

Genome-wide identification and expression analysis of the C-type lectins family in discus fish (*Symphysodon aequifasciatus*) during parental care

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Introduction

Discus fish (*Symphysodon aequifasciatus*) exhibit an unique parental care behavior, that is, adult discus produce a secretion through their skin, on which the larvae live for the first month after birth. In addition, the immune ingredients in the secretion of the skin of adult discus change in different stages of childbearing in order to adapt the immune needs of its larvae. At the same time, despite the offspring's continuous biting stimulation for up to 1 month, they rarely cause infection and disease on the body surface of the adult discus. This suggests that the parent body surface may also have a strong immune defense ability.

C-Type lectins (CTLs) refer to a superfamily of protein families that rely on calcium ions for selective binding to the carbohydrates. They play an important role in fish mucosal immunity.

This study identified, classified and analyzed the C-type lectin family of discus fish.

Materials

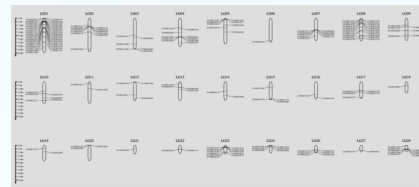
21 pairs (each pair: one male and one female) of adult discus fish were provided by the Key Laboratory of Freshwater Genetic Resources, Ministry of Agriculture, Shanghai Ocean University (Shanghai, China). Each pair of fish was reared in 21 glass tanks (40×40×40cm) with constant temperature (temperature $28.5 \pm 0.5^\circ \text{C}$, pH 6.5 ± 0.5 , L/D=12/12), and fed quantitative beef heart burgers twice a day, and change the water once.

Result

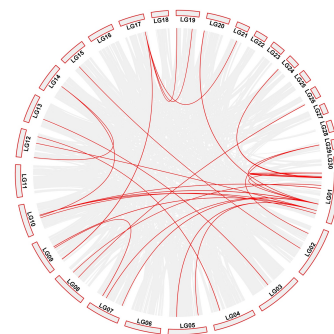
Protein physicochemical properties

We identified 186 CTL family members. The molecular weight of the CTL family proteins of discus fish is in the range of 10.30~517.10kDa, and the theoretical isoelectric point is between 4.33~9.84.

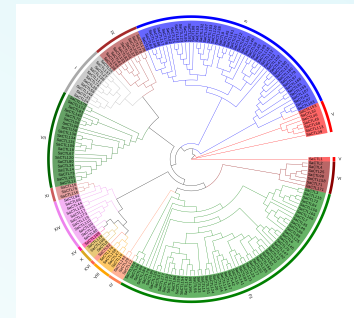
Chromosome location and synteny analysis of the discus fish CTL genes.



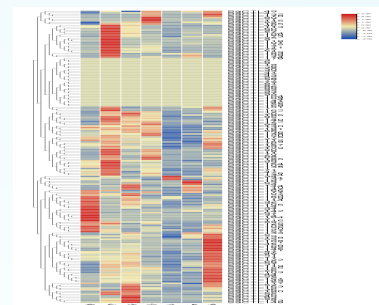
CTL genes of discus fish are unevenly distributed on 27 linkage groups. A total of 80 gene replication events occurred, of which 15 pairs of genes were subjected to segmental duplication, and 65 pairs of genes were subjected to tandem duplication



Phylogenetic analysis of the discus fish CTL genes



Expression profiles of the discus fish CTL genes



RNA-seq analysis indicates that the CTL family members in the skin of parent discus fish show different expression patterns in seven different stages of breeding cycle.

Methodology

The websites used in the study are as follows:

<https://www.uniprot.org/>
<https://www.ncbi.nlm.nih.gov>
<http://pfam.xfam.org/>
<http://smart.embl.de/>
http://mg2c.iask.in/mg2c_v2.1/
<https://www.expasy.org/>
<https://wolfsort.hgc.jp/>
<https://www.evolgenius.info/evolview/#login>
<http://meme-suite.org/tools/meme>
Multiple Collinearity Scan toolkit (MCScanX)

Conclusion

In summary, a total of 186 CTL genes with CTLD were identified in the discus fish genome. CTL members derived from discus, Fugu rubripes and human were clustered into 14 groups. Their conserved motifs within the same groups shared a high similarity. We identified 15 and 65 pairs of segmental and tandem duplicated CTL genes, respectively. Most CTL were expressed in the skin of discus during breeding cycle and exhibited a certain stages-specific pattern between male and female parents. Our study provided new insights into the evolution and potential function of the CTL gene in discus fish.