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The toxicity effect of LAMDA cyhalothrin on *Channa punctatus*

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Abstract
Insecticidal use in agriculture gained momentum around the mid-twentieth century. Fungicides are also used in agriculture for the prevention of fungal infection in seed grain. Later these compounds discharge in nearby water bodies and consumed by fishes and other aquatic life. These fat-soluble contaminants concentrate in the adipose tissue of fishes by bioaccumulation and biomagnification. The present study helps in assessment of toxicity of lambda-cyhalothrin, a pyrethroid to fishes Channa punctatus. The effect of exposure to sub lethal concentrations of Lamda-cyhalothrin (0.011, 0.016 and 0.020 mg/ kg) on biochemical contents in liver and muscles of *Channa punctatu*s was studied up to 35 days at an interval of 5 days. The exposed fish exhibited significant changes in biochemical contents. During exposure period total lipids in both the tissues were decreased up to 5 days but after 5 days these contents were slightly recovered during next 25 days. Protein concentration in the liver and muscles of fish was also decreased. The changes were dependent on period of exposure and concentration of lamda cyhalothrin.

Keywords: toxicity, LAMDA, *Channa punctatus*

Introduction
The freshwater is polluted due to the entry of excess sewage water, industrial effluents and large number of pesticides in natural and agricultural pest. Lambda-cyhalothrin is an important pyrethroid pesticide indiscriminately used in India. Lambda cyhalothrin is used in agriculture to control a range of insect pest in horticulture and agriculture crops. Fisheries provide an important source of food, employment, income and recreation for people throughout the world. Heteropneustes fossilis and Channa punctatus are selected for study purpose because they are hardy and freshwater fishes so it is easily handling, rearing and adapted to the laboratory environment. Fish is an important bio indicator species can play an important role in the aquatic environment. The fishes, best indicator of water body pollution, are the most sensitive of all the aquatic animals towards the pollutant. The accumulation of effluents becomes hazardous to the aquatic organism because they are the most important factors of food chain. Fish and other aquatic species has been victim of pesticide poisoning.
Keeping these views in front, this study is designed to assess the extent of toxicity of lambda-cyhalothrin to Heteropneustes fossilis and Channa punctatus in laboratory conditions.
Lamda Cyhalothrin belongs to a class of synthetic pyrethroids which are well known for their insecticidal activity and are being used worldwide for the last 40 years. Several workers have also reported their effect on non target organisms including fish (Khan, 1983; Bradbury and Coats, 1989; Jeelani and Shaffi, 1989; Saxena and Seth, 2002) [6, 1, 5]. Saxena and Gupta (2003) [12] have reported these compounds to be highly toxic to *Channa punctatus* and observed behavioral and haematological changes in this fish. It is also reported to cause biochemical changes in various fishes (David and Somasunderam, 1985) [2]. The present investigations were carried out to obtain further information about disturbances in protein and lipid metabolism in *Channa punctatus* due to exposure to Lamda-cyhalothrin.

Materials and Methods
In order to estimate the LC_{50} value, the fishes of different experimental sets have been treated with different concentrations of test compound as 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 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. 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 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. 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 have been calculated and summed up as $\sum wx$, $\sum wy$, $\sum wxy$, $\sum wx^2$, $\sum wy^2$ respectively.

Results

The LC_{50} value for Heteropneustes fossilis and Channa punctatus were calculated as 8.32 and 6.88µg/l respectively using lambda-cyhalothrin as toxicant 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 up to 50% mortality of organism. Then the sub lethal concentrations are decided by dividing with 10 to minimize the risk of mortality for further studies if any. LC_{50}value for Channa punctatus were calculated as 6.88µg/l.
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) [11] reported an LC_{50} value of 0.86mg/L to be highly toxic at 96 hrs exposure of *Clarias batrachus* (Linn.) to malachite green. Subramanian *et al*., (2007) [15] studied the toxic effect of heavy metal; chromium on *Clarias batrachus* (Linn.) and reported an LC_{50} value of 2.3401mg/L at 96 hrs exposure to be highly toxic. Venkatesan and Subramanian (2007) [16] observed an LC_{50} value of 0.253mg/L at 96 hrs exposure of Oreochromis mossambicus (Peters) to copper sulphate. The LC_{50} value in the present study is temperature regulated and also depends on water parameters. The concentrations 0.030 and 0.040 mg/kg were found lethal for *Channa punctatus* as mortality was observed within 5 days. At 0.02 mg/kg or below mortality was not observed even after 30 days of exposure. However, fish exhibited erratic movements due to the toxic effect of Lamda -cyhalothrin.
Total lipids in control group fishes were 203.33 µg g^{-1} in liver and 218.66 µg g^{-1} in muscles. In first 5 days of exposure total lipids were significantly ($p<0.05$) decreased in both the tissues. In liver this decrease was 59.27% and in muscles this decrease was 44.92% in comparison to their control values when the fishes were exposed to 0.02 mg/kg Lamda -cyhalothrin. After 5 days total lipids gradually recovered up to 30 days and after 30 days this reduction remained 21.60 and 18.20%, respectively at 0.02 mg/kg Lamda-cyhalothrin.

Discussion

The Lamda cyhalothrin is separated to be highly toxic to fishes because it is strongly absorbed by the gills even at very low concentration in water due to its high lipophilicity. This compound is also reported to cause biochemical and haematological changes in fishes (Krishnappa *et al*., 2000) [7].
The Changes in total lipids in fish have been reported (Ramos and Herrera, 1996) [10] due to exposure to various insecticides. In the present studies total lipids in muscles and liver of *Channa punctatus* were decreased due to exposure to Lamda -cyhalothrin. It can be correlated with the changes in the lipid digesting enzymes like lipase. Since lipids constitute very rich energy reserve, its decrease indicates the changes in energy demands of fish during exposure to Lamda -cyhalothrin.
Depletion of tissue protein in fishes exposed to toxicants has been reported by several workers (Dubale and Awasthi, 1984; Saxena and Gupta, 2003) [3, 12]. Studies carried out by Ramalingam and Ramalingam (1982) [9] suggested that the pesticide stress influences the conversion of tissue protein into soluble fraction reaching in the blood for utilization. The reduction in proteins may be due to increased energy demand during stress or it could be due to altered enzymatic activities (Lett *et al*., 1976) [8]. The depletion in protein contents in the present investigations is parallel with the findings of previous workers. In long term exposure to Lamda -cyhalothrin much of the energy must have been used up to compensate the stress, hence the depletion in the protein content is observed.

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