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Zoology

HAEMOTOXIC ASSESSMENT OF COMMONLY USED FERTILIZERS IN FISHES

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ABSTRACT The Urea toxicity is more pronounced than Diammonium Phosphate on the fishes followed by Calcium ammonium niterate and Muriate of potash.The toxic effect of urea resulted in sudden fall of hematological parameters-Hb, RBC count, HCt at higher concentration and at lower concentration gradual decreases, in *C. batrachus*, maximum lowering of 80.11% for Hb content, 37.90% for RBC count, and 15.60% for HCt is recorded. The effect of CAN is not so pronounced as in DAP and Urea. In *C. batrachus*, maximum decrease of 24.05%, 26.68% and 34.91% below control is observed in Hb. RBC count and TLC respectively. In *C. batrachus*, at lower concentrations (5.60, 6.15, 6.70 *g/l*) and shorter exposures, the three parameters studied-Hb, RBC count and HCt remained almost unaffected giving an idea that fishes tolerate these concentrations of fertilizer muriate of potash.

KEYWORDS : Fertilizer, Fishes, Heaemoglobin, Haematocrit, RBC count.

INTRODUCTION

In India, a revolutionary change in agriculture sector was brought out by the introduction of high yielding variety of seeds whose food potential could only be realised by the use of fertilizers. On world wide spectrum, over 50 percent of the increase in yield on per unit area basis during the past three decades has been due to increased use of fertilizers. In most of Indian states, fertilizer consumption has more than doubled during last ten years. The per hectare consumption has increased by more than 200 percent in the states of Madhya Pradesh, Bihar, Himanchal Pradesh, West Bengal, Jammu & Kashmir and Manipur. It has gone up by 150-200 percent in Haryana, Punjab and Tamil Nadu. The Corresponding increase has been 100-150 percent is the states of Kerala, Karnataka, Rajasthan, Uttar Pradesh, Nagaland and Maharashtra.

The presence of fertilizers in rivers and ponds through drainage system and runoff waterways cause serious ecological disturbances, adversely affecting aquatic flora and fauna specially the fishes (1-7). The aquatic animals maintain their internal body chemistry by a variety of regulatory adjustments. In the aquatic environments, when the levels of pollutants exceed the capacity of regulatory adjustments, it leads to haematotoxic changes (8-15). The lethal concentrations, for 90 to 100%, fishes were worked out on two fresh water teleost fishes, *Clarias batrachus* and *Heteropnustes fossilis* 24, 44, 72, 96, 120 and 144 hours exposures to four commonly used fertilizers-Diammonium Phosphate, Urea, Calcium Ammonium Nitrate and Muriate of Potash. The details of concentrations are given in Table-1 and specifications in Table-2.

MATERIAL AND METHODS

The fishes were hand netted from river Gomti, Lucknow, with the help of local fishermen. They were brought to laboratory in large plastic containers in natural water avoiding injuries and stresses as far as possible; washed four times in tap water, and treated with 2.5% $KMnO_4$, to remove external infections. Uninfected, normal and healthy fishes, selected for the experiments, were transferred to large glass aquaria, and acclimated for 72 hours. The lethal concentrations of fertilizer Diammonium phosphate for 24, 48, 72, 96, 120 and 144 hours were recorded earlier (16,17).

The characteristics of water were analysed at the beginning and at the termination of each experiment, using the standard procedures (6). Throughout the experiment, proper oxygen supply was maintained through an electric aerator. Fishes were taken out at 24, 48, 72, 90, 120 and 144 hours of intervals and exposures to particular concentrations. Blood was collected by puncturing the caudal vein in vials and mixed with 1% EDTA (Ethylene Diamino-Tetra Acetic Acid). Haematological parameters Haemoglobin, RBC Count, Hct and TLC were analysed by using semi automatic blood cell counter- Boehringer Mannheim Diagnostics, HC-555.

OBSERVATIONS AND RESULTS

I. EFFECT OF DIAMMONIUM PHOSPHATE FERTILIZER ON TELEOST FISHES CLARIAS BATRACHUS AND HETEROPNEUSTES FOSSILIS - The toxic effect of Diammonium Phosphate was more pronounced than that of urea in both the fishes. The toxic effect resulted in a sudden fall of hematological parameters-Hb, RBC count, HCt at higher concentration, and at lower concentrations gradual decreases were seen over comparatively longer durations.

In H. fossilis, the maximum decreases of 50.79%. 52.75% and 82.16% from the Controls were seen in Hb, RBC count and HCt respectively. Leucocytosis was evident at all concentrations and exposures.

II. EFFECT OF UREA FERTILIZER ON HAEMATOLOGICAL PARAMETERS OF TELEOST FISHES, CLARIAS BATRACHUS AND HETEROPNEUSTES FOSSILIS - Hematological parameters- Hb, RBC count and HCt decreased during urea intoxication in both fishes. In *C. batrachus*, maximum lowerings of 80.11% for Hb content, 37.90% for RBC count, and 15.60% for HCt were recorded. TLC increased at all concentrations and exposure of urea. In *H. fossilis*, maximum lowering of 69.62%, in RBC count,82.74% in Hb content and 83.62% in HCt were recorded.

III- EFFECT OF-CALCIUM AMMONIUM NITRATE FERTILIZER ON TELEOST FISHES, CLARIAS BATRACHUS AND HETEROPNEUSTES FOSSILIS - Fertilizer CAN decreased Hb, RBC count and HCt in both the fishes at all concentrations and exposures, The effect of CAN was not so pronounced as in DAP and Urea. In *C. batrachus*, maximum decrease of 24.05%, 26.68% and 34.91% below control were observed in Hb. RBC count and TLC respectively. TLC, at higher concentrations and shorter exposures increased gradually and reached the peak value when the fishes died.

IV. EFFECT OF MURIATE OF POTASH FERTILIZER ON TELEOST FISHES, CLARIAS BATRACHUS AND HETEROPNEUSTES FOSSILIS - In *C. batrachus*, at lower concentrations (5.60, 6.15, 6.70 *g/l*) and shorter exposures, the three parameters studied-Hb, RBC count and HCt remained almost unaffected giving an idea that fishes tolerated these concentrations. However, due to apparent failure in adjustment of body chemistry, the fishes died in prolonged exposures ie 96 to 144 hours when the Hb Ievels had fallen from the controls. At higher concentrations (7.10, 7.80. 8.75 *g/l*) and shorter exposures (24 to 72 hours), maximum lowering of 25.75% in Hb, 31.25% in RBC count and 36.10% in HCt were recorded. TLC at lower concentrations (5.60, 6.15, 6.70 *g/l*) and shorter exposures, were similar to controls, while it increased gradually with progressing concentrations in longer time intervals giving an idea of fishes being infected and unable to adjust the toxic effect of fertilizer. TLC was highest 43.77% above the controls, at lowest concentration of 5.60 *g/l* in 144 hours after which the fertilizer proved lethal to fishes.

DISCUSSION :

Lowering of haemoglobin content in the fish blood due to pollution of the aquatic medium with fertilizers-DAP, Urea, CAN and MP indicate that the pollutants even at the low experimental concentrations either blocks denovo synthesis of haemoglobin at some stage, or it causes increased destruction of erythrocytes or delays their maturation interfering with normal hematopoiesis. A fall in haemoglobin content due to a variety of pollutants has been reported earlier by a number of workers (16, 17). Environmental pollutants in fresh water fish are known to cause increased plasma urea (18) and uraemia has been found to be commonly associated with anaemia in humans. Urea also splits the haemoglobin molecule. All these facts furnish ample support to our findings regarding a decline in Hb content, RBC count and HCt values on exposures of the fishes to fertilizers polluted aquatic environment, but whether the exact cause of these anaemic symptoms is the impairment of haemoglobin synthesis due to interference by urea with the absorption of iron at the intestinal mucosa, or it is due to an. impairment of the concerned enzyme systems at the corpuscular level or it is due to increased destruction of erythrocytes caused by a disbalanced cell plasma relationship, or it is due to a combination of one or more of these factors can only be settled by detailed biochemical investigations. The results hive opened a wide scope for further experimentation and work in relation to these findings is in progress in my laboratory.

Leucocytosis in response to environmental pollution in aquatic animals has been reported by a number of workers. Leucocytosis occurs as an immunological response to internal toxins as well as environmental pollution. It is certainly a pathological state and a diagnostic symptoms of morbidity. The total leucocyte count in case of fish like that in other vertebrate does reflect the state of internal as well as external environment, significant toxicity was observed due to agricultural fertilizers in fishes (19-31).

CONCLUSION

Our findings lead to the inference that the pollution of' aquatic environment with fertilizers DAP, Urea. CAN and MP even at low concentrations causes anaemia in the fresh water fishes *Clarias batrachus* and *Heteropneustes fossilis* and that with a rise in concentration of the pollutant, both the symptoms increase in intensity.

TABLE -I

90-100% Lethal concentrations (g/l) of different fertilizers to fresh water teleost fishes

Name of the fertilizers	*Clarias batrachus* Exposure Time in Hours						*Heteropneustes fossilis* Exposure Time in Hours					
	24	48	72	92	120	144	24	48	72	96	120	144
Diammonium Phosphate	1.10	1.01	0.97	0.92	0.86	0.81	3.00	2.70	2.15	1.85	1.50	1.15
Urea	31.30	24.70	20.30	16.25	11.80	7.50	36.60	31.90	27.70	21.35	12.15	8.50
Calcium Ammonium Nitrate	20.80	17.45	15.70	13.50	11.30	9.20	8.90	7.70	6.30	5.65	4.20	3.75
Muriate of Potash	8.75	7.80	7.10	6.70	6.15	5.60	6.50	6.10	5.80	5.55	5.30	4.50

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