Genetic Perspective on Stress Response and Disease Resistance in Aquaculture

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Key words: stress, immune system, QTL, gene expression

Abstract

Despite continuous progress and improvements in aquaculture technologies and husbandry techniques, fish diseases remain a major limiting factor in the fish culture industry. The aquaculture environment exposes fish to repeated acute stress, which leads to physiological responses that have suppressive effects on growth, reproduction, and immune capacity. The strong link between stress and susceptibility to diseases in farm animals has long been acknowledged, and parameters of high and low stress response are associated with disease resistance in fish. Few studies on genetic aspects of immune response to stress have been conducted. The estimated heritability of several parameters of the innate immune response is mostly moderate. Quantitative trait loci have been found for different responses to stress conditions. Gene expression studies show that hundreds of genes can be involved in fishes’ physiological and immunological response to stress. This general response to stress is controlled by a few major genes at the top of the pathway, which activate a cascade of reactions, having a significant effect on the overall health of the fish. Selective breeding for disease resistant fish is an attractive strategy for disease prevention and several studies have reported progress in this field. However, the biological pathways of stress response and disease resistance are not well characterized, and their genetic basis and control are still poorly understood. Extensive research is still needed for a better understanding of these pathways, and this should be a collaborative effort of researchers from different fields: genetics, immunology, pathology, physiology, and endocrinology.

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