Physiochemical changes analysis while introduction of endosulfan on Indian cat fish Heteropneustes fossils (Bloch)

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Abstract:

Endosulfan could be a non-systemic pesticide and is mostly used for agricultural functions, biological science and agriculture. sterol is a crucial element of nice significance in living systems. Stinging catfish Heteropneustes fossilis exposed to completely different concentrations of associate organochlorine chemical endosulfan below static conditions, discovered statistically vital increase in sterol contents of liver, brain and gill tissues even at rock bottom concentration (0.0010 mg/l). Fish additionally evoked behavioural changes thanks to chemical toxicity. symptom gave the impression to ensue to fret induced metabolic alterations caused by intoxication.

Keywords : Organochlorine, Behavioral alterations ,Heteropneustes fossilis ,toxicants, Spectronic

INTRODUCTION

Organochlorine pesticides ar still used for crop protection in many countries while not considering their cyanogenic effects on aquatic life. These pesticides reach in water bodies principally through run-off from agricultural fields and have an effect on the lifetime of non-target organisms like fishes, that ar a lot of vulnerable than invertebrates (Schocttiger, 1970; and Tandon and Dubey, 1983). Endosulfan could be a non-systemic pesticide and is usually used for agricultural functions, biological science and agriculture. sterol is a crucial element of nice significance in living systems. It holds a key and central position within the metabolism of the many closely connected biologically necessary compounds (Shell, 1961), precursor of steroid hormones (Lehninger, 1975) and a crucial constituent of cell wall wherever it modulates their runniness, fragility and consequently the membrane operate (Suhail et al., 1988). gift paper embodies observations on cyanogenic effects of endosulfan on sterol contents of liver, brain and gill tissues of fresh stinging catfish Heteropneustes fossilis, a vigorous and hardy fish of economic importance and features a nice demand owing to its healthful price (Talwar and Jhingran, 1991; and Daniels, 2000). Pollutants like pesticides ar glorious to change the behavioural pattern, growth, replica and resistance to diseases of aquatic organism, touching on a spread of organic chemistry and physiological mechanism (Geraldine et al., 1999).

MATERIALS AND STRATEGIES

They were properly fed and so starved for twenty-four hours before the experiment. Fish from constant cluster unbroken below traditional conditions, were used as management. Live Heteropneustes fossilis obtained from watercourse Gomti at Lucknow were transported and acclimatized to the laboratory atmosphere, as delineated earlier (Chandra, 1988). solely healthy wanting and active fishes of weight vary 100-150 grams were chosen for the experiment. The recommendations created by Doudoroff et al. (1951) and APHA (1992) were followed for the static bioassay tests. The chemical concentrations, chosen on the premise of 80-100% survival of fishes (Table I). Fish were exposed to completely different concentrations of chemical from twenty four to ninety six hours relying upon their survival at the actual concentration. Fish were taken out frequently when each twenty four hours interval from the experimental in addition as from management cluster and washed with H2O. The chemical science characteristics of dechlorinated water throughout the experiment were- temperature 19-21 0C; pH seven.0-7.4; dissolved atomic number 8 seven.2-7.6 mg/l; total pH 108-115 mg/l; and total hardness 118-128 mg/l. Their liver, brain and gill were compound out, washed and unbroken in zero.7% cold isosmotic solution. 2.5% homogenates were ready in glacial ethanoic acid and sterol level was calculable following technique of Rosenthol et al. (1957), exploitation Bausch and Lomb Spectronic - twenty photometer at 560 nm.

Consequence

The effects of endosulfan toxicity on sterol levels in liver, brain and gill tissues ar summarized in Table a pair of. At rock bottom concentration of zero.0010 mg/l the sterol levels in liver, brain and gill multiplied incessantly upto seventy two hours of chemical exposure and so shrunken when ninety six hours however remained still on top of their various management levels. At 0.0015 mg/l, 0.0020 mg/l and zero.0025 mg/l chemical concentration the sterol levels in liver and brain rose continuously until the terminal hours of exposure.

Table-01 Present survival of fishes in endosulfan activity

Pesticide Conc. mg/l	Time of exposure in Hours				
	24	48	72	96	120
Control	100%	100%	100%	100%	100%
0.0010	100%	100%	90%	80%	45%
0.0015	100%	90%	80%	40%	20%
0.0020	100%	80%	50%	10%	00%
0.0025	80%	30%	10%	00%	00%

In gills the cholesterol contents enlarged upto 48 hours of toxicant exposure at 0.0015 mg/l concentration and then declined. However, with increasing concentration of pesticide, cholesterol levels of gills enlarged during initial exposure period but later decreased. Interestingly the maximal rise in cholesterol level during the experiment was observed in gills (36.09%), followed by brain (29.65%) and liver (27.07%) at 0.0015mg/l concentration. Elevated cholesterol contents in liver, brain and gills due to toxic effect of endosulfan were statistically significant ($P<0.01$) as compared to their respective control levels. Endosulfan also produced behavioral changes in H.fossilis such as convulsions which were more frequent during the terminal hours of experiment, rapid air gulping, copious mucus secretion, loss of balance and sensitivity to touch and sound.

DISCUSSION

Karuppasamy 2002; David et al., 2003). Certain pathological informations along with physiological and biochemical data may provide accurate and early indication of toxicity of organochlorine pesticide (Krishnagopal et al. 1988). The toxicants on entering into fish body cause deleterious effects on functional activity of endocrine system and metabolism leading to physiological, pathological and biochemical disorders (Bais and Arasta, 1995; Arasta et al., 1999, Pandey et al., 2000; Endosulfan had significantly enlarged cholesterol levels of liver, brain and gill tissues of H.fossilis at all concentrations in these experiments. It was further observed that the rate of enlarge in cholesterol was higher in the initial period of pesticide exposure to fishes but following prolonged exposure the same was much lower. However, the level remained above the control level. Lipids provide an essential, readily available energy source for fish, of which cholesterol is of major importance because of its relationship to many physiologically active steroids and hormones (Tiez, 1970; Evans, 1998). Alterations in cholesterol level may be an indirect result of toxicant effect on metabolic enzymes (Mayer et al., 1992; Padmini et al., 2004). Marked biochemical alterations in blood and tissues of freshwater cat fish H.fossilis have been reported by Singh and Srivastava (1998) and Chandra (2008) following formothion and malathion exposure. Biochemical changes are primarily due to shift in the respiratory metabolism caused by pesticide in the ambient environment and utilization of organic reserves yielding excess energy to compensate the stress. Toxic stress to fish H.fossilis was quite evident in these experiments showing abnormal behavioral changes. Rao et al. (1981) reported reduced oxygen consumption in fish M.aculeatum treated with endosulfan. Exposure to sublethal concentration of thiodon lead to 40% decline in oxygen consumption rate in Mystus vittatus (Reddy and Gonathy, 1977). Varied respiratory response may occur in fishes (Thosar andLonker, 2004) depending upon exposure period of toxicant, stress and the intensity of damage caused to gills. Further dose dependent behavioral changes in fish H.fossilis clearly indicated stages of stress response, the alarm reaction, the state of resistance and the stage of exhaustion in present experiment. It appeared that fishes exposed to lowest concentration of pesticide did not reach upto the state of exhaustion, rather they were able to accommodate and adapt the stress. However, fishes exposed to higher concentration of endosulfan could not resist the stress for longer duration and died. Nath (2003) also reported abnormal behavior in Clarias batrachus, Heteropneustes fossilis and Labeo rohita of wetland pond of Bihar, contaminated with endosulfan. Matsmura (1980) reported that susceptibility and survival time in fishes are directly related to body size, weight and age in ambient environment. Deshmukh and Sonawane (2007) reported significant changes is blood corpuscles number and attributed as an adaptation to meet stressful condition in the fish Channa gachua following long term exposure to endosulfan. Chandra et al. (2007) reported significant enlarge in Glutamic oxalacetic and pyruvic transaminase in brain and liver of C.batrachus due to toxicity of malathion and dimicron pesticides which indicated impaired carbohydrate and protein metabolism.

Table-02 Cholesterol levels of non-identical tissues of H. fossils following endosulf toxicity

Pesticide Conc. mg/l	Cholesterol mg/100mg. Fress weight Mean ±Std. deviation Time of exposure in hours			
	24	48	72	96
Liver –Control -2.29±0.12				
0.0010	2.62±0.13	2.80±0.17	2.85±0.30	2.60±0.30
0.0015	2.80±0.16	2.98±0.15	3.14±0.32	
0.0020	3.04±0.42	3.10±0.24		
0.0025	3.00±0.25			
Brain–Control -2.80±0.08				
0.0010	3.27±0.17	3.46±0.24	3.70±0.23	3.40±0.42
0.0015	3.40±0.38	3.66±0.30	3.98±0.31	
0.0020	3.60±0.28	3.84±0.42		
0.0025	3.37±0.38			
Gills–Control -1.40±0.28				
0.0010	1.28±0.13	1.35±0.08	1.40±0.06	1.20±0.12
0.0015	1.39±0.08	1.69±0.12	1.46±0.28	
0.0020	1.48±0.19	1.60±0.21		
0.0025	1.22±0.25			

Aldolase, an relevant gluconeogenic enzyme which plays an essential role in mobilization of energy to tolerate additional stress, was also reported to escalate significantly in liver, brain and gill of C. batrachus, following pesticide exposure (Chandra, 2010). Such biochemical changes clearly indicated utilization of organic reserves yielding excess energy to cope up the toxic stress of environment at their level best. Since cholesterol plays an relevant role in body metabolism and being associated with almost every organ of body, was the foremost biochemical component of tissues revealing significant alterations in present observations. The percentage elevation of cholesterol were noted to be higher during early period of exposure to toxicant than prolonged one, which suggested that the fish tried its best to accommodate with the situation and doing so body metabolism became rapid to fulfil energy requirement, utilizing organic reserves, yielding excess energy to compensate the toxic stress. The mobilization of energy substances as secondary response and reduced capacity to tolerate additional stress have been described as a part of integrated response in fish (Bonga, 1997). Enlarged glucose contents in brain of H.fossilis (Shrivastava et al., 2002) and changes in liver cholesterol have been observed following exposure of fish to various pollutants (Kasthuri and Chandran, 1997; and Kulkarni and Dharmadhker, 1998). Gills being the primary sites of absorption but having poor drug metabolizing capacity, indicated maximum rise (36.09%) in cholesterol level. Endosulfan toxicity have also been reported to cause degeneration, necrosis, hyperplasia and hypertrophy in gills, liver and muscle tissues (Kumar et al., 2000; and Sharma et al., 2001). These observations further support the decreasing cholesterol levels in liver, brain and gill tissues of H.fossilis following prolonged exposure and increasing doses to pesticide when fish became exhausted.

Thus it can be concluded that even very low concentration of endosulfan pesticide significantly altered cholesterol level of fish H.fossilis and behavioral changes are the early symptoms to gauge the potential toxicity of a toxicant.

REFERENCES :

- Zayapragassarazan, Z. (1999). Effect of dichlorv intoxication in the freshwater prawn Macrobrachium malcolmsoni. J. Environ. Biol., 20:141-148.
- Karuppasamy, R. (2002). Short and long term effect of phenyl mercuric. acelate on protein metabolism in Channa punctatus. J. Natcon., 12: 83-93.
- Kasthuri, J. and Chandran, M.R. (1997). Sublethal effect of lead on feeding, energetics growth performance, biochemical composition and accumulation in the eusturine catfish Mystus gulia. J. Env. Biol., 18:95-101.
- Rosenthal, H.L., Pfluke, M.L. and Buscaglia, S. (1957). A stable iron reagent for determination of Cholesterol. J. Lab. Clin. Med., 50:318.
- Schocttiger, R.A. (1970). Toxicity of thiodon in several fish and aquatic invertebrates. U.S. dept. Int. Fish. Wildl. Serv. Rep., 35.
- Sharma, R.R., Pandey, A.K. and Shukla, G.R. (2001). Histopathological alterations in fish tissues Induced by pesticides toxicity. Aquacult., 2: 31-43.
- Shell, E.W. (1961). Chemical composition of blood of small mouthbass. Res. Rep. U.S. Wildl. Serv., 57:1-36.
- Shrivastava, S., Singh, S. and Shrivastava, K. (2002). Effect of carbaryl on glucose content in the brain of Heteropneustes fossilis. J. Ecotoxicol. Environ. Monit., 12:205-208.
- Singh, N.N. and Srivastava, A.K.(1998). Formothion induced biochemical changes in blood and tissues of freshwater catfish Heteropneustes fossilis. Malys. Appl. Biol., 27:39-43

- Suhail, M., Athar, J. and Rizvi, S.I. (1988). Lipid changes in red cell membrane in leukemia., Ind. J. Med. Res., 88:350355.
- Talwar, P.K. and Jhingran, R.J. (1991). Inland Fishes. vol. 2, Oxford & IBH Pub. Co. Pvt. Ltd., India.
- Krishnagopal, Ram, M.D., Gupta, G.S.D. and Anand, M. (1988). Lindane induced histological changes in the gills of Channa punctatus. Ind. J. Bioresearch., 8:25-29.
- Kulkarni, G.P.P. and Sunita Dharmadhker, M.(1998). Effect of dairy effluents on biochemical parameters of wheat seed and fish. Proc. Acad. Environ. Biol. 7:57-60.
- Kumar, S., Lata, S. and Krishnagopal (2000). Histopathological changes in gills of Heteropneustes fossilis, induced by Deltamethrin. Proc. Acad. Environ. Biol., 9:171-173.
- Lehninger, A.L. (1975). Biochemistry, 2nd ed. Werth Publ. Inc., New Work. Matsmura, F. (1980). Toxicity of Weedkillers. Plenum Press, London. Mayer, F.L.,Versteeg, D.J. and Rattner, B.A. (1992).
- Biomarkers – Physiological and histological markers of anthropogenic stress. Proc. Viii Pelston Workshop, Lewis Pub. U.S.A. Nath, A., (2003).
- Bioaccumulation of various pesticides in fish muscle. J. Ecophysiol. Occup. Hlth., 1:40-46 Padmini, E., Thendral Hepsibha, B. and Santhalin Shellomith, A.S. (2004).
- Lipid alteration as stress markers in grey mullets Mugil cephalus caused by industrial effluents in Ennore eustury. Aquacult., 5:115-118.
- Pandey, A.C., Krishnagopal and Pandey, A.K. (2000). Pollution and fish physiology. Aquacult., 1:1-8.
- Rao, D.M.R., Dani., A.M. and Murthy, A.S. (1981). Toxicity and metabolism of endosulfan and its effect on oxygen consumption and total nitrogen excretion of the fishMacrognathus aculeatum. Pestic, Biochem. Physiol., 15:282287.
- Reddy, T.G. and Gonathy, S. (1977). Toxicity and respiratory effect on catfish Mystus vittatus, Ind. J. Env. Hlth., 19:360363.