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ORIGINAL RESEARCH ARTICLE

Metasystox Induced Haematological Modulation In The South Indian Snakeheaded *Channa striata*

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ABSTRACT

Snakeheaded *Channa striata* reared in freshwater of metasystox (1.7 mg L^{-1}) for 15 d and 30 d. Evaluation of some of the haematological parameters showed that on exposure, haematocrit content (Ht), haemoglobin content (Hb), total erythrocyte count (RBC), neutrophil, basophil, lymphocyte values markedly increased and depressed monocyte values. **Observations** of blood parameters allows the most rapid detection changes in fish, which may be used as a diagnostic test for aquatic pollution.

Key words : Metasystox, *Channa striata*, total erythrocyte, haemoglobin and haematocrit

INTRODUCTION

Indiscriminate and extensive uses of pesticides to protect crops possess a serious threat to humans and the surrounding environment. Almost all pesticides are volatile in nature when applied to crops. These pesticides can be circulated into different ecosystems by different agents (Weber, 1977) after entering into the environment like air, water, different food chains, soil and other agents (Farmer *et al*., 1972). The pesticides which are liberated into the aquatic environment have a deterious effect on fish and subsequently to man (Metelev *et al.*, 1983). Metasystox is a locally used pesticide against cotton, paddy and vegetable crops pests. Lethal and sublethal concentration of metasystox exposure causes many changes in respiration, oxidative enzymes, haematological and histopathological changes in the snakeheaded air-breathing fish *Channa striata* (Natarajan *et al.*, 1998). Blood parameters are considered pathological indicators of the whole body and therefore are important in diagnosing the structural and functional status of fish exposed to toxicants (Adhikari *et al.* 2004). The present study was aimed to analyse the impact of sublethal concentrations of metasystox on haematological parameters of snakeheaded *Channa striata*.

MATERIALS AND METHODS

Apparently healthy snakeheaded *Channa striata* reared in fresh water of 20 g - 25 g in body weight and 10 cm - 13 cm in total length were purchased from commercial catcheries. The fish were acclimated to the laboratory conditions in glass aquaria filled with aged, aerated dechlorinated water under natural photoperiod for 15 d for experimentation. Technical grade metasystox (Oxydemeton–methy l, 0, 0-dimethyl-S-2 (ethyl sulfinyl) ethyl phosphorothioate) of 95 % purity manufactured by Bayer Ltd., Bombay, India was used for the study. A stock solution of metasystox was made in acetone (1 mg mL^{-1}) and suitable quantities of this solution were added to the aquaria to obtain the desired concentrations. Lethal (Lc 50 / 48 h) concentration (5 mg L^{-1}) was calculated by a probit method (Finney, 1964) and approximately 1/3 of the LC 50/48 hr concentration (1.7 mg L^{-1}) was chosen for sublethal exposure. Fish were sacrificed by pithing and blood samples were taken by severing the caudal vein of the fish. Pipettes were rinsed with anticoagulant to delay coagulation before drawing the blood sample. Haematological parameters were determined by standard methods as described by Blaxhall and Daisley (1973), while differential leucocyte cell counts were determined by methods of Hillman (1968). Statistical significance of difference between control and treated groups of different exposure period were tested by using‘t’ test (Zar, 1984).

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RESULTS AND DISCUSSION

Water pollution is recognized globally as a potential threat to both human and other animal populations which interact with the aquatic environments. At sublethal concentration, the fish survived even after prolonged periods of exposure (Natarajan, 1984). It was determined that the use of pesticide caused a slight increase in the haematological parameters except monocyte. Peripheral haematological parameter is a reliable indicator of physiological status of fish and an effective parameter to assess the background effects of environmental perturbation (Natarajan *et al.*, 1998). In fisheries practice, the ascertainment of leukocrit values is important, since changes in this parameter are relatively easily measurable. With the help of DLC value (Alexander and Ingram, 1992) the number of leucocytes can be determined without the necessity of carrying out exact counts. The increase of this value involves foremost an increase in the number of granulocytes (Secombes and Fletcher, 1992).

Exposure of snakeheaded *Channa striata* to metasystox results in disturbances in haematology. Sublethal concentrations of metasystox significantly increased the RBC content at 15 d (+34.57%; P<0.05) and 30 d (+41.71; P<0.05) exposure, haemoglobin content is also greater at short term (+12.86% P<0.02) and long-term (+15.60%; P<0.05) exposures. In differential leucocyte count (DLC) except monocyte, all other blood cell count increased in short-term and long term treatments. However, the elevations were not uniform and consistent. While neutrophils, basnophils and lymphocyte exhibited gradual increase at 15 d and 30 d period, eosinophils decreased at 30 d exposure. There was an elevation of RBC, Hb and Hct level in short term-exposure. This disturbance may be due to a haemopoetic or erythrocytic mobilization response to hypoxaemia induced by pesticide stress. Such an increase has also been reported for *Oreochromus mossambicus* (Sampath *et al*., 1993), *Ctenopharyngodon idella* (Ahmad, Ali and Shakoori, 1995) and *Heteropneustes fossilis* (Ramanujam and Mohanty, 1997) on exposure to pesticide. The increase observed in the mean lymphocytes values of *C. striata* exposure to sublethal levels of metasystox initially may be attributed to the production of more antibodies to combat stressor (Spielman, 2004). And also, the significant increase in eosinophil counts was recorded initially follows the normal trends as recorded by Spielman (2004). The increase may be due to stressor, as it plays an vital role in inflammatory reactions and other foreign proteins. The fall in the level of these parameters in long-term exposure is an indication of the recovery from pesticide stress. The fish tries to restore homeostasis by keeping these parameters within the normal level.

The present study suggested that the perturbations in these blood indices attributed to a defense reaction against toxicity of metasystox through the stimulation of erythropoesis or may be due to the disturbances that occurred in both metabolic and haemopoetic activities of fish exposed to sublethal concentration. The toxicant caused haematological disturbance could lead to impairment of the fish ability to combat diseases, reduce its changes for survival and potential for growth and reproduction.

Table 1. Haematological values of control and metasystox exposed snakehead *Channa striata*

Parameter	Control	Metasystox exposed			
		15 days	% Change	30 days	% Change
RBC(x 10^4/mm^3)	3.50 ± 0.60	4.71 ± 0.67	+34.57*	4.96 ± 0.42	+41.71*
Hb (g/100ml)	14.62 ± 0.70	16.50 ± 0.81	+12.86**	16.90 ± 0.71	+15.60**
Ht (%)	32.34 ± 3.00	38.51 ± 4.06	+19.08*	33.56 ± 3.91	+3.77
Neutrophil	22.4 ± 5.3	32.5 ± 6.7	+45.09*	40.6 ± 5.28	+81.25*
Basophil	11.0 ± 2.8	12.4 ± 4.3	+12.73*	15.0 ± 6.1	+36.36*
Eosinophil	6.01 ± 3.0	10.2 ± 38.2	+69.72*	6.5 ± 2.17	+8.15
Monocyte	1.4 ± 0.05	2.2 ± 0.08	+57.14*	1.0 ± 0.06	-28.57**
Lymphocyte	60.0 ± 7.46	88.0 ± 10.12	+46.67*	90.6 + 13.40	+51*

CONCLUSION

The measuring of haematological parameters has provided valuable information. The employment of haematological techniques has provided valuable knowledge in the assessment of fish health and in monitoring stress response. The treatment of fish metasystox induced haematological modulations. Technologies should be developed to control the aquatic pollution. Measures to lessen the contaminants should be investigated. Hence, further research is needed to protect the aquatic organisms from toxicants.

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