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ORIGINAL RESEARCH ARTICLE

Toxicity of Malathion on Metabolic Activities in the River Cauvery of Tilapia Fish *(Oreochromis mossambicus)*

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ABSTRACT
Malathion is commonly used insecticide for agricultural and non agricultural purpose in India. The toxic effect of the insecticide malathion on some biochemical characteristics (total protein and carbohydrate in liver, muscle, kidney and gills) of the tilapia fish *(Oreochromis mossambicus*) were estimated. There is decreased in all tissues on comparison with control. The results indicated the toxic nature of the insecticide malathion.

Key words: Insecticides, Malathion, Tilapia fish and River Cauvery.

1. INTRODUCTION
Malathion, a widely used insecticide is known to cause serious metabolic disturbances in non-target species, like fish and fresh - water mussels [12]. With the increasing industrialization human beings are continuously disturbing the delicate ecological balance in aquatic ecosystems. Pesticides are mainly synthetic organic compounds that are deliberately introduced into the environment to control selected organisms. Organophosphorous insecticides are used throughout the world for control of agricultural and domestic insect pests. Organophosphorous insecticides are employed in medicine and industry, because of their relatively low persistence due to biodegradability [13]. Palanichamy *et al.* [6] have reported that the sublethal effects of malathion, thiodon and ekalux on protein, carbohydrate and lipid content of muscles and liver of *Oreochromis mossambicus.* Sakakushi [10] reported liver damage and hepatic necrosis in fish under Malathion stress. In the present study malathion was chosen to evaluate its influence on the metabolic activity in the tissues of the fish *Oreochromis mossambicus* at different times after exposure to malathion.

2. MATERIALS AND METHODS
A commercial formulation of malathion (agrothion 57% EC 500 g l^{-1}) was purchased from a local market in Thanjavur and was used in this study. The main structural characteristics and structural formula of Malathion were presented in (Fig. 1 and Table 1). Fig. 1: Structural formula of Malathion For the present study, Fresh water fish Tilapia (*Oreochromis mossambicus)* were collected from Cauvery river and experiment was conducted in the laboratory at Department of Zoology, Rajah Serfoji Govt.College, Thanjavur during summer 2013. A stock solution of 1000 ppm (mg/ml) malathion was prepared in acetone. Required dilutions of the acetone formulation were made with tap water. Acetone in the quantity used was not toxic to fish. The fishes were acclimated to the laboratory temperature (23±0.5) in large glass aquarium. The fish were fed twice daily with 38% protein commercial fish food. The period of acclimation lasted for 2 weeks. Batches of 10 healthy fishes were exposed to different concentrations of insecticide malathion to calculate the medium lethal concentration LC_{50} value using probit analysis method [1].

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The fishes (Four groups) were exposed to the sub lethal concentration (0.5 ppm) of malathion for 24, 48, 72 and 96 hr respectively.

Table 1: The main structural characteristics of Malathion

Characteristics	Information
CAS Nomenclature	Diethyl[(dimethoxyphosphino – thioyl)thio]butanedioate
Common name	Malathion
Chemical formula	$C_{10}H_{19}O_6PS_2$
Molecular weight	330.36
Color	Colorless liquid Deep brown to yellow
Physical state	Liquid
Melting point	2.9 EC
Boiling point	156–157 EC
Density	at 25 EC 1.23 g/cm3
Solubility: Water at 20 EC	145 mg/L

Another group was maintained as control. At the end of each exposure period, fishes were sacrificed and tissues such as liver, gill, muscle and kidney were dissected and removed. The tissues (10 mg) were homogenized in 80% methanol, centrifuged at 3500 rpm for 15 min. and the clear supernatant was used for the analysis of total proteins and carbohydrates. Total Protein concentration was estimated by the method of Lowry [15]. Total carbohydrate in the tissue was estimated by the method described by Hedge and Horfreiter [3].

3. RESULTS AND DISCUSSION

The changes in the biochemical constituents in the muscles, gills, liver and kidney of the fish *Oreochromis mossambicus* exposed to malathion at different exposure were observed in the present study. Environmental and chemical stress can interfere with physiological and biochemical functions such as growth, development, reproduction and circulatory system in fish. Numerous biochemical indices of stress have been proposed to assess the health of non-target organisms exposed to toxic chemicals in aquatic ecosystem [5]. However, it has been reported that apart from nervous tissue, tissues like blood, liver and gills also contribute information in the detection of toxic symptoms caused by certain groups of pesticides [14].

The changes in biochemical's parameters such as carbohydrates and proteins are important to indicate the susceptibility of organ systems to pollutants by altering their function. Proteins are important organic substances required by organisms in tissue building and play an important role in energy metabolism. Proteins can be expected to be involved in the compensatory mechanism of stressed organisms. The result of the present study showed that when the fish were exposed to malathion (0.5 ppm) the protein content were found to have decreased (TABLE II). Ram and Sathyansen [7] reported reduction in total protein, lipid and elevation in cholesterol and alakaline phosphates content in liver of *Channa punctatus* exposed to mercurial fungicide. Khalaf Allah [4] reported that the decreased level of protein, globulin and serum enzyme activity in vaccinated *Tilapia nilotica* exposed to sub lethal concentration malathion pesticide.

Sahib *et al.* [9] found out elevated level of protein in muscle, gills and liver tissues of fresh water fish *Tilapia mossambica* under malathion exposure. Severe damage was found after 48 and 72 hours of exposure. After a 24 hours of exposure to a 6mg/L malathion showed more severe damage in the gills. The microridged epithelial cells of the gill arch became perforated and the control portion of the filament appeared elevated. Numerous mucous gland openings were visible. After 48 and 72 hours of exposures, the damage of gill and structural changes were more pronounced. When compared with the 4mg/L exposure. Enlarged mucous gland opening were formed on the gill arch.

Dubhat and Bapat [2] observed maximum decrease in protein contents in the liver of *Channa orientalis*. The reduction of protein may be due to proteolysis and increased metabolism under toxicant stress [8]. The results of the present findings showed a significant decrease in carbohydrate content in all the tissues studied (TABLE III). The decrease in carbohydrates contents may result in impairment of carbohydrate metabolism due to toxic effect [11]. Generally, the results indicated the toxic nature of the insecticide malathion. The present decrease was found to be greater in all exposures in liver and muscle tissues.

Most of the pesticides and heavy metals affected fresh water organisms even at very low concentrations. Sometimes the effects of these deleterious chemicals go unnoticed because most of the changes occurring in the body are subtle and can be noticed only when the conditions have become irreparable. The present investigation has thrown light in to biochemical alterations in the vital organs of *Oreochromis mossambicus* brought about by incipient lethal doses of an organophosphorus insecticide, malathion. In concentrations which do not produce immediate death, statistically significant alterations in biochemical factors could be noticed, mainly associated with acclimation to the toxic environment, an in-built adaptation to combat chemical stress with a significant norm of reaction.

Table 2: Showing the protein content (mg/g) in tissues of tilapia fish (*Oreochromis mossambicus*) exposed to 0.5 ppm malathion. Means + SD (N=3)

Exposure	Treatment	Muscles	Gills	Liver	Kidney
24	Control	5.29 ± 0.12	4.74 ± 0.04	6.29 ± 0.05	5.21 ± 0.06
	Malathion	4.62 ± 0.06	3.93 ± 0.17	4.53 ± 0.05	4.17 ± 0.04
48	Control	5.35 ± 0.08	4.27 ± 0.08	6.57 ± 0.14	5.35 ± 0.11
	Malathion	3.13 ± 0.13	2.93 ± 0.05	4.03 ± 0.07	4.43 ± 0.09
72	Control	5.45 ± 0.05	4.61 ± 0.03	6.34 ± 0.08	5.18 ± 0.05
	Malathion	3.12 ± 0.05	2.71 ± 0.06	3.54 ± 0.06	3.91 ± 0.07
96	Control	5.56 ± 0.07	4.41 ± 0.09	6.22 ± 0.06	5.34 ± 0.09
	Malathion	2.56 ± 0.08	2.62 ± 0.03	3.24 ± 0.07	2.26 ± 0.08

Table 3: Showing the Carbohydrates content (mg/g) in tissues of tilapia fish (*Oreochromis mossambicus*) exposed to 0.5 ppm malathion. Means + SD (N=3).

Exposure	Treatment	Muscles	Gills	Liver	Kidney
24	Control	5.21 ± 0.09	5.25 ± 0.02	6.16 ± 0.04	1.84 ± 0.11
	Malathion	3.77 ± 0.14	3.54 ± 0.07	4.59 ± 0.06	1.70 ± 0.10
48	Control	4.22 ± 0.10	4.17 ± 0.01	6.25 ± 0.07	1.68 ± 0.09
	Malathion	3.79 ± 0.05	3.26 ± 0.06	4.15 ± 0.05	0.91 ± 0.01
72	Control	4.49 ± 0.31	4.92 ± 0.01	5.67 ± 0.05	1.17 ± 0.01
	Malathion	2.96 ± 0.02	2.91 ± 0.06	3.85 ± 0.04	0.66 ± 0.01
96	Control	4.85 ± 0.07	4.26 ± 0.05	5.18 ± 0.02	1.15 ± 0.05
	Malathion	2.50 ± 0.06	2.23 ± 0.10	2.59 ± 0.03	0.43 ± 0.00

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REFERENCES

1. Buratti, F.M., Aniello, A.D., Volpe, M., Meneguz, A., and Testai, E., 2005. Malathion Bioactivation in the human Liver: The Contribution of Different Cytochrome P450 Isoforms. *DMD*, 33:295-302.
2. Dubhat, I.N., and Bapat, S.S., 1984. Influence of Ekalux on the organic reserves of Channa orientalis (Ham) Proc. Symp. Assess. Environ. Poll. 129 – 134.
3. Hedge, J.E., and Hofreiter, B.T., 1962. Determination of reducing sugars, Method in carbohydrate chemistry. M. L., Academic Press, New York.
4. Khalaf-Allaha, S.S., 1999. Effect of pesticide water pollution on some heamatological, biochemical and immunological parameters in Tilapia nilotica fish. *Dtsch. Tierarztl. wochencher*, 106(2): 67-71.
5. Nimmi, A. J., 1990. Review of biochemical methods and other indicators to assess fish health in aquatic ecosystem containing toxic chemicals. *J. Great Lakes Res.* 16:529 - 541.
6. Palanichamy, S., Bhaskaran. P., Balasubramaniam, M.P., 1986. Sublethal effect of selected pesticides on protein, carbohydrate and lipid content in different tissues of *Oreochromis mossambicus. Proc.Sym. Pest. Resid. Env. Pollu.* 97 – 102.
7. Ram, N.R., and Sathynesen, A.G., (1987). Histological and biochemical changes in the liver of the teleost fish *Channa punctatus* induced by mercurial fungicide, *Env. Plosot.* 479(2): 135-146.
8. Remia, K.M., Logaswamy, S., Logankumar, K., and Rajmohan, D., 2008. Effect of an insecticide (Monocrotophos) on some biochemical constituents of the fish *Tilipia Mossambica. Poll. Res*. 27(3):523-526.
9. Sahib, K.R., Rao., and Rao, K.V., 1984. Effect pf malathion on protein synthetic potentiality of the tissues of teleost, Tilapia mossambica (peters) as measured through incorporation of (14c) amino acids.
10. Sakakushi, H., 1972: *Bull. Tap. Soc.Sci.Fish*., 38: 555.
11. Thenmozhi, C., Vignesh, V., Thirumurugan, R., and Arun, S., 2010. Impacts of malathion on mortality and biochemical changes of freshwater fish *labeo rohita. Iran. J. Environ. Health. Sci. Eng.* 8(4):189-198.
12. U. S.E. Protection Agency, 1972. *The use of pesticides in suburban homes and gardens and their impact on the aquatic environment*, Pesticide Study Series, No. 2, Washington, D.C.

13. Uzun, F.G., Kalender, S., Durak, D., Demir, F., and Kalender, Y., 2009. Malathion induced testicular toxicity in male rats and the protective effect of vitamins C and E. *Food Chem. Toxicol*. 47:1903–1908.
14. Venkataramana, G. V., Sandhya Rani, P. N., and Murthy, P. S., 2006. Impact of malathion on the biochemical parameters of gobiid fish, *Glossogobius giuris* (Ham). *J. Environ. Biol*., 27(1):119-122.
15. Wauchope, R.D., Butler, T. M., Hornsby, A. G., Augustin-Beckers, P. M., and Burt, J. P., 1992. The SCS/ARS/CES pesticide properties database for environmental decision making. *Environ. Contam. Toxicol*. 123:1-155.