

Comparative Transcriptomic Analysis Reveals Morphotype Associated Differences in Immune Responses to *Ichthyophthirius multifiliis* Exposure in Goldfish (*Carassius auratus*)

Farwa Butt, Dejun Ji*

College of Animal Science and Technology, Yangzhou University, Yangzhou, China

Email address:

farwabutt419@gmail.com (Farwa Butt), djji@yzu.edu.cn (Dejun Ji)

*Corresponding author

Abstract

Ichthyophthirius multifiliis (Ich) is a highly invasive protozoan parasite that causes massive disease outbreaks in freshwater fish, posing a significant threat to global aquaculture. Despite its impact, the molecular basis of differential host response to *I. multifiliis* exposure in goldfish (*Carassius auratus*) remain poorly understood. This study addressed this gap by comparing the transcriptome profiles of single-tail (S) and twin-tail (T) goldfish following parasite exposure to identify the genetic basis of host responses. RNA-seq analysis identified 9,408 differentially expressed genes (DEGs) between the two morphotypes, with 4,387 genes up-regulated and 5,021 down-regulated in the S group compared to the T group. Functional enrichment and KEGG analysis revealed that these DEGs were primarily involved in cellular and metabolic processes, as well as key immune signaling pathways, including NOD-like receptor, RIG-I-like receptor, C-type lectin receptor, chemokine, NF- κ B, and JAK-STAT signaling. Among 92 genes associated with Ich responses across 10 immune pathways, 15 candidate genes were prioritized for further functional investigation. Quantitative RT-PCR validation of five key immune genes (*GIMAP4*, *TRIM25*, *GFAP*, *C-type lectin*, and *CHRNA3*) confirmed the reliability of the RNA-seq data. These results provide insight into morphotype-associated differences in transcriptomic immune responses to *I. multifiliis* exposure in goldfish and identify candidate pathways and genes for future functional studies.

Keywords

Twin-tail Goldfish, *Carassius Auratus*, *Ichthyophthirius Multifiliis*, Transcriptome Analysis, Immune Response, Parasite Exposure