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Acute and sublethal toxicity of chlorpyrifos on developmental stages of *Dattaphrynus melanostictus*

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ABSTRACT

Organophosphate (OP) compounds are commonly used as pesticides in agriculture, in homes, offices and gardens, parasiticides in veterinary medicine, and also employed as chemical warfare agents (CWA). However, extensive application of these OPs within agricultural proximity leads to the deleterious effects on inhabiting fauna. This study was aimed to find out acute toxicity and elucidates the sub-lethal effect of commercially formulated organophosphate chlorpyrifos (CPF) on *Duttaphrynus melanostictus* tadpoles. In this study, the 96 h LC_{50} value found to be 5.9 mg/L. Tadpoles exposed to three sub-lethal concentrations (0.7, 1.1, and 1.9 mg/L) of CPF showed a significant ($p < 0.05$) alterations in enzymatic antioxidants like catalase, superoxide dismutase glutathione peroxidase and non-enzymatic malondialdehyde, further the anticholinesterase potential of CPF was evident in concentration-dependent trend at five days of exposure tenure. It could be therefore emphasized that the CPF poses a potential threat to *D. melanostictus* tadpoles under the selected concentrations and hence it is advised that care should be taken when the toxicant is used and disposed under aquatic proximity. The investigation further serves as the preliminary data in the due course of regulatory surveillance and could be of a greater help in monitoring water with suspected CPF contamination.

INTRODUCTION

Large-scale anthropogenic activities have been associated with the drastic decline of amphibian populations globally (Jones *et al.*, 2009). According to International Union for Conservation of Nature (IUCN) report, 32.5% of total amphibian species have declined in terms of their number, which is far more critical than for birds and mammals (Quaranta *et al.*, 2009). Amphibians, unlike other animals, constitute a unique group among many ecosystems due to their active and multiple roles as, prey, predators, and herbivores (Touchon and Wojdak, 2014). Their contribution to tropic dynamics makes them one of the crucial features in determining the survival ability of other organisms through the food chain (Arribas *et al.*, 2014). Hence their existence at certain population ratio could be accountable for other species continuity as well.

Even though the loss of habitat is considered to be the primary reason for the amphibian decline (Collins and Storfer, 2003), the role of pesticide contamination in freshwater habitats often questions its contribution in survival rate and reproduction of anurans (Knapp *et al.*, 2007). In addition to this, amphibians complete their larval development in an aquatic medium like ponds and lakes to which the pesticidal effluents from agricultural runoffs often find their way (Hayes *et al.*, 2003; Grayson *et al.*, 2011). The rich permeability of skin and egg which often get absorbed, persist and bioaccumulate further explains the vulnerability of tadpoles to environmental xenobiotics (Brühl *et al.*, 2013). A number of factors like morphological deformities compromised reproducing ability, immune-suppression, and reduction in growth and development have indicated the potential risk of pesticide contamination against anurans (Johnson *et al.*, 2007; Groner and Relyea, 2011). The use of integrated biomarker approaches for studying the inter-cascading changes in physiology and biochemistry has become an advanced strategy for reporting the overall health of tadpoles under the toxicological point of view (Boone and Semlitsch, 2001). Amphibian susceptibility to insecticides has been very well acknowledged in the past (Brühl

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