OPEN ACCESS Freely available online

ISSN: 2155-9546
Journal of Aquaculture Research & Development

Perspective

Function of Dicer in the Environmental Stress Response of Aquatic Species

Jinu Win*

Department of Marine Biology, Chang Gung University, Taoyuan, Taiwan

DESCRIPTION

In the vast realm of aquatic species, a fascinating molecular process known as RNA interference (RNAi) plays a crucial role in regulating gene expression and defending against viral infections. At the heart of this intricate mechanism lies an essential enzyme called Dicer, which acts as a key player in the RNAi pathway. Dicer's multifaceted functions in aquatic organisms have captured the attention of researcher's worldwide, unraveling new insights into the molecular machinery that governs life beneath the water's surface. RNA interference is a natural process that regulates gene expression by selectively silencing specific genes. It involves the recognition and degradation of target RNA molecules, inhibiting their translation into proteins. The RNAi pathway consists of several key steps, with Dicer playing a pivotal role in two critical stages: the processing of double-stranded RNA (dsRNA) into small interfering RNAs (siRNAs) and the subsequent assembly of the RNA-Induced Silencing Complex (RISC). Dicer, a ribonuclease III enzyme, possesses distinctive structural and functional characteristics that make it well-suited for its role in RNAi. It consists of an amino-terminal helicase domain, which unwinds dsRNA, and a carboxyl-terminal Dicer domain, which cleaves the dsRNA into 21-23 nucleotide siRNAs. Additionally, Dicer contains two RNase III domains responsible for precise cleavage of the dsRNA molecule, yielding short RNA duplexes with characteristic 2-nucleotide overhangs.

In aquatic species, Dicer performs a wide array of functions essential for normal development, cellular homeostasis, and immune response. One of its primary roles is the defense against viral infections. When a virus infects an aquatic organism, it introduces its genetic material in the form of dsRNA. Dicer recognizes and cleaves the viral dsRNA, generating siRNAs. These siRNAs then guide the assembly of RISC, leading to the degradation of viral RNA molecules, thereby inhibiting viral replication and spread. Furthermore, Dicer-mediated RNAi is involved in regulating the expression of endogenous genes in aquatic organisms. It plays a vital role in developmental processes, such as metamorphosis, tissue regeneration, and organogenesis. By selectively silencing specific genes at precise developmental stages, Dicer ensures the coordinated and controlled growth of aquatic species. The impact of Dicer extends beyond individual organisms to ecological interactions within aquatic ecosystems. For instance, the regulation of gene expression through Dicer-mediated RNAi can influence the susceptibility of aquatic organisms to environmental stressors, such as pollution or changes in temperature and salinity. By modulating the expression of stress response genes, Dicer helps aquatic species adapt to challenging environmental conditions and maintain their survival and reproductive success.

Studying Dicer functions in aquatic species has not only deepened our understanding of the molecular mechanisms underlying RNAi but has also importance for potential applications in various fields. Researchers are exploring the therapeutic potential of harnessing Dicer-mediated RNAi to combat viral infections in aquaculture, offering a potential avenue for developing effective antiviral strategies to protect valuable aquatic species. Dicer, the essential enzyme in the RNAi pathway, plays a significant role in aquatic species, governing gene expression, defense against viral infections, and adaptation to environmental stressors. Its multifaceted functions highlight the intricate nature of molecular mechanisms in the aquatic world. Further research into Dicer and RNAi in aquatic species promises to unveil new insights into the fascinating world of gene regulation and inspire innovative approaches for conservation, aquaculture, and biomedical applications.

Correspondence to: Jinu Win, Department of Marine Biology, Chang Gung University, Taoyuan, Taiwan, E-mail: Jinuwin@gmail.com

Received: 15-May-2023, Manuscript No. JARD-23-21881; **Editor assigned:** 17-May-2023, Pre QC No. JARD-23-21881 (PQ); **Reviewed:** 01-Jun-2023, QC No JARD-23-21881; **Revised:** 08-Jun-2023, Manuscript No. JARD-23-21881 (R); **Published:** 15-Jun-2023, DOI: 10.35248/2155-9546.23.14.774

Citation: Win J (2023) Sustainability in Aquaculture: Biochar-Enhanced Water Treatment for Fish Farming. J Aquac Res Dev.14:774.