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SHORT COMMUNICATION

Ultrastructural Alterations in the Gills of *Labeo rohita* Fingerlings Exposed to Thermal Extremes

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Summary

This study aimed to determine the cellular alterations in the gill of *Labeo rohita* exposed to lethal temperature maxima (LT_{Max}) and lethal temperature minima (LT_{Min}) by means of transmission electron microscopy (TEM). Acclimation of advanced fingerlings of *L. rohita* was carried out at 26°C for 30 days. Acclimated fish were subjected to a constant rate of increase or decrease in temperature (0.3°C/min) until the LT_{Max} and LT_{Min} values were reached. Dissected gills were processed for TEM, both at the end of acclimation period at ambient temperature (26°C) and at lethal temperatures. Results indicated that at ambient temperature, the gill tissues appeared normal. However, significant changes were observed at lethal temperatures. The gill tissues at lethal temperature maxima showed severely damaged lamellae, with more vacuolated space. At lethal temperature minima, gill tissues showed increased density of mitochondria. Our *prima-facie* report indicated that *L. rohita* exposed to lethal temperatures exhibited marked ultrastructural changes in the gills.

Introduction

Fishes are poikilotherms, and drastic change in the surrounding water temperature markedly influences their metabolic processes, behaviour, migration, growth, reproduction and survival. It has been shown in animals that extreme temperature changes induce stress in the organisms that is characterized by changes at the physiological (Tort, 2011) as well as at the cellular architectural levels (Egginnton and Sidell, 1989). However, moderate change (increase) in the water temperature has beneficial repercussions on the aquaculture animals; it increases the metabolism of the animals to a certain limit and facilitates faster growth. Fishes have temperature tolerance limits, as well as optimum temperature for growth (Das et al., 2005), reproduction (Das et al., 2006) and resistance to diseases.

It has been proposed by the United States National Research Council that the global mean temperature may increase by 1.5–4.5°C in the next half a century (Beitinger et al., 2000). The potential impact of global warming has compelled researchers to make continuous effort to define thermal adaptation in fishes and to elucidate their consequences on the health status. The various problems arising due to global warming have given greater urgency for understanding the biological responses due to temperature fluctuations, particularly when ectothermic organisms have limited independence from changes in their environmental temperature. Surface water temperature is likely to fluctuate up to 40°C depending on latitude, season, altitude, time of day, depth of water and other factors (Munro, 2001) and will be more frequent in tropical shallow freshwater bodies than in the sea. It is therefore essential to know the effect of thermal extremes (both lower and higher) on histo-architecture of vital organs in aquatic organisms. Among different organs, gills are vital because they are the main sites for gaseous