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Assessment of Antioxidant and Cholinergic Systems, and Liver Histopathologies in Lithobates catesbeianus Exposed to the Waters of an Urban Stream

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Abstract : Anthropogenic activities promote changes in the community's structures and decrease the species abundance of amphibians. Biological communities of fluvial systems are assemblies of organisms that have adapted to regional conditions, including the physical environment and food resources, and are further refined through interactions with other species. The aim of this study was to assess neurotoxic alterations and in the antioxidant system on tadpoles of Lithobates catesbeianus exposed to waters from Cascavel River, in the south of Brazil. A total of 420 L of water was collected from the Cascavel River, 140 L from each of the three different locations: Site 1 – headwater; Site 2 – stretch of the stream that runs through an urbanized area; Site 3 – a stretch from the rural area. Twelve tadpoles were acclimated in each aquarium (100 L of water) for seven days. The water from each aquarium was replaced with the ones sampled from the river, except the one from the control aquarium. After seven days, a portion of the liver was removed and conditioned for ChE, SOD, CAT and LPO analysis; other part of the tissue was conditioned for histological analysis. The statistical analysis performed was one-way ANOVA, followed by post-hoc Tukey-HSD test, and the multivariate principal components analysis. It was not observed any neurotoxic effect, but a slight increase in SOD activity and elevation of CAT activity in both urban and rural environment. A decrease in LPO reaction was detected, mainly among the tadpoles exposed to the waters from the rural area. The results of the present study demonstrate the alteration of the antioxidant system, as well as liver histopathologies in tadpoles exposed mainly to waters collected in urban and rural environments. These alterations may cause the reduction in the velocity of the metamorphosis process from the tadpoles. Further, were observed histological alterations, highlighting necrotic areas mainly among the animals exposed to urban waters. Those damages can lead to metabolic dysfunction, interfering with survival capacity, diminishing not only individual fitness but for the whole population. In the interpretation synthesis of all biomarkers, the cellular damage gradient is perceptible, characterized by the variables related to the antioxidant system, due to the flow direction of the stream. This result is indicative that along the course of the creek occurs dumping of organic material, which promoted an acute response upon tadpoles of L. catesbeianus. and it was also observed the difference in tissue damage between the experimental groups and the control group, the latter presenting histological alterations, but to a lesser degree than the animals exposed to the waters of the Cascavel river. These damages, caused by reactive oxygen species possibly resulting from the contamination by organic compounds, can lead the animals to a series of metabolic dysfunctions, interfering with its metamorphosis capacity. Interruption of metamorphosis may affect survival, which may impair its growth, development and reproduction, diminishing not only the fitness of each individual but in a long-term, to the entire population.

Keywords : American bullfrog, histopathology, oxidative stress, urban creeks pollution
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