

High Temperature Tolerance of Chironomus Sulfuosus and Its Molecular Mechanisms

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Abstract : Introduction: Organisms employ adaptive mechanisms when faced with any stressor or risk of being wiped out. This has made it possible for them to survive in harsh environmental conditions such as increasing temperature, low pH, and anoxia. Some of the mechanisms they utilize include the expression of heat shock proteins, synthesis of cryoprotectants, and anhydrobiosis. Heat shock proteins (HSPs) have been widely studied to determine their involvement in stress tolerance among various organism, of which chironomid species have been no exception. We examined the survival and expression of genes encoding five (5) heat shock proteins (HSP70, HSP67, HSP60, HSP27, and HSP23) from Chironomus sulfuosus larvae reared from 1st instar at 25°C, 30°C, 35°C, and 40°C. Results: The highest survival rate was recorded at 30°C, followed by 25°C, then 35°C. Only a small percentage of C. sulfuosus survived at 40°C (14.5%). With regards to HSPs expression, some HSPs responded to an increase in high temperature. The relative expression levels were lowest at 30°C for HSP70, HSP60, HSP27, and HSP23. At 25°C and 40°C, HSP70, HSP67, HSP60, HSP27, and HSP23 had the highest expression. At 35°C, all had the lowest expression. Discussion: The expression of heat shock proteins varies from one species to another. We designated the genes HSP 70, HSP 67, HSP 60, HSP 27, and HSP 23 genes based on transcriptome analysis of C. sulfuosus. Our study can be termed as a long-heat shock study as C. sulfuosus was reared from the first instar to the fourth instar, and this might have led to a continuous induction of HSPs at 25°C. 40°C had the lowest survival but highest HSPs expression as C. sulfuosus larvae had to utilize HSPs for sustenance. These results and future high-throughput studies at both the transcriptome and proteome level will improve the information needed to predict the future geographic distribution of these species within the context of global warming.

Keywords : chironomid, heat shock proteins, high temperature, heat shock protein expression

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