reactions to pathogens.
As a preliminary step, the expression of antimicrobial effectors encoding genes characterised in the different species are analysed in response to infections, and at individual and population levels, and then in animals surviving to infections.

Specific scientific and technological objectives of Immunaqua

The project has the following specific objectives: we isolate and characterise from cultured molluscs and shrimps, antimicrobial peptides/proteins by biochemical (proteomic) and molecular (genomic) approaches (WP2 and WP3 respectively). These natural molecules are produced in recombinant systems or by chemical synthesis (WP4) to investigate their *in vitro* properties and antimicrobial activities against a wide range of micro-organisms (bacteria, virus, fungi) and protozoa (WP5) and to evaluate their toxicity or iniquity, and their effect on live food such as artemia and microalgae, then on larvae (WP6). To better understand the immune response in oyster and shrimp, we study the spatio-temporal localisation and expression of antimicrobial effector encoding genes in animals, in response to infections and during development (WP7). Finally, we analyse the expression of AMP-encoding genes in different populations to check if these effectors may be correlated with a better survival to infections and thus may represent markers for response to microbial infections in the cultured species (WP8). For that, quantitative methods are developed for analyses of AMP effectors gene expression in different shrimp species.

Conclusion

The project aims at the development and transfer of new approaches and methodologies for use in mollusc and shrimp farming. Expected results and outcomes may contribute to generate environment-friendly technologies for a sustainable development of the aquaculture industry.

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http://www.ifremer.fr/Immunaqua