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Abstract
The complement system is a crucial part of the immune system of vertebrates, protecting hosts from invading pathogens. The optimal activation of the complement system is tightly regulated by regulators of complement activation (RCAs) for host cell protection. In vertebrates, the RCAs can be categorized into two groups, including group 1 and group2. Despite increasing researches on complement components of rainbow trout, the RCA group 2 genes are still unknown. In this study, two RCA group 2 genes were cloned and identified in rainbow trout, named TRC1 and TRC2. The TRC1 is comprised of a signal peptide and ten SCR domains, while TRC2 only comprised of six SCR domains. Protein sequence alignment, gene structure comparison, phylogenetic and syntenic analysis revealed that TRC1 and TRC2 are two homologous genes, which may duplicate and evolved from an ancestral gene by the salmonid-specific whole-genome duplication (WGD) event. Further analysis revealed that the SCR domains of fish group 2 RCAs can be clustered into four types (A, B, C and D), and the SCR orders of TRC1 and TRC2 are ADBAABADCA and ADBADC, respectively. Expression analysis showed that TRC1 and TRC2 are constitutively expressed in various tissues and leukocyte subpopulations, with the expression level of TRC1 higher than that of TRC2, especially in IgT+ and IgM+ B cells. Previous studies have shown that vertebrate RCA group 2 genes are closely located in one chromosome, the first time we report two homologous, but significantly different RCA group 2 genes located in two different chromosomes in rainbow trout, providing new insights into the duplication and evolution of RCA genes in vertebrates.
keywords: Complement, regulator, duplication, evolution, rainbow trout

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P-077.

Influence of traditional Chinese medicine and *Bacillus* species (TCMBS) on growth, immune response and disease resistance in Nile tilapia, *Oreochromis niloticus*

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Abstract
Multispecies herbs and probiotic bacteria offered to fish might enhance their immune response and increase disease resistance, but the dose effects of herbal-probiotic application remain unclear. Therefore, the effect of herbal-probiotic mixtures of traditional Chinese medicine (TCM) of composition *Astragalus membranaceus*, *Angelica sinensis*, *Crataegus hupehensis* and probiotic Bacillus species (BS) of composition *Bacillus subtilis* and *Bacillus lincheniformis* as natural immunostimulants in tilapia *Oreochromis niloticus* have been investigated. Fish were randomly divided into four groups: control diet (CT), TCMBS1 [TCM at 3 g/kg and BS at 7 g/kg], TCMBS2 [TCM at 5 g/kg and BS at 5 g/kg], TCMBS3 [TCM at 7 g/kg and BS at 3 g/kg]. Tilapia in the TCMBS3 group showed significant improvement in weight gain, specific growth rate, and lowered feed conversion ratio compared with other treated groups and the control. Concerning immune indexes, all treated groups significantly enhanced lysozyme, superoxide dismutase, catalase, protease and antiprotease activities, with highest values in catalase and antiprotease activities in TCMBS3 compared with control. TCMBS3 demonstrated higher expression of beta-defensin, lysozyme, heat shock protein 70, catalase and transforming growth factor-beta compared with other treated groups or the control group in both mid-intestines and head-kidney. After challenge with *Streptococcus agalactiae*, the best survival was found in TCMBS3 (97%), followed by TCMBS2 (73%), and TCMBS1 (69%) compared with the CT (35%). Collectively the present results suggest that TCMBS3 dose might potentiate a higher immune response and disease resistance in fish.
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Serotransferrin and C-type lectin could mediated NCC activity by interacting with NCCRP-1 in Nile tilapia (*Oreochromis niloticus*)

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Abstract
Nonspecific cytotoxic cells (NCCs) are precursor cells of mammalian natural killer cells and play an important role in innate immunity of fish. NCCCRP-1, as an activated receptor of NCC, could combining many exogenous substances or endogenous proteins to mediate NCC activity. In this study, we obtained two proteins, On-C-type lectin and On-serotransferrin, that could interacting with NCCRP-1 through screening of Yeast Two-hybrid library. These two recombinant proteins can effectively induce some toxic effector molecules of NCC high expression. At the same time, On-C-type lectin and On-serotransferrin stimulated NCC could effectively activating FHM apoptotic signal, but blocking on-NCCRP-1 by anti-On-NCCRP-1 antibody could inhibit this apoptotic signal. These results indicate that on-C-type lectin and on-serotransferrin could mediate the killing activity of NCC through NCCRP-1. This study contributes in better understanding the mechanism of NCC activation in teleost.
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