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Toxicity of deltamethrin on total protein of kidney, liver, testis & ovary of air breathing fish *Clarias batrachus* (Linn.)

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Abstract
The present study includes the biochemical, total protein alterations induced by chronic (30 days) exposure of *Clarias batrachus* to a sublethal concentrations (0.015 ppm conc.) of deltamethrin on the profile of total protein in the liver, kidney, testis and ovary. The liver, kidney, testis and ovary showed significant depletion of total protein amounting. The present study therefore points towards a severe metabolic dysfunction in response to deltamethrin toxicity in the fish *Clarias batrachus* (Bloch.).

Keywords: Deltamethrin, *Clarias batrachus*, toxicity, pesticide, biochemical, total protein

Introduction
Deltamethrin belongs to a group of pesticides called synthetic pyrethroids. Pyrethroid insecticides are highly toxic to insects and fish and have generally low toxicity to mammals, forming the basis of their favorable selectivity. Pyrethroid pesticides interact with the γ-amino butyric acid (GABA) receptor – ionophore complex to cause neurotoxicity (IPCS, 1990) [7]. Pyrethroids were introduced as replacement for the persistent nature of the organophosphates and chlorinated pesticides. Deltamethrin is considerably less harmful to the environment and most non-target organisms than other insecticides like DDT, pyrethroids are used to spray inside the houses, to impregnate bednets, which protect populations from malarial mosquito bites. They are three times as expensive as DDT, but used in very low amounts for bed net spraying (Rehman, 2014) [14]. In other hand their consequent development of resistance by pests and their harmful effects on non-target organisms, WWF (World Wildlife Fund) does not recommend pyrethroid as a viable alternative to DDT, also the studies on toxic effects of deltamethrin are very less. So, there is a need to investigate deleterious toxic effects of deltamethrin and other pyrethroids to determine their impact in case of human exposure.
Hence, in this paper efforts have been made to illustrate the effects of pesticide, deltamethrin on biochemical mainly total protein profile of the vital organs of the experimental fish, *Clarias batrachus*, locally known as "Mangur", is a freshwater air breathing fish having the presence of suprabranchial accessory respiratory organs.

Materials and Methods
The air-breathing teleost *Clarias batrachus* procured live from the local fish market were washed with 0.1% $KMnO_4$ solution to remove dermal infection if any. Healthy fish of average length (9–12cm) and weight (21–25 g) were acclimated for 15 days to laboratory conditions. The fish were fed with chopped goat liver every day adlibitum. Running tap water was used in all the experiments and the fish were adjusted to natural photoperiod and ambient temperature. No aeration was done.
Static acute bioassays were performed to determine LC_{50} values of deltamethrin for 24, 48, 72 and 96 hours following the methods of APHA, AWWA & WPCF (1985) [2]. The LC_{50} values for these periods were 1.5 ppm, 0.85 ppm, 0.45 ppm and 0.15 ppm respectively. The sub-lethal concentration was determined following the formula of Hart *et al.* (1945) [5]. Twenty acclimated fish were exposed to a sub-lethal concentration (0.015 ppm) of deltamethrin for 30 days. Side by side same number of fish as that of experimental one was maintained as the control group.

On 30th day at the end of exposure period the fish were anaesthetized with 1:4000 MS 222 (Tricane, methane, sulfonate, sandoz) for two minutes. The liver, kidney, testis and ovary were quickly dissected out, weighed to nearest mg and processed for the quantitative estimation of total protein by the methods of Varley *et al.* (1980) [18].

Results

The protein profiles of liver, kidney, testis and ovary in response to deltamethrin exposure showed a significant decline. The liver and kidney showed statistically more significant decline. The liver and kidney showed statistically more significant (p< 0.001) decline i.e. 31% in , while 30% in liver. The testis showed significant (p< 0.05) while ovary showed significant at (p< 0.01). The testis showed decline 19% while ovary 17%. Total protein in the control liver, kidney, testis and ovary was estimated to be 103.19±1.80, 75.05±1.05, 80.45±1.45, and 120.01±1.80 respectively. As against there, the total protein profiles in the experimental lots were 50.1±1.95, 45.05±0.10, 60.06±0.05 and 70.05±0.05 respectively (Table-I).

Table 1: Profiles of total protein (mg/g wet tissue) in tissue of *Clarias batrachus* chronically exposed to deltamethrin for 30 days. Values are mean ± SE 0f 5 observations

Tissue	Control	Deltamethrin treated
Liver	103.19±1.80	50.1±1.95
Kedney	75.05±1.05	45.05±0.10
Testis	80.45±1.45	60.06±0.05
Ovary	120.01±1.80	70.05±0.05

Value are mean ± SE of 5 observations, Significant level = p<0.05

Discussions

The present investigation was undertaken the alteration of protein profiles of some vital organs i.e. liver, kidney, testis and ovary of *Clarias batrachus* in response to sublethal dose of deltamethrin exposure. The level of tissue protein in control fish recorded in the present study indicates that total proteins are the largest contributors to the wet weight of the tissues after water. Ramalingam and Ramalingam (1982) [12]; Kumar and Ansari (1984) [8]; Tripathy and Singh (2003) [17]; Rita and Milton (2006) [15]; Rani *et al.* (2008) [13]; Pratibha & Kumar, (2013) [11]; Sunita Rani, *et al.* (2015) [16]; Dilip and Vidya (2016) [4], and Mohan, (2017) [9] have observed similar result under the various toxic chemicals exposure of malathion, Nuvan, fenvalerate, endosulfan, Eklaux and heavy metals in various fresh water fishes. The loss of gonadal proteins may also be associated to the direct action of pyrethroids leading to arrest of vitellogenesis in ovary and loss of germ cells in testis (Jha and Jha, 1995; Chow, *et al.* 2013) [6, 3]. The liver of *Clarias gariepinus* exposed to the cypermethrin showed hyperplastic hepatic and necrosis of hepatic cells (Andem *et al.* 2016) [1]. The toxicity was found to increase with pesticide, endosulfan concentration, various structural changes were already induced on the morphology of the vital organs, i.e. gill, liver and kidney even with exposure to low, sublethal endosulfan concentration reported by Nordin, *et al.* (2018) [10] The toxic effects of surfactant, dodecyl dimethyl benzyl ammonium chloride (1227) on larval locomotors of zebrafish was observed by Yanan, *et al.* (2015) [19]. Proteins being involved in the architecture and physiology of the cell seem to occupy a key role in the cell metabolism. The observed significant depletion of tissue protein in the present case denotes high catabolic potency of those organs and may be attributed to the intensive proteolysis and utilization of their degradation products for metabolism under the toxic influence of deltamethrin. It is, therefore, conclude that the toxicity of the pesticide deltamethrin depend upon a number of physical, chemical and biological factors. Each of which may be used as a tool for pesticide toxicity to fish.

Conclusion

The test fish *Clarias batrachus* when exposed to sub lethal concentration of deltamethrin (0.015 ppm) for 30 days, significant decrease in total protein content in the tissue of all four organs, liver, kidney, testis and ovary. The decrease might have occurred mainly due to altered lipid and protein metabolism and energy demand in fishes under stress of toxicants.

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