

学 位 論 文 要 旨

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題 目	Effect of Various Feed Additives on the Performance of Aquatic Animals (水棲動物における各種飼料添加物の効果に関する研究)

Aquaculture industry is playing an increasing role to supply comparatively safer animal protein for human consumption, as intensive aquaculture expanded, diseases occurred more frequently. The need for enhanced disease resistance, feed efficiency and growth performance of cultured organisms is substantial for various sectors of this industry. Moreover, the application of antibiotics and chemotherapeutics to control these diseases caused many other problems such as the spread of drug resistant pathogens, suppression of aquatic animal's immune system, environmental hazards and food safety problems. Nowadays, we have learned more sustainable ways to manage gut microflora and fish performance using functional feed additives to modulate the health of farmed animals. Therefore, this study revealed the use of substantially important and promising additives in aqua feed. The options available to regulate fish performances include the use of probiotics, prebiotics and immunostimulants. The red sea bream, *Pagrus major* and amberjack, *Seriola dumerili* are important cultured species in East Asia countries, particularly Japan due to their high market value, desirable taste and recent supply shortage. The current research was conducted to evaluate the effects of various feed additives on the performances of red sea bream and amberjack. In the first part three studies were conducted to determine the supplemental effects of heat-killed *Lactobacillus plantarum* (HK-LP), *Pediococcus pentosaceus* (PP) and β -glucan (BG) on red sea bream. Six diets were prepared to contain HK-LP at 0, 1, 10, 100, 1000, and 2000 mg kg⁻¹ diet. After 56 days, the fish fed diet HK-LP at 1000 mg kg⁻¹ resulted in a significant increase in growth performance, feed utilization, immune response and stress resistance when compared to the control diet. To study the supplemental effects of PP on red sea bream, fish fed five diets containing (0, 1.6×10¹⁰, 1.6×10¹¹, 1.6×10¹², and 3.2×10¹² cells g⁻¹). After 56 days, fish fed PP supplemented diets resulted in significantly higher growth performance, immune response and stress resistance in a dose dependent manner than the control group. Same trend has been reported for fish fed diet containing BG at 250, 500 or 1000 mg of BG kg⁻¹ diet. Considering these promising results, we suggest that the supplementation of HK-LP, PP and BG improves growth and health condition of red sea bream.

In the second part, seven diets were formulated to contain 0%, 15%, 30% and 45% SBM together with HK-LP at 0.0 and 0.1%, and fed for amberjack. Fish fed a diet containing 30% SBM with HK-LP grew significantly faster than other groups with notable feed utilization. Further, feed utilization significantly increased in fish fed diets supplemented with HK-LP except for fish fed diet contains 45% SBM. Interestingly, immune response significantly enhanced in fish fed diets containing 15% and 30% SBM with HK-LP. In conclusion, the addition of HK-LP to amberjack diets appeared to improve SBM utilization, immune response and stress resistance. In the third part, dietary HK-LP and BG had a significant interaction on enhancing the growth, digestibility and immune responses of red sea bream, where, diets were formulated to contain three levels of HK-LP (0.025, 0.05 and 0.1% of dry diet) combined with two levels of BG (0 and 0.1% of dry diet) according to a 3×2 factorial design. A diet without HK-LP and BG supplementation was used as a negative control. Fourth part, red sea bream was fed with basal diet supplemented with *L. rhamnosus* (LR), *Lactococcus lactis* (LL), and *L. rhamnosus* + *Lactococcus lactis* (LR+LL) at 10⁶ cell g⁻¹ diet. Feeding a mixture of LR and LL significantly increased growth performance, intestine bacteria count, immune response and enhanced oxidative status. In the last part, we evaluated the effects of dietary HK-LP and vitamin C (VC) on the performances of red sea bream. Beside the basal diet, four diets with 0 or 1 g HK-LP kg⁻¹ combined with 0.5 or 1 g VC kg⁻¹ were fed to red sea bream. fish fed with both supplements showed higher growth, humoral and mucosal immune responses, anti-oxidative status, mucus secretion and stress resistance as well as decreased plasma triglyceride and total cholesterol levels than the fish fed control diet with significant interaction between HK-LP and VC. The overall findings of this research suggest that these additives have beneficial effects on growth performances and health condition of red sea bream and amberjack.