(106)

Impact of Climate Change on Selected Physiological Parameters of *Polypedates Cruciger* (Common Hourglass Tree Frog)

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Abstract

Increased temperature and atmospheric CO_2 concentration leading to acidification of water bodies are major attributes of climate change. Amphibians are known to be highly-sensitive to climate change. Accordingly, the objective of this study was to determine the chronic physiological responses of *Polypedates cruciger* to climate change based on continuous exposure to elevated temperature and CO_2-induced acidification from early-larval to adult stages. Newly-hatched tadpoles of *Polypedates cruciger* were allocated to treatment tanks containing de-chlorinated tap water and acclimatized for two weeks. The experimental treatments were two elevated temperatures (E32 and E34), one elevated CO_2 treatment (ECO_2) treatment and a Control at ambient temperature and CO_2. In E32 and E34, water temperatures were elevated up to 32±0.5^o C and 34±0.5^o C at ambient CO_2 to represent predicted warming under Representative Concentration Pathway (RCP) 8.5 (E34) and RCP 2.6 (E32). In ECO_2, CO_2 in water was elevated to maintain its pH between 5.5 and 5.6±0.1 to represent the range predicted by RCPs 8.5 and 2.6 respectively. Each treatment was triplicated with 15 tadpoles in each. The experiment continued until the tadpoles reached Gosner Stage 42. Mean concentration of ammonia released per individual was (AmRel) was calculated using ammonia concentration of each tank, determined by Phenate method. AmRel of E34 and E32 were not significantly different from the Control. AmRel of ECO_2 was significantly higher than the Control during the first two weeks however, the opposite was observed during the rest of experiment. AmRel of all treatments was reduced during metamorphosis and showed weekly variations, with E34 treatment showing the highest variation. Although statistically insignificant, the mean catalase activity was greater in ECO_2, while the overall swimming speed was lower in all treatments, compared to control. Lysozyme activity of tadpoles was significantly greater in ECO_2 compared to Control. The number of leukocytes in 2000 erythrocytes was significantly different among ECO_2, E32 and the Control, with highest and lowest values being recorded from the Control and ECO_2 respectively. Deformities (oedema, tail kink, pale pigmentation) were most abundant in E32. Results showed that temperature and CO_2 elevations predicted under even the most eco-friendly scenario of RCP2.6 (E32) can affect the physiology of *Polypedates cruciger*. In conclusion, the abundance of deformities and physiological parameters such as ammonia excretion, swimming activity, catalase enzyme activity and immunity in terms of lysozyme activity and WBC levels of *Polypedates cruciger* are affected by predicted temperature and CO_2 increases attributed to future climate change.

Keywords: Elevated temperature and CO_2, Reduced pH, Ammonia, Catalase, Lysozyme