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RESEARCH ARTICLE

BIOASSAY AND IMPACT OF HOUSE HOLD SEWAGE ON SURVIVALITY, GROWTH AND FECUNDITY OF *ESOMUS DANRICUS*.

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Abstract

The Darke fish (*Esomus danricus*) is a freshwater fish. It is one of the most commonly kept aquarium fish. Inland water bodies are subjected to heavy stress due to enormous addition of domestic waste water. The 96 hours static bioassay studies showed LC5-LC90 values ranging from 23.60-67.89% and 25.67 – 76.46% respectively. Exposure to three different dilutions (5%, 50%, 90%) of domestic sewage effluents for 100 days resulted in significant changes ($P<0.05$) on fecundity, survivality and GSI of the fish as compared to control. Among physicochemical parameters, significant alterations were noticed in dissolved oxygen (DO), of bottom sediment. The data indicated higher number of fecal coliform and aerobic nitrogen fixers (ANF) and also high heterotrophic bacterial density.

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Introduction:-

We have many small sized fishes in our surrounding water bodies. Many of them are considered to be unwanted for conventional farming. Some of them has a good market demand as ornamental fish. *Esomus danricus* (Darke fish) is one of them. It has a good market demand as aquarium fish.

Domestic sewage mainly composed of high amount of nitrogenous metabolites, fecal coliform and heterotrophic bacteria. The inland freshwater resources are increasingly subjected to heavy stress due to huge discharge of domestic waste water. It results in deterioration of water quality and effects on ichthyofauna diversity (Choudhury & Mitra, 2005). Waste water although rich in nutrients but it poses problem such as toxicity to fish and their natural food, bioaccumulation of pesticides, heavy metals and detergents, etc. in fish (Buras, 1988). It also acts as potential vectors for the transmission of pathogens (Geldrich and Clark, 1996).

A number of studies have been made earlier in India on the use of waste water in aquaculture (Ghosh, et.al., 1988; Jana, 1998). Reports on the toxicological influences of waste water on anchovy fishes and aquatic ecosystem are very limited. Present study was made to evaluate the impact of crude domestic sewage water on a famous aquarium fish *Esomus danricus*. A study was also made to determine the degree of impact of the sewage water on their exposed ecosystem.

Materials and Methods:-

Different separate experimental set up were made for this anchovy fish. The experiments were performed in a water reservoir of 500 litter tank for 100 days using three different concentrations of sewage (5%, 50%, 90%). One similar

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arrangement was made without giving the sewage water was treated as control. The total concentrations were calculated and given in three monthly installments. Unchlorinated tap water was used as diluents.

Each tank was stocked with 25 fries of *Esomus danricus* (length 30.5 ± 2.3 mm) and weight 0.91 ± 0.48 gm). Appropriate control was maintained. The control tank fishes were feed with rich bran and groundnut oilcake (1:1) thrice a week @ 2% of fish biomass. No supplementary feed was given in experimental sets. The fishes were collected from local water bodies and acclimatized for 7 days in the same tank in laboratory. Among them, only healthy fishes were selected for experimental purpose. Fishes were exposed for 96 hours in 20 litter glass aquaria containing 10 litters of tap water. Initial hydrological parameters were measures as pH=7.3±0.1, DO= 2.5 mg/lit, Total alkalinity 246 mg/lit., Hardness 120 mg/lit. Free Co₂ 9.7mg/lit., Temperature= 24.4⁰ C).

Crude sewage water was collected from a drain and physicochemical, biological and bacteriological studies were made following the standard methods (APHA, 1985). The values were given in Table-1. The total aerobes were determined by pour plate methods after 48 hours of incubation in sodium caseinate Baird and Parker agar medium. Other microbial groups were counted by MPN methods using three tubes. Observation on behavioral changes and mortality of fish were made daily. At the end of the experiment, weight, length, maturity indices (MI) and Gastrosomatic index (GSI) of test fishes were calculated separately for the two exposed fishes. The statistical significance between the treated and control set was calculated by t-test at 5% level of significance.

Results and Discussion:-

The physicochemical and microbiological features of collected sewage water used for the present study is given in table-I.

Table-I:- Shows physicochemical and microbiological features of collected domestic sewage water.

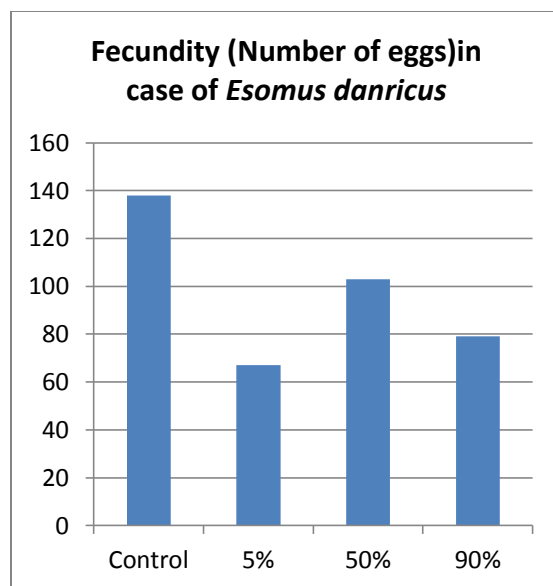
-Parameters	Values	Parameters	Values
pH	7.3	Temperature	29 ⁰ C
DO	0.4 mg/lit.	Total Alkalinity	245 mg/lit.
Total Hardness	450 mg/lit	HCO ₃ ions	550 mg/lit.
Chloride	120 mg/lit	BOD ₅	168 mg/lit.
Nitrate	0.23 mg/lit	COD	277 mg/lit.
Coliforms count	4.0x10 ⁴ per ml.		

The present study shows the 96 hours LC₅, LC₅₀ and LC₉₅ values of waste water for *Esomus danricus* was 25.43, 56.43, and 69.87% respectively. It was observed that toxic effects of sewage water on the fishes occurred with first 48 hours.

Acute toxicity values of domestic waste water were measured using different species of fish by earlier workers (Gill and Toor, 1975, Sarkar *et al.*, 1993, and Bhowmik *et al.*, 1995). The 96 hours LC₅₀ for fry of *Cyprinus carpio* was 34% of domestic waste water as reported by Ghosh *et al.*, (1985). Sarker *et al.*, (1993) reported the values as 31-33% in case of fry of *Labeo rohita*. The previous data indicated that the exposed fishes in the present study were more resistant than other species of fishes studied earlier.

The present study also indicates the reaction of domestic sewage water on fishes. Fishes exposed to 70% dilutions (70:30 sewage water: tap water) lost body balance within 5-6 hours for the exposed fishes. The opercular movements of the fishes were reduced and later lethargic movements with frequent surfacing were noticed in the present study.

In 50% dilution, the fishes were lethargic after about 24 hours of exposure. When the fishes were exposed to lower concentration (10%) for sewage water, they remain very much active and behaved normally throughout the study. No notable behavioral changes were observed in this fish when exposed to different concentrations of waste water during the whole study period. The survival rate of *Esomus danricus* was 81% in 5% sewage water concentrations, 75% in 50% sewage water and 55% in case of 90% sewage water concentrations. This shows that *Esomus danricus*, more or less more tolerant than other previously studied species in experimental conditions. In the present study, the control shows about 95% survival rate.



The mean growth increase of *Esomus danricus* recorded were 0.03, 0.021 and 0.05 gram per day in 5%, 50% and 90% sewage water respectively. The mean growth of the control was seen 0.01gm per day. The mean growth increase of *Chanda nama* recorded were 0.01, 0.02 and 0.031 gm per day in 5%, 50% and 90% sewage water respectively Bayoumi and Khalil (1988). The mean growth of the control was seen 0.016 gm per day in case of *Chanda nama* Bayoumi and Khalil (1988). The results showed that the fish production in 90% sewage water was higher in case this fishes, might due to the presence of higher concentrations of organic matters.

These results tally with the observation of Bayoumi and Khalil (1988), and Ghosh et. al., (1988). The fecundity was observed in the present case was 138 ± 0.08 eggs in control, 138 ± 0.08 eggs in 5% sewage water, 103 ± 0.63 eggs in case of 50% sewage water while 79 ± 0.59 eggs in case of 90% sewage water. These results slightly contradict with the earlier observations. Earlier observations showed slight increase of fecundity in sewage water in case of *Oreochromes mossambicus* (Sarkar, et. al., 2000).

The gastrosomatic index (GSI) in this case was 5.75 ± 0.67 in case of control. 5.23 ± 0.09 in case of 5% sewage water, 6.66 ± 0.79 in case of 50% sewage water and 6.18 ± 0.56 in case of 90% sewage water. In this case the GSI remained more or less unchanged in three different experimental conditions in comparison to the control. Therefore, from the present study it was revealed that the target fish shows good growth rate in 90% sewage water but it can survive for considerable days and shows good fecundity in case of medium containing 50% sewage water.

In case of Esomus danricus

	Control 0% Sewage water	5 % Sewage water	50% Sewage water	90% Sewage water
Survivality	$95 \pm 0.61\%$	$81 \pm 0.05\%$	$75 \pm 0.45\%$	$50 \pm 0.34\%$
Growth rate (gm/day)	0.01 ± 0.002	0.03 ± 0.001	0.021 ± 0.002	0.05 ± 0.001
Fecundity (Number of eggs)	138 ± 0.08	67 ± 0.04	103 ± 0.63	79 ± 0.59
GSI	5.75 ± 0.67	5.23 ± 0.09	6.66 ± 0.79	6.18 ± 0.56

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