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Effect of λ -cyhalothrin on the Activities of Trypsin and Lipase in Fresh Water Fish *Channa punctatus*

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Abstract: The effect of λ cyhalothrin toxicity was studied on the activities of trypsin and lipase in *Channa punctatus*. The fish was exposed to sublethal concentrations (0.010, 0.015, 0.020 ppm) of λ cyhalothrin for 30 days. During exposure period the activities of these two enzymes were recorded in liver and muscles of fish up to 30 days at an interval of 5 days. The results obtained indicate that exposure to λ -cyhalothrin decreased the activities of these enzymes in treated fishes in comparison to control fishes. The effect of λ cyhalothrin on *Channa punctatus* was dependent on period of exposure and concentration of λ cyhalothrin.

Key words: - λ -Cyhalothrin, fish, muscle, liver, trypsin, lipase

INTRODUCTION

Pyrethroids are widely used to combat a wide range of pests of agriculture (Elliot *et al.*, 1978), public health (Hirano, 1989) and animal health importance (Gupta and Bhaumi, 1988) because of their excellent insecticidal activity, rapid decomposition in soil (Agnihotro, 1988) low mammalian toxicity (Bradbury and Coats, 1989) and non persistence in environment (Sirohi and Saxena, 2006). These pesticides are maintaining very high position in the market. The toxicological studies of these pesticides upon aquatic organisms are very important from the view point of environmental consequences.

Pyrethroids are reported (Banik *et al.*, 1986; Saxena and Seth, 2002; Das and Mukerjee, 2003; Saxena and Gupta, 2003) to produce toxic effect on the biochemical and hematological parameters of various terrestrial and aquatic animals.

The persistence of these pyrethroids in aquatic environment is dangerous for the blood physiology, metabolism and survival of fish because gills and skin of fish directly absorb these compounds from surrounding water.

In the present studies an attempt has been made to study the effect of λ -cyhalothrin on digestive enzymes in *Channa punctatus*.

MATERIALS AND METHODS

The fresh water fish *Channa punctatus* were collected from the local water bodies. They were maintained in glass aquaria and acclimated to laboratory conditions for 10 days in untreated soft well water. After acclimation fish were divided into experimental and control groups. Experimental groups were exposed to different concentrations (0.010, 0.015, 0.020 ppm) of λ -Cyhalothrin for 30 days. During this period fish were sacrificed after 5, 10, 15, 20, 25 and 30 days for the study of biochemical changes. Liver and muscles of fish were collected, weighed and homogenized in glass homogenizer using distilled water and centrifuged in Zantetzi k-24 refrigerated centrifuge. The supernatants were taken for measuring the activity of trypsin and lipase in both the tissue.

The activities of trypsin and lipase were measured by methods given in Bergmeyer (1971). The experiment was repeated at least 3 times and standard and mean error was calculated. The t-test described by Fisher (1950) was employed to test the significance between control and experimental values.

RESULTS

Results obtained in present studies indicate significant impact of λ -cyhalothrin on the activities of both lipase and trypsin. 0.030 and 0.040 ppm λ -cyhalothrin was found to be lethal for *Channa punctatus* as mortality was observed within 5 days of exposure.

In control group fishes the activity of lipase in liver was 0.5 unit/mL at the beginning of exposure period (Table 1). This activity was enhanced upto 15 days and then reduced upto 30 days. Exposure to λ -cyhalothrin caused alterations in the activity of this enzymes. The activity was enhanced by 147.34% by 0.010 ppm after 10 days exposure. After 10 days fluctuations were recorded upto the end of exposure period. In liver of *Channa punctatus* the activity of lipase was 0.8 unit/mL at the beginning of the experiment (Table 2). This activity was decreased significantly ($p < 0.05$) due to exposure to λ -cyhalothrin. Maximum decrease in activity was recorded as 83.33% when fish were exposed to 0.020 ppm for 5 days.

Table 1: Effect of λ -Cyhalothrin on Lipase (unit/mL) in liver of *Channa punctatus*

Day \ Conc. (ppm)	Liver			
	Control	0.010	0.015	0.020
0	0.5 $\pm$ 0.084a			
5	0.4 $\pm$ 0.094	0.9 $\pm$ 0.033 (125)	0.7 $\pm$ 0.0979 (75)	0.166 $\pm$ 0.5445 (58.5)
10	0.5 $\pm$ 0.098	1.4 $\pm$ 0.047 (147.347)	0.8 $\pm$ 0.11 (41.34)	0.33 $\pm$ 0.027 (41.69)
15	0.7 $\pm$ 0.081	0.5 $\pm$ 0.047 (28.57)	1.5 $\pm$ 0.0471 (114.28)	0.66 $\pm$ 0.0816 (5.71)
20	0.6 $\pm$ 0.11	0.3 $\pm$ 0.105 (16.66)	0.9 $\pm$ 0.12 (66.67)	0.30 $\pm$ 0.00 (50)
25	0.6 $\pm$ 0.10	0.5 $\pm$ 0.048 (16.66)	1.0 $\pm$ 0.0471 (66.67)	0.3 $\pm$ 0.00 (50)
30	0.3 $\pm$ 0.074	0.367 $\pm$ 0.11 (22.22)	0.5 $\pm$ 0.0169 (66.66)	0.166 $\pm$ 0.0272 (44.66)

a = Mean $\pm$ SE (n>3), Values in parentheses represent % changes from control value

Table 2: Effect of λ -Cyhalothrin on Lipase in muscle (unit/mL) of *Channa punctatus*

Day \ Conc. (ppm)	Muscles			
	Control	0.010	0.015	0.020
0	0.8 $\pm$ 0.79 ^a			
5	0.6 $\pm$ 0.49	0.5 $\pm$ 0.0471 (16.66)	0.8 $\pm$ 0.15 (33.33)	1.1 $\pm$ 0.0816 (83.33)
10	0.7 $\pm$ 0.25	0.2 $\pm$ 0.0471 (71.42)	0.9 $\pm$ 0.033 (28.57)	0.5 $\pm$ 0.0471 (28.57)
15	0.8 $\pm$ 0.0745	0.366 $\pm$ 0.0269 (54.25)	0.9 $\pm$ 0.074 (12.5)	0.5 $\pm$ 0.0471 (37.5)
20	0.9 $\pm$ 0.047	0.566 $\pm$ 0.0980 (37.11)	0.5 $\pm$ 0.0471 (44.45)	0.36 $\pm$ 0.11 (60)
25	0.8 $\pm$ 0.0745	0.7 $\pm$ 0.124 (12.5)	0.6 $\pm$ 0.149 (25)	0.26 $\pm$ 0.0942 (67.5)
30	0.6 $\pm$ 0.10	0.5 $\pm$ 0.066 (16.6)	0.33 $\pm$ 0.0745 (45)	0.2 $\pm$ 0.471 (66.66)

a = Mean $\pm$ SE (n>3), Values in parentheses represent % changes from control values

Table 3: Effect of λ -Cyhalothrin on Trypsin (mg mL^{-1}) in liver of *Channa punctatus*

Conc. (ppm)		Muscles			
Day		Control	0.010	0.015	0.020
0		0.0753 $\pm$ 0.0019 ^a			
5		0.078 $\pm$ 0.00408	0.0508 $\pm$ 0.00157 (34.87)	0.0462 $\pm$ 0.00821 (40.76)	0.0431 $\pm$ 0.00121 (44.74)
10		0.0610 $\pm$ 0.00089	0.0495 $\pm$ 0.0002 (19.25)	0.0510 $\pm$ 0.0021 (15.98)	0.0462 $\pm$ 0.00025 (24.63)
15		0.0515 $\pm$ 0.0021	0.0443 $\pm$ 0.0008 (13.98)	0.0462 $\pm$ 0.008 (10.29)	0.0493 $\pm$ 0.0005 (4.27)
20		0.067 $\pm$ 0.0016	0.0426 $\pm$ 0.0008 (36.03)	0.0432 $\pm$ 0.0005 (35.13)	0.0443 $\pm$ 0.008 (33.48)
25		0.0743 $\pm$ 0.0021	0.0416 $\pm$ 0.0006 (44.01)	0.0411 $\pm$ 0.0006 (44.68)	0.0432 $\pm$ 0.0005 (41.85)
30		0.068 $\pm$ 0.0016	0.0411 $\pm$ 0.0006 (39.55)	0.040 $\pm$ 0.0003 (41.17)	0.0416 $\pm$ 0.0006 (38.82)

a = Mean $\pm$ SE (n>3), Values in parentheses represent % changes from control values

Table 4: Effect of λ -Cyhalothrin on Trypsin (mg mL^{-1}) in Muscles of *Channa punctatus*

Conc. (ppm)		Muscles			
Day		Control	0.010	0.015	0.020
0		0.0560 $\pm$ 0.0011 ^a			
5		0.0576 $\pm$ 0.0012	0.0426 $\pm$ 0.0008 (26.04)	0.05 $\pm$ 0.0 (13.10)	0.0561 $\pm$ 0.0014 (2.60)
10		0.0530 $\pm$ 0.0025	0.0443 $\pm$ 0.0008 (16.41)	0.0578 $\pm$ 0.0013 (9.05)	0.0596 $\pm$ 0.0024 (12.45)
15		0.0563 $\pm$ 0.0025	0.0508 $\pm$ 0.0015 (9.76)	0.0473 $\pm$ 0.0005 (15.98)	0.0543 $\pm$ 0.0001 (3.55)
20		0.0561 $\pm$ 0.0014	0.00445 $\pm$ 0.0 (20.67)	0.0455 $\pm$ 0.0004 (18.89)	0.0473 $\pm$ 0.0005 (15.68)
25		0.0546 $\pm$ 0.0022	0.00426 $\pm$ 0.0008 (21.97)	0.0438 $\pm$ 0.0026 (19.78)	0.0443 $\pm$ 0.0008 (18.86)
30		0.0508 $\pm$ 0.0015	0.0400 $\pm$ 0.0003 (21.25)	0.0416 $\pm$ 0.0006 (18.11)	0.0426 $\pm$ 0.0008 (16.14)

a = Mean $\pm$ SE (n>3), Values in parentheses represent % changes from control values

The activity of trypsin in liver and muscles of control group fishes was 0.078 and 0.0576 mg mL^{-1} , respectively (Table 3 and 4). Significant reduction ($p < 0.05$) was recorded when fish were exposed to sublethal concentrations of λ -cyhalothrin.

Maximum reduction in liver was 44.74% after exposure to 0.020 ppm for 5 days while in muscles maximum reduction recorded was 21.97% after exposure to 0.010 ppm for 25 days.

DISCUSSION

λ -cyhalothrin is a pyrethroid which belongs to the class of lipophilic insecticides which are easily degraded in the natural environment (Elliot, 1989). These compounds are reported to be highly toxic to fish (Saxena and Gupta, 2003). Morphological and behavioral changes in *Channa punctatus* exposed to λ -cyhalothrin were observed during present investigation which indicate that fish became erratic due to this exposure and showed uncoordinated swimming. λ -cyhalothrin has been found to be lethal to *Channa punctatus* as death was recorded at concentrations 0.30 and above. The present investigations show that prolonged exposure of *Channa punctatus* to λ -cyhalothrin in water induced alterations in the activities of trypsin and lipase in both liver and muscles. Some other workers (Mahendru and Agarwal, 1983; Simon *et al.*, 1999) have also reported similar type of changes in fish and snails due to exposure to pesticides.

Several workers (Dubale and Awasthi, 1984; Ghosh and Chatterjee, 1988; Ramos and Herrera, 1996; Saxena and Gupta, 2005; Velisek *et al.*, 2006) have also reported metabolic changes in the tissues of fishes due to exposure to pesticides. The present investigations show that the fish were under stress during λ -cyhalothrin exposure. It might be due to accumulation of residue of this compound in the tissue of *Channa punctatus*.

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REFERENCES

- Agnihothrodu, V., 1988. Pyrethroids. Their Future and Toxicology. In : Advances in Toxicology and Environment Health. Gupta, P.K. and V. Raviprakash (Eds.), Jagminder Book Agency, New Delhi, India, pp: 65-69.
- Banik, S., S. Chakraborty and J.R. Choudhary, 1996. *Haemolytic anaemia* in *Anabas testudineus* with reference to endosulfan. Uttar Pradesh J. Zool., 16: 87-88.
- Bardbury, S.P. and J.R. Coats, 1989. Comparative toxicology of pyrethroid insecticides. Rev. Environ. Contam. Toxicol., 108: 132-177.
- Bergmeyer, H.U., 1971. Methods of Enzymatic analysis. Academic Press, New York.
- Das, B.K. and S.C. Mukherjee, 2003. Toxicity of cypermethrin in *Labeo rohita* fingerlings: Biochemical enzymatic and haematological consequence. Comp. Biochem. Physiol. Toxicol. Pharmacol., 134: 109-121.
- Dubale, M.S. and M. Awasthi, 1984. Biochemical changes in the liver and kidney of a catfish *Heteropneustes fossilis* exposed to dimethoate. Comp. Physiol. Ecol., 7: 111-114.
- Elliot, M., A.W. Farnham, N.F. James, P.H. Needham, D.A. Pullmans and J.H. Stevenson, 1973. A photostable pyrethroid. Nature, 246: 169-170.
- Fisher, R.A., 1950. Statistical methods for research workers, 11th Edn., Oliver and Boyd, London.
- Ghosh, T.K. and S.K. Chatterjee, 1987. Toxic influence of fenvalerate on the biological parameters of the fish *Anabas testudinus*. Environ. Ecol., 6: 107-110.
- Gupta, P.K. and A. Bhaumik, 1988. Pyrethroids: Their Use in the Control of Animal Ectoparasites and Impact on the Environment. In advances in toxicology and environment Health. Gupta, P.K. and V. Raviprakash (Eds.), Jagminder Book Agency, New Delhi, India, pp: 71-80.
- Hirano, M., 1989. Characteristics of pyrethroids for insect pest control in agriculture. Pesticide Sci., 27: 353-360.
- Mahendru, V.K. and R.A. Agarwal, 1983. Phorate and mexacarbate induced changes in enzymes of the snail, *Lymnaea acuminata*. J. Arch. Environ. Contam. Toxicol., 12: 77-82.
- Ramos, G.B. and A.A. Herrera, 1996. Changes in the total lipid and total protein levels of the muscles, liver and brain of *Oreochromis niloticus* chronically exposed to a fenvalerate containing synthetic pyrethroid. Asia Life Sci., 5: 113-124.
- Saxena, K.K. and N. Seth, 2002. Toxic effects of cypermethrin on certain haematological aspects of fresh water fish *Channa punctatus*. Bull. Environ. Contam. Toxicol., 69: 364-369.
- Saxena, K.K. and P. Gupta, 2003. Effect of Permethrin on the activities of acid and alkaline phosphomonoesterases in a fresh water fish *Channa punctatus*. Nat. Symp. Biochem. Sci. Hlth. Environ. Aspects, pp: 477-479.

- Saxena, K.K. and P. Gupta, 2005. Impact of carbamates on glycogen contents in the muscles of fresh water fish *Channa punctatus*. Poll. Res., 24: 669-670.
- Simon, L.M., K. Laszlo, M. Kotorman, A. Vertesi, K. Bagi and J. Nemesok, 1999. Effect of synthetic pyrethroids and metidathion on activities of some digestive enzymes in carp (*C. carpio* L.). J. Environ. Sci. Health B., 34: 819-828.
- Sirohi, V. and K.K. Saxena, 2006. Toxic effect of λ -Cyhalothrin on Biochemical contents of Fresh water fish *Channa punctatus*. J. Fish. Aquatic Sci., 1: 112-116.
- Velisek, J.R. Dobsikova, Z. Svobodova, M. Modra and V. Luskova, 2006. Effect of deltamethrin on the biochemical profile of common carp (*Cyprinus carpio* L.). Bull. Environ. Contam. Toxicol., 76: 992-998.