

Acute toxicity of Malathion pesticides to fresh water fish *Labeo rohita* (HAM)

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Abstract

Toxicity effects of pesticide is an important threat to the aquatic environment and its organisms. In the present analysis the acute toxicity of malathion to *Labeo rohita* were established based on the method of Finney, 1971. Lethal concentration (LC₅₀) for which was 9.0µ/L. One tenth of the LC₅₀ value (0.9µ/L) was taken for the sublethal studies according to Sprague (1973). A descending value of lethal concentration (LC₅₀) has been found. The fish showed ungraceful behaviour such as erratic and jerky swimming, attempt to jump out of the water, recurrent surfacing and gulping of air, decreases in opercular movement and copious secretion of mucus all over the body. This surveillance can be considered to monitor the quality of aquatic ecosystems and severity of pollution.

Keywords: toxicity, malathion, *Labeo rohita* and LC₅₀

Introduction

The environment is plagued with different kinds of pollutants. Insecticides are one of such pollutants which play an important role in controlling different types of insects that cause damage to the crop plants. Indiscriminate use of insecticides on crops causes serious environmental hazards affecting aquatic and land dwelling animals. Unfortunately, most of the insecticides are not biodegradable and tend to persist for years together in soil and water. There are many reports available related to toxicity of insecticides on different fish species (Sharma, 1991, Shivaji and Mangaise, 1967, Wildish, 1971) [18, 19, 23]. Acute toxicity caused by different toxicant on freshwater fish can be evaluated by quantitative parameters like survival and mortality of test animals and sensitivity of different fish species against metal toxicity. Toxicity in fish is the culmination of a series of events involving various physical, chemical and biological processes. LC₅₀ is indicator to the level of resistance of population response to metals (Reda, *et al.*, 2010) [14]

Malathion is a wide spectrum aliphatic organophosphate insecticide widely used for both domestic and commercial agricultural purposes. Phosphamidon and monocrotophos are the commonly used organophosphates in the paddy fields of Tamil Nadu. The indiscriminate uses of these pesticides in the paddy fields ultimately pollute the aquatic environment, affecting aquatic fauna. Studies on the effect of phosphamidon on the cultivable species of carps in the paddy fields have already been done by many scientists. But studies on the effect of monocrotophos on these fishes are meager. Here, an attempt is made to study the lethal toxicity of monocrotophos in the juveniles of *Labeo rohita* (Ham). As these fishes are suitable for toxicity monitoring (Asharaf *et al.*, 1992; Nair and Sherief, 1998) [1, 11].

L. rohita is a prime cultured and important staple freshwater fish generally found in rivers, ponds and reservoirs (Dube and Hosetti, 2010) [5] and popular in Thailand, Bangladesh,

Northern India and Pakistan (Rainer *et al.*, 2005) [16]. The present study is to determine the lethal concentration (LC₅₀) of malathion at 96 hours and the behavioural alterations due to action of malathion compounds on air breathing fish *L. rohita* (Ham).

Materials and Methods

L. rohita (2.87±0.04g) was collected from the Sabari Fish Farm, Vellanguli, Tirunelveli, Tamil Nadu, India. They were acclimated to the laboratory conditions for 3 weeks, during which they were fed with 35% protein diet. The fish were starved one day prior to the experiment and throughout the bioassay test. After acclimation, healthy fish of *L. rohita* were separated from the stock. An acute toxicity (LC₅₀) test by static renewal bioassay method was conducted to determine the toxicity of malathion in fresh water fish, *L. rohita* which were exposed to 9.0 concentration of malathion for 96hr and the pesticide was procured from the Padma shop, Thoothukudi, Tamil Nadu, India. The required quantity of malathion was drawn directly from this concentration using a micropipette. After 96hr of exposure the data obtained was subjected to finny's probit analysis method (Finny, 1971) to determine LC₅₀ value. The concentration at 50% survival/mortality occurred in malathion treated fishes was taken as the median lethal concentration (LC₅₀) for 96hr. Which was 9.0µ/L. One tenth of the LC₅₀ value (0.9µ/L) was taken for the sublethal studies according to Sprague (1973) [21]. The experimental fish groups (2.83 ± 0.04 g) were separately exposed to 0.9µ/L (ppm) in plastic troughs containing 10 l of test media and mortality was recorded for 96 hr. *L. rohita* groups were exposed to 0.9µ/L a control was also maintained simultaneously. Experiment was conducted in the water temperature of 27 + 1^o C, DO of 4.2 ml O₂ l⁻¹ and pH of 7.7. A static renewable bioassay method was adopted to determine the 96 hr. LC₅₀ (Sprague, 1973) [21] and juveniles were not fed during the bioassay test. The test media were changed daily at

0800 hr. to maintain the constant toxic concentrations during the bioassay test. The 96 hr. LC₅₀, its 95% confidence limits and the slope function were determined following the method of Finney, (1971)^[6]. The behavioral changes of *L. rohita* were observed in lethal concentrations of malathion during the bioassay test.

Results and Discussion

The behavioural changes of *L. rohita* were found to be different when they exposed to toxic concentrations of malathion. At lethal concentrations (9.0µl/L) (table 1), they tried to avoid the toxicant (Malathion) by irregular erratic swimming, jerky movement, rapid opercular movements, restlessness, frequent surfacing, gulping of air, upside down surface movement and extension of fins. An important local effect was the abundant discharge of mucus at the gills and on the skin. Suffocation of fish exposed to malathion was discernible in the form of air bubbles on the water surface when the fish had been directed towards the water surface. Finally they lost their equilibrium and settled at the bottom dead. The dead animals showed blood clots on the widely opened mouth and gills of *L. rohita*. Sahib, *et al.* (1984)^[17] found out sub lethal concentration of malathion inhibiting acetyl cholinesterase activity of brain, muscle, gill and liver tissues of the fish, *Tilapia mossambica*. The liver is the largest gland of the body connected with several function. It has no direct contact with the environmental pollutants dissolved in water but due to its contact with blood, it's indirectly affected. The malathion and dieldrin enhances the activation of aromatic amines in liver of fish *Sparusaurata* exposed to different environmental pollutants (Rodroquez-Ariza, *et al.*, 1995)^[15].

Pugazhvendan *et al.*, (2009)^[13] reported that the control fish behaved in natural manner i.e. they were active with their well coordinated movements. They were alert at the slightest

disturbance, but in the toxic environment, fish exhibited irregular, erratic and darting swimming movements and loss of equilibrium which is due to inhibition of AChE activity leading to accumulation of acetylcholine in cholinergic synapses ending up with hyperstimulation by Mushigeri, *et al.*, (2005)^[9]. It is evident of my work from the results that the malathion can be rated as moderately toxic to fish. Maruthanayagam *et al.*, 2002^[7] told that the behavioural alterations like erratic swimming, restlessness and surfacing may be an avoiding reaction to the heavy metal narcotic effects or to change in sensitivity of chemo-receptors. The reduction of opercular movement and lethargic movements with frequent surfacing were noticed in for fresh water fish species viz., *Catlacatla*, *Labeobata*, *Cyprinus carpio* and *Oreochromis mossambicus* exposed to different concentrations of ammonia Bhakta (2006)^[4].

The 96 hr LC₅₀ value of Malathion toxicity of *L. rohita* were 9.0µl/L respectively. No mortality was observed below the malathion concentration of 7.5 mg l⁻¹ in *L. rohita*. However, the concentrations of 9.0 µl/L and above were observed to be toxic (Table 6.1). The 95% confidence limits were 1.92mg l⁻¹ (lower limit) and 1.96 mg l⁻¹ (upper limit) mg l⁻¹ in *L. rohita* (Table 6.1). The slope function calculated of test animal was 9.0 µl/L respectively. A positive correlation co-efficient was obtained for the relationship between the malathion concentrations and percent mortality and it was statistically significant (r = 0.9878; P < 0.01) for *L. rohita* exposed to toxic levels of malathion (Fig 1). Walia *et al.*, 2013 reported that the lethal concentration of 96h value of tannery industry effluent was reported as 28.32 ppm for *L. rohita*. The lethal concentration (LC₅₀) 98h value of Rimon was reported as 3.322 ppm for *L. rohita* by Nagaraju *et al.*, (2011)^[12] and Lethal concentration of 96h (LC₅₀) value of chromium was reported as 3.5 ppm for *L. rohita* (Muthukumaravel and Rajaraman, 2013)^[10].

Table 1: Effect of malathion concentrations on percent mortality in *Labeo rohita* exposed µl/L for 96 hr. Lethal concentration, slope function and 95% confidence limits are expressed in.

Concentration of Malathion	Dead/tested	Mortality (%)	Lethal Concentration(µl/L)			Slope function(S)	95% Confidence limit	
			16%	50%	84%		Lower	Upper
7.5	1/10	10						
8.0	2/10	20						
8.5	3/10	30						
9.0	5/10	50	7.8	9.0	9.8	1.12	1.92	1.96
9.5	7/10	70						
10.0	10/10	100						

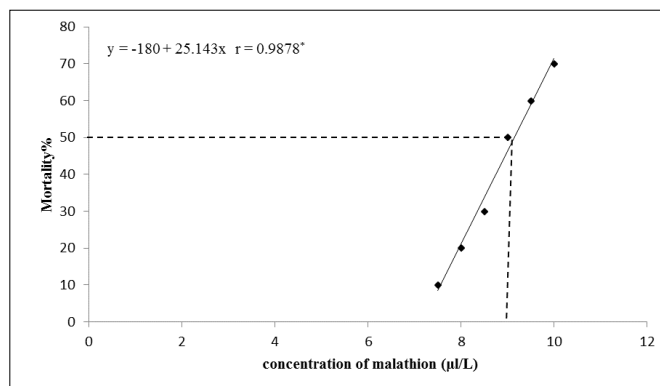


Fig 1: Effect of malathion concentration on mortality(%) in *Labeo rohita* exposed for 96 hr. *P<0.01.

The present chapter concludes that, the 96 hr LC₅₀ value of malathion of *L. rohita* were 9.0 µl/L respectively. The high 'b' value in fish indicates that the toxic impact of malathion in *L. rohita*. The toxicity reported by other studies differs from this study probably due to different species used, age, size of the organisms, test methods and water quality such as water hardness, as this can affect toxicity (McCahon and Pascoe, 1988) of metal may vary depending upon their permeability and detoxification mechanisms (Darmona *et al.*, 1990). The magnitude of toxic effects of pesticides also depends on length and weight, corporal surface to body weight ration and breathing rate. (Singh and Narain, 1982; Alkahem *et al.*, 1998)^[3]. However, *Ipomoea aquatica* diets improved the food utilization parameters in Malathion exposed fish because

I.aquatica is one of the medicinal plant told that previous report.

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