R&D Innovations in Microbial Managementin Fish and Shellfish Larviculture

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Abstract

Although aquaculture is currently the fastest growing food producing sector in the world (9 % annual growthsince the 1970's), the larval phase of the aquacultureproduction cycle is however still affected by low and unpredictable survival, high susceptibility todiseases (caused e.g. by Vibrio spp. bacteria) and slow growth, all constituting bottlenecks for thesustainable expansion of aquaculture (FAO Global Conference on Aquaculture, October 2010). This isespecially the case in crustaceans, bivalve and marine fish culture.

In early stages of larvaldevelopment of aquatic organisms, microbial colonization is stochastic (Verschuere et al., 2000) andresults in high inter-individual and high inter-batch variability in the composition of the standingmicrobial community. This has species-dependent deleterious or beneficial effects on the host, e.g. atthe immunological level.
From an experimental point of view this stochastic colonization creates ascientific burden.Hence, there is a high scientific and practical interest in unraveling the host microbial interactions inthe early larval stages, which have so far been studied in a rather empirical way. In this respect, thereis a clear need for gnotobiotic experimental systems, i.e. systems in which the host is associated with a well-known set of micro-organisms, increasing experimental reproducibility and hence leading tomore unambiguous results. These models could then be used to generate crucial data on the mode of action (positive or negative) of micro-organisms, including induced immune responses in larvae.

The UGent Aquaculture R&D Consortium has set up an interdisciplinary research team to study host-microbial interactions in aquatic organisms using gnotobiotic model systems for marine fish, crustaceans and mollusks. Two research approaches are followed: 1) to influence microbial numbers and/or their activity, i.e. interfering in bacterial quorum-sensing behavior through quorum-quenching applications or modifying microbial compositions through modulation of the intestinal pH, and 2) to stimulate the host's immune system by application of heat-shock protein treatments or dietary yeast cell-wall bound components.

Based on this apparent important microbial interaction INVE Technologies has in the past 2 years developed novel techniques to reduce the microbial impact of live food (rotifers and Artemia), which may result in successful improvements in marine fish & shrimp hatcheries.