Annals of Natural Sciences
Vol. 2(4), December 2016: 11-16
Journal's URL: http://www.crsdindia.com/ans.html
Email: crsdindia@gmail.com

e-ISSN: 2455-667X
Annals of Natural Sciences

ORIGINAL ARTICLE

Toxicity Studies in Three Indian Major Carps under Stress of Parathion

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ABSTRACT

Parathion is the important pesticide used in Indian conditions. This pesticide in turn through rain wash goes to water ecosystem and affects aquatic fauna specially fishes. Indian carps are major source of food in most of the population. It is necessary to study the toxicity standards and bioassay in Indian major carps under stress of parathion.

Key words: *Toxicity, Parathion, pesticide*

Received: 11th July, 2016, Revised: 30th August. 2016, Accepted: 5th September 2016

How to cite this article:
Pathak L., Saxena R.S. and Sharma H.N. (2016): Toxicity Studies in Three Indian Major Carps under Stress of Parathion. Annals of Natural Sciences, Vol. 2[4]: December, 2016: 11-16.

INTRODUCTION

Our surroundings have always affected our lives by every way. We need air, water, food etc. For survival and good health but the modern era of industrialization produces various contaminants in our surroundings and add them to air, water and food products

They harm us at every level viz. physiological, anatomical, biochemical, haematological and psychological. The fact is true for every living organism on the earth either it is human, quadrate animals, birds or even fishes. Fishes are the most sensitive among them all as all the contaminants are going on in water from air and land and contaminate water bodies. This affects life of aquatic fauna and ultimately the human life as most of the world's population depends on aquatic food and they feed contaminated fish food which are not only less nutritious and beneficial but harmful to us, to cause disease and various disorders in our body. How the effect has been assessed? The only way is to assess the effect of most important contaminants on fishes of different species. Organophosphates are the most common pesticides used in agriculture and they run off in water bodies during rain. They are simultaneously accumulated in fish body and damage their vital systems.

The most common fishes from Indian point of view are *Catlacatla*, *Cirrhinusmrigala*and *Labeorohita* which are mainly linked to food industry. All these points indicate a sharp study about the vital systems such as toxicity evaluation in these fishes showing the effects of organophosphates of which parathion in the present study to show the activity of these harmful pesticides.

METHODOLOGY

In order to estimate the LC_{50} value, the fishes of different experimental sets have been treated with different concentrations of test compounds as per given in Tables. The mortality number of fishes at different time intervals i.e. 24 hrs, 48 hrs, 72 hrs and 96 hrs and percentage mortality for 96 hrs (Table-1-9, Fig. 1-3) have been calculated which was used as final mortality for calculation as per international standards for fishes. The mortality number showed a corresponding increase with the increasing concentrations of the test compounds.

LC_{50} values have been calculated by the log dose/probit regression line method (Finney, 1971). The test doses have been converted to their logarithms for ease of calculation. Empirical probit values corresponding to the percentage mortality have been obtained from standard table (Finney, 1971) and tabulated in the appropriate columns of the respective tables. The empirical probit values have thereafter been plotted against log dose on the graph paper and a provisional line filling the points is drawn. From this line, expected probit values 'Y' are noted for the values of log dose 'X'. The working probit 'y' have been calculated using the following formula:

$$y = y_0 + kp$$

Where y_0 and k are noted from the table for the expected probit Y and p is the percentage mortality.

The weighing coefficient 'n' for each point is also noted from the table (Finney 1971). Each weighing coefficient is multiplied by the number of fishes used and the products have been taken as 'w'. After this, for each row the products of wx, wy, wxy, wx^2, wy^2 have been calculated and summed up as $\sum wx$, $\sum wy$, $\sum wxy$, $\sum wx^2$, $\sum wy^2$ respectively and finally the mean have been calculated by the following formula:

$$\bar{X} = \Sigma wx / \Sigma w$$

$$\bar{Y} = \Sigma wy / \Sigma w$$

The value of 'b' has been calculated by the following formula:

$$b = (\Sigma wxy - \bar{X}\, \Sigma wy) / (\Sigma wx^2 - \bar{X}\, \Sigma wx)$$

Regressionequation-

$$Y = \bar{Y} + b\,(x - \bar{X})$$

Values of 'Y' corresponding to the original values of 'X' have been calculated and the regression line is drawn.

The variance has been calculated by the following formula:

$$\text{Variance (V)} = \frac{1}{b^2}\left(\frac{1}{\Sigma w} + \frac{(X - \bar{X})^2}{\Sigma wx^2 - \frac{(\Sigma wx)^2}{\Sigma w}}\right)$$

The fiducial limits with 95% confidence have been obtained by the following formula:

$$m_1 = m + 1.96\ V$$
$$m_2 = m - 1.96\ V$$

RESULTS AND DISCUSSION

The LC_{50} value for *Catlacatla*, *Cirrhinusmrigala*and *Labeorohita* were 0.35ppm, 0.46ppm, 0.53ppm for parathion. The sub-lethal concentrations for *Catlacatla*, *Cirrhinusmrigala*and *Labeorohita* were 0.03ppm, 0.04ppm, 0.05ppm for parathion for further studies.

Lethal concentration for 50% mortality is defined as LC_{50} value for a particular species against a particular pesticide. This can be calculated by using different doses against the organism and tested for mortality. Then after a massive statistical calculation, the final LC_{50} value has been estimated which is lethal upto 50% mortality of organism. Then the sub-lethal concentrations are decided by dividing with 10 to minimize the risk of mortality. At last three consecutive concentrations were selected to observe the effect on haematology of the experimental fishes. The LC_{50} value for *Catlacatla*, *Cirrhinusmrigala*and *Labeorohita* was 0.35ppm, 0.46ppm, 0.53ppm for parathion. This reflects that *Catlacatla* is most sensitive amongst all them.

The LC_{50} values differ from genus to genus and species to species for the same or different pesticides because of different mode of action and physiology of organism. Environmental factors may also affect the LC_{50} value. Many studies have been done in this regard as Raizada and Rana (1998) reported an LC_{50} value of 0.86 mg/L to be highly toxic at 96hrs exposure of *Clariasbatrachus* (Linn.) to malachite green. Subramanian, *et al*. (2007) studied the toxic effect of heavy metal; chromium on *Clariasbatrachus* (Linn.) and reported an LC_{50} value of 2.3401 mg/L at 96hrs exposure to be highly toxic. Venkatesan and Subramanian (2007) observed an LC_{50} value of 0.253 mg/L at 96hrs exposure of *Oreochromismossambicus* (Peters) to copper sulphate. The LC_{50} value in the present study is temperature regulated and also depends on water parameters.

Table 1: Mortality rate of Catlacatla after treatment with parathion at different time intervals

S.No.	Concentration (in ppm)	No. of fishes	Mortality number after exposure of			
			24hrs	48hrs	72hrs	96hrs
1	0.20	10	0	0	0	0
2	0.30	10	1	1	3	4
3	0.40	10	1	2	4	5
4	0.50	10	1	3	6	7
5	0.60	10	3	7	9	10

Table 2: Survival number and percentage mortality of Catlacatla after 96 hours of treatment with parathion

S.No.	Concentration (ppm)	No. of fishes	Exposure time (hrs)	Mortality number	Percentage mortality	Survival number
1	0.20	10	96	0	0	10
2	0.30	10	96	4	40	6
3	0.40	10	96	5	50	5
4	0.50	10	96	7	70	3
5	0.60	10	96	10	100	0

Table 3: Toxicity evaluation of parathion to *Catlacatla*specifying fiducial limits

Experimental animal	Compound	Regression equation	LC_{50} (ppm)	Variance	Fiducial limits
Catlacatla	Parathion	Y = 5.38+5.62 (X-0.62)	0.35	0.001	m_1 = (+) 0.5549 m_2 = (-) 0.5510

Table 4: Mortality rate of *Cirrhinusmrigala* after treatment with parathion at different time intervals

S.No.	Concentration (ppm)	No. of fishes	Mortality number after exposure time of			
			24hrs	48hrs	72hrs	96hrs
1	0.30	10	0	0	0	0
2	0.40	10	0	1	2	3
3	0.50	10	1	2	3	5
4	0.60	10	1	2	5	7
5	0.70	10	2	4	7	10

Table 5: Survival number and percentage mortality of *Cirrhinusmrigala* after 96 hours of treatment with parathion

S.No.	Concentration (ppm)	No. of fishes	Exposure time (hrs)	Mortality number	Percentage mortality	Survival number
1	0.30	10	96	0	0	10
2	0.40	10	96	3	30	7
3	0.50	10	96	5	50	5
4	.60	10	96	8	80	2
5	0.70	10	96	10	100	0

Table 6: Toxicity evaluation of parathion to *Cirrhinusmrigala*specifying fiducial limits

Experimental animal	Compound	Regression equation	LC_{50} (ppm)	Variance	Fiducial limits
Cirrhinusmrigala	Parathion	Y = 5.38+9.24 (X-0.71)	0.46	0.0005	m_1 = (+) 0.67098 m_2 = (-) 0.66902

Table 7: Mortality of *Labeorohita* at different time intervals after treatment with different concentrations of parathion

S.No.	Concentration (ppm)	No. of fishes	Mortality number after exposure time of			
			24hrs	48hrs	72hrs	96hrs
1	0.40	10	0	0	0	0
2	0.50	10	0	1	2	4
3	0.60	10	1	2	3	6
4	0.70	10	2	3	5	8
5	0.80	10	2	5	8	10

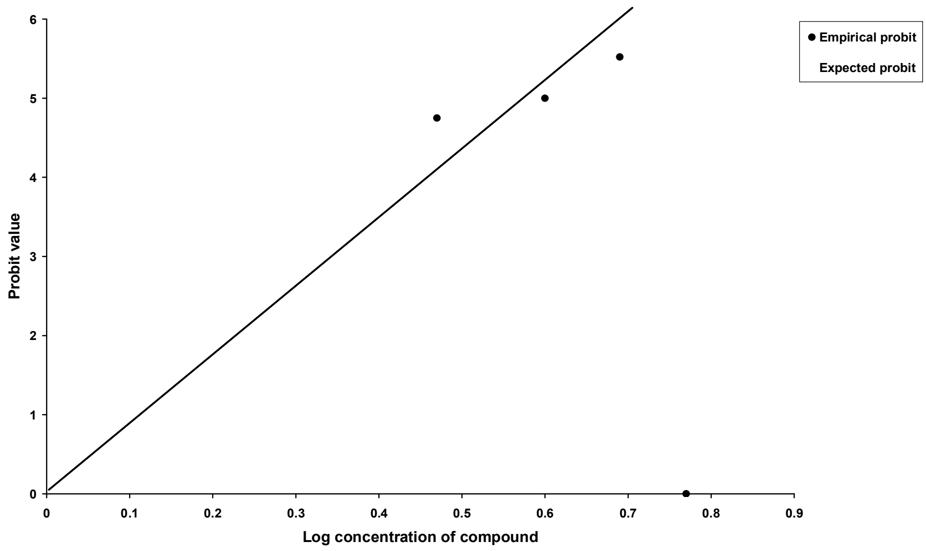
Table 8: Survival number and percentage mortality of *Labeorohita* after 96 hours of treatment with parathion

S.No.	Concentration (ppm)	No. of fishes	Exposure time (hrs)	Mortality number	Percentage mortality	Survival number
1	0.40	10	96	0	0	10
2	0.50	10	96	4	40	6
3	0.60	10	96	6	60	4
4	0.70	10	96	8	80	2
5	0.80	10	96	10	100	0

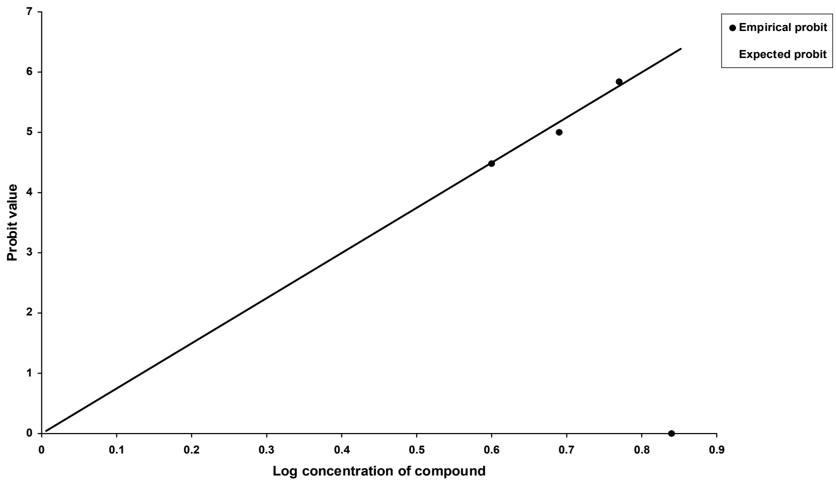
Table 9: Toxicity evaluation of parathion to *Labeorohita* specifying fiducial limits

Experimental animal	Compound	Regression equation	LC_{50}(ppm)	Variance	Fiducial limits
Labeorohita	Parathion	Y = 5.52+8.75 (X-0.78)	0.53	0.0006	m_1 = (+) 0.72117 m_2 = (-) 0.71882

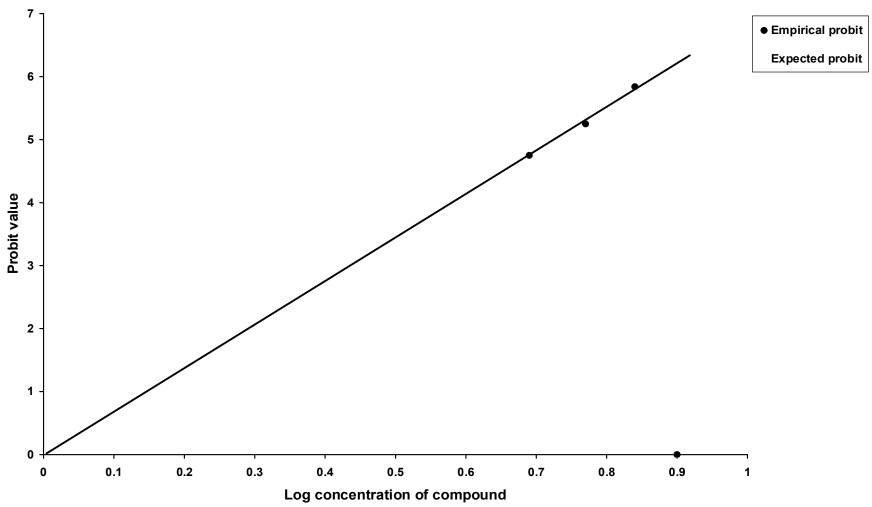
Graph 1: Regression line for LC_{50} of parathion for *Catlacatla*



Graph 2: Regression line for LC_{50} of parathion for *Cirrhinusmrigala*



Graph 3: Regression line for LC_{50} of parathion for *Labeorohita*



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