

# QUORUM SENSING-INTERFERENCE TO REDUCE MORTALITY DURING BLUE MUSSEL (*MYTILUS EDULIS*) LARVICULTURE

Plovie Aäron<sup>1</sup>, Nancy Nevejan<sup>1</sup>, Tom Defoirdt<sup>1</sup>, Nico Boon<sup>2</sup> and Peter Bossier<sup>1</sup>

<sup>1</sup> Laboratory of Aquaculture and Artemia Reference Center, Ghent University, Rozier 44, B-9000 Gent, Belgium  
E-mail: [Aaron.Plovie@UGent.be](mailto:Aaron.Plovie@UGent.be)

<sup>2</sup> Laboratory for Microbial Ecology and Technology, Ghent University, Coupure Links 653, B-9000 Gent, Belgium

In 2005, blue mussel (*Mytilus edulis*) was the primary cultured bivalve in Europe. Mussels are cultured by capturing larvae or by fishing young mussel seed from the wild and on-growing these to marketable size. Unfortunately, the production is extremely variable due to uncertain availability of natural spat. Hatchery production of mussel larvae is one solution to this problem (Galley *et al.*, 2010). However, mass production of mussel seed in hatcheries is hampered by outbreaks of diseases, caused by pathogenic bacteria. In the past, diseases were combated with antimicrobial drugs (ADs). This led to the emergence of AD-resistant pathogens (Martinez, 2009). Therefore, alternatives to the use of antibiotics are necessary. The technique of quorum sensing-interference is a new field of research that deserves considerable attention. Quorum sensing (QS) is a type of bacterial cell-to-cell communication that regulates the pathogen's virulence. Blocking QS can result in decreased virulence (Defoirdt *et al.*, 2004).

A gnotobiotic test system is being developed for blue mussel larvae. This system will be used for challenge tests during which the interactions between selected quorum sensing-using pathogens (i), selected quorum sensing-interfering bacteria (ii) and mussel larvae (iii) will be determined. The survival, growth and immune status of gnotobiotic mussel larvae will be monitored as well as the composition of the bacterial communities associated with the mussel larvae and present in the medium. In parallel, the effect of the quorum sensing-interfering bacteria on microalgae cultures will be determined. Selected bacteria will be screened for their positive effects on algal growth. Subsequently the microalgae that are co-cultured with the bacteria will be administered to the mussel larvae of which growth rates and survival will be measured. The aim is to identify bacteria that have a beneficial effect on both microalgae and mussel larvae.

Understanding the role of QS will enable the development, evaluation and commercialization of quorum sensing-interfering bacterial mixtures, which will increase considerably hatchery mussel larvae production without the necessity to use antibiotics. A stable and predictive supply of high quality mussel seed is a pre-condition to develop commercial mussel farms when natural supply becomes unreliable. Also integrated multi-trophic aquaculture (IMTA) projects (Troell *et al.*, 2009) and offshore projects (e.g. windmill parks) (Michler-Cieluch *et al.*, 2009) can be supplied with hatchery seed, supporting the worldwide concern to develop sustainable aquaculture practices.

Hatchery production of mussel seed also permits genetic breeding programs and the generation of triploid seed, which can lead to mussels containing more meat with a better taste and/or mussels that are resistant to certain bacterial diseases or parasites (Beaumont *et al.*, 2007).

## References

- Beaumont A., T. Gjedrem and P. Moran. 2007. Blue mussel – *Mytilus edulis* Mediterranean mussel – *M. galloprovincialis*. Genimpact final scientific report: 62-69.
- Defoirdt T., N. Boon, P. Bossier and W. Verstraete. 2004. Disruption of bacterial quorum sensing: an unexplored strategy to fight infections in aquaculture. *Aquaculture* 240:69-88.
- Galley T.H., F.M. Batista, R. Braithwaite, J. King and A.R. Beaumont. 2010. Optimization of larval culture of the mussel *Mytilus edulis* (L.). *Aquaculture international* 18:315-325.
- Michler-Cieluch T., G. Krause and B.H. Buck. 2009. Reflections on integrating operation and maintenance activities of offshore wind farms and mariculture. *Ocean and Coastal Management* 52:57-68.
- Martinez J.L. 2009. Environmental pollution by antibiotics and by antibiotic resistance determinants. *Environmental Pollution* 157:2893-2902.
- Troell M., A. Joyce, T. Chopin, A. Neori, A.H. Buschmann and J.G. Fang. 2009. Ecological engineering in aquaculture – potential for integrated multi-trophic aquaculture (IMTA) in marine offshore systems. *Aquaculture* 297:1-9.