

Study of Respiratory Behaviour of Fish Catla Catla

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Abstract

The goal of this study was to determine the behavioural effects of Diazinon at sublethal doses on catla catla. Static bioassay testing revealed an LC50 value of 0.004 ml/l for Diazinon over a 96-hour period. For a total of 96 hours, the fish were left out in the open. After being exposed to Diazinon, the resting duration was reduced, opercular movement and air gulping increased, and jerk, threat, and burst swimming behaviours were all enhanced. Pesticide-treated fish had a slow eating response, swam on the water's surface hanging vertically, and dispersed across the aquarium. Fish deaths occurred at concentrations as high as 0.01ml/l. Fish were killed by opening their mouths and bending their midsections. Before they die, fish lie motionless in the aquarium's bottom. Diazinon-treated fish showed fading of their skin's pigmentation. These findings imply that Diazinon at sublethal dosages affects *Labeo rohita's* behaviour and respiration.

Keywords: Behaviour, Root water extract, *Balanites aegyptiaca*, Fish *Catla catla*.

1. INTRODUCTION

In the early phases of shellfish and finfish cultivation, the availability of live food organisms in sufficient quantities is critical. Hatcheries have only used a few types of live feed organisms. Despite the availability of *Artemia nauplii* and rotifers in aquaculture, there is an increasing need for live zooplankton. Zooplankton is a great food source for larval prawns and fish, especially in the early phases of development. Fish, especially fry and fingerlings, like zooplankton as a food source. [1]

Catla also known as the major South Asian carp, is an economically important South Asian Cyprinidae are a family of freshwater fish that includes carp. It is indigenous to the rivers and lakes of northern India, Bangladesh, Myanmar, Nepal, and Pakistan, although it has been introduced and widely farmed elsewhere in South Asia. Bhakura is the name given to it in Nepal and neighbouring Indian territories up to Odisha. An upturned mouth and bulging lower jaw distinguish Catla, a huge and broad-headed fish. Its back is covered in thick, grey scales, while its belly is white. [2]

The mortality rate of heavy metal lead nitrate ($Pb(NO_3)_2$) in freshwater fish *Catla Catla* was examined in the current study. Static and renewable methods of Probit analysis were used to determine the median deadly concentration. According to the results, the median lethal concentration of was 190.56, 181.81, 172.43, and 163.04 mgL⁻¹ for periods of 24 hours, 48 hours, and 72 hours. Hyperactivity, loss of balance, vertical and downward swimming patterns, frequent surfacing activity, convulsion, difficulty breathing, and mucus secretion all over the body are some of the behavioural alterations seen in the experiment. [3]

Meaty flesh, few intramuscular bones, and therapeutic potential make them popular among consumers. These fish are prized for their high nutritional value and are sold in live form because of their ability to survive for long periods of time outside of water. As a result of their fast growth rate, high consumer preferences, lucrative market value and ability to endure unfavourable water conditions they are attractive candidates for freshwater aquaculture productions. The current supply of Striped Murrel seed is sufficient to meet demand. Commercial cultivation of Striped Murrel, on the other hand, is still uncommon due to a lack of seed. [4]

Aquatic toxicology is increasingly incorporating knowledge of fish physiology. Sub-lethal quantities of contaminants in the environment are a key factor affecting how fish respond physiologically. The amount of environmental data amassed up to now is impressive, but we still don't know enough about agrochemicals, the creatures they effect, and the surrounding environmental conditions. To assess a chemical's potential hazard, it is necessary to provide a qualitative and quantitative description of any detrimental toxic effects. [5]

2. LITTRATURE REVIEW

Rajinder Jadhao is the culprit (2021) The study's goal is to find out whether freshwater fish *Catla catla*'s behaviour changes over time. The roots of the tree *Balanites aegyptiaca* were extracted and exposed for 24 to 96 hours. LC results ranged from 1.00mg/l to 13.00mg/l for 50 the prepared concentration after 24, 48, 72, and 96 hours. At this level of concentration, researchers have observed a variety of physiological changes, including a loss of reflexes, gulping of air, erratically swimming, mucus secretion, scaling away of skin, haematoma, jerky movement, leaping out of water, and a thick mucous covering the entire body surface. [6]

Ramakrishna Prasad P, Gopala Rao N, and Sundara Rao G(2021) The common carp, exotic one cultured along with the three Indian major carps when exposed to Deltamethrin of pyrethroid type II, technical grade as well as 11% EC in the laboratory in vivo studies resulted a change in the consumption of oxygen white inspiration of the respiration, a physiological process. The toxic action of the effect of the two toxicants was inferred as changes in the 'life' gas, which will diffuse through the gills. [7]

the two women, Priyanka Kumari and Mmr Nomani, were (2021) It was discovered that the parasites were connected to lamellar tissues in the gills, creating erosions of the epithelium in certain areas. The parasites generated considerable tissue-level effects such as hyperplasia and fusion of neighbouring secondary lamellae in the secondary lamellar epithelium. Other organs in the infected zebrafish showed no signs of alteration. Fish demonstrated growth retardation with severe infestations. Fish parasites can be detected histopathologically, which is an important step in the ongoing surveillance of fish health. *Catla* fingerlings and adults were shown to be more vulnerable than other IMC to this illness. [8]

Tristan J. McArley, Erik Sandblom, and Neill A. Herbert are experts in their respective fields (2021) Hyperoxia is a condition in which the amount of oxygen (O₂) in the blood exceeds the safe level for the environment (i.e. >100% saturation in the air). When fish live in shallow water, they are more susceptible to hyperoxia, which can be caused by photosynthesis or O₂ supplementation in aquaculture. To the best of our knowledge, this review covers all aspects of hyperoxia's impacts on fish, including effects on cardiorespiratory function, acid-base balance, oxidative stress, and overall animal performance (e.g., thermal tolerance and growth). [9]

the two authors, M. Ilavazhahan and R. Tamilselvi (2015) Pathogens (*Pseudomonas putida*), pesticides (Methyl parathion), and metals (Ferrous sulphate) were studied to see how they affected the oxygen consumption of *catla catla* fish (Ham.). The effects of toxicant exposure on fish *cata catla* were investigated for oxygen intake. With increased exposure time, a shift in the oxygen increment was seen. pests of crops and disease-carrying insects, but their incorrect usage in agricultural practises has put human life and the environment at severe risk. [10]

3. TAXONOMY

It used to be thought of as the sole member of the genus *Catla*, however this was a misnomer since *Catla* is actually a synonym for *Gibelion*. Catalog of Fishes relocated this species to *Labeo* in the last several years. Because of their striking likeness, especially in the size of their heads, this species is frequently mistaken for the enormous barb of Southeast Asia.

4. METHODOLOGY

Animal collection and maintenance

Fingerlings of Indian big Carp (*Labeo rohita*) were obtained from the Rankala fish seed growing centre in Kolhapur, Maharashtra (6-7cm in length). After suitable acclimatisation, the fingerlings were moved to a 40-liter glass tank in the lab. The use of aerators in the storage tanks ensured that the air in the tanks was well aerated. Ground nut oil cake feed was used to supplement the fish's diet, which was provided to them twice daily. To avoid ammonia buildup in the aquarium, the holding tank's walls were completely cleaned and excreta was drained off on a daily basis. Before being used in the trials, the fish were conditioned for seven days in a tank. water at the optimum temperature, dissolved oxygen concentration, and pH (6.530.15) throughout the experiment was 24 degrees Celsius with a dissolved oxygen concentration of 4.69 milligrammes per lit. In the present study, only individuals with a total length and weight of 6-7 cm and 82 gramme were included. Diazinon lethal doses of 0.01, 0.008, 0.006, 0.004, 0.002ml/l were administered for exposure periods of 24, 48, 72, and 96 hours, respectively. Respiratory Rate Test: Shivakumar's method of Welsh and Smith (1953) was used to measure the respiratory rate (oxygen intake) of Diazinon-exposed fish (2008). The results are given in millilitres of oxygen consumed per kilogramme of wet fish per hour. The dissolved oxygen concentration in

medium was determined using the 'Winkler's' volumetric method (Anonymous 1995) and the results were expressed as mg.hr-1/fish of oxygen consumed for 1 hour after the test fish were introduced (milligram per hours).

Animal selected

There is a freshwater fish called catla catla that can be found in abundance in India's rivers, lakes, and ponds. This fish is preferred by a large percentage of fish eaters because it is a good source of protein, has tender meat, and has less bones than other varieties. Apart from the fact that it can adapt to laboratory conditions and is appropriate for toxicity investigations, this compound has many other advantages. As a result, this fish was chosen as the study's experimental subject. A total of 1.35 million tonnes of Catla catla was produced and consumed globally in 2006, making it one of India's three most important carps (Anonymous, 2011).

Biology of Catla catla

It's called 'catla' since it belongs to the Cyprinidae family. It's the most expensive edible fish in India, and you can find it wherever. Indian big carp is the best known species and may be found throughout northern and central India. South India's Godavari and Krishna rivers are also known to contain it. Catla catla is a high-protein fish that may be eaten by humans. As a result, this carp has edible fish that is vital to the economy and has a high commercial value.

Procurement and maintenance of fish

We took precautions throughout this experiment because the level of toxicity has been shown to fluctuate depending on the interaction of numerous extrinsic and intrinsic parameters such as temperature, salinity and water hardness. In addition, water from the same source was used to keep the fish healthy. The chosen animals' sizes were likewise closely adhered to throughout the research.

Pesticide Selected

Fipronil is a broad-spectrum insecticide that belongs to the phenylpyrazole chemical family. It disrupts the insect central nervous system by blocking GABA-gated chloride channels and glutamate-gated chloride (GluCl) channels. This causes hyperexcitation of contaminated insects' nerves and muscles. Fipronil's specificity towards insects is believed to be due to its greater affinity to the GABA receptor in insects relative to mammals and its effect on GluCl channels, which do not exist in mammals, (Raymond-Delpech V et.al., (2005) Because of its effectiveness on a large number of pests, fipronil is used as the active ingredient in flea control products for pets and home roach traps as well as field pest control for corn, golf courses, and commercial turf. Its widespread use makes its specific effects the subject of considerable attention. This includes ongoing observations on possible off-target harm to humans or ecosystems as well as the monitoring of resistance development. (Maddison, Jill E.et.al., (2008)).

Broad spectrum pesticides will kill insects indiscriminately, without regard to the species. These type of pesticides include most neonicotinoid, organophosphate, pyrethroid and carbamate insecticides and are identified on the labels of all commercial pesticides. Some broad spectrum pesticides, such as achlorpyrifos, can be effective to use in selectively targeting pests when used in moderation. It's important to consider the impact of using a broad spectrum pesticide on the natural enemies of beneficial insects. If more natural enemies survive, they will help control nuisance species later in the season and limit the amount of pesticides that need to be reapplied. Fipronil has been shown to enter the aquatic environment from agricultural runoff or drift from aerial or ground based spraying applications where they may pose threat to nontarget organism including fishes (Gupta et al. 2012).

Studies on Lethal toxicity

In each experiment, the toxicant stock solution was produced in 100% pure acetone with a Fipronil concentration of 0.1mg/L, and the control group was maintained. Experimental animals were given Fipronil to see if the drug had any deadly effects, and safety precautions were taken to keep the solvent acetone to a minimum. Using the OECD's static renewal approach, the acute toxicity (96-hour LC50) of toxicants tested on the freshwater fish Catla catla was measured in the lab (1998). The test medium containers had a 15-liter capacity, and five containers were utilised for each test, with ten fish being placed into each container. Five duplicates of each concentration of the insecticide Fipronil were used on the fish. 10 fish were utilised for each concentration of the toxicant under test, and 10 more were kept separate in a container along with the experimental group adding pure acetone and used as controls. They were also maintained in a separate container. Water was replaced in the test medium every day for 24 hours with a 5 percent solution of Fipronil SC, and no oxygen was added (aeration). A record of the fish mortality rate was kept, and the dead fish were gathered and disposed of. It was decided to run the toxicity testing for 4 days (96 hours) in static renewal systems to

select the mortality range of 10% to 96%. The median lethal concentration (LC50) and its 95% confidence limits were calculated using Finney Probit analysis (Finney, 1971) as documented by Roberts and Boyce (1972). The Finney Probit Kill theory approach was used to calculate the average values (1971).

The data was subjected to the following statistical equations for at LC50 values.

$$\text{Log LC}_{50} = \frac{\text{Log A} + 50 - a}{b - a \text{Log}^2}$$

Where: A = Concentration of pesticide at 50% mortality

a = Percent kill just below 50% mortality

b = Percent kill just above 50% mortality

5. ANALYSIS

Many non-target organisms, particularly fish, can be affected by pesticide-induced changes in the chemical composition of natural aquatic environments (Adams and Greely, 2000). It was found that fish in the control group had normal operculum movement and mucus production, as well as skin that stayed silvery white throughout the 96-hour experiment. There was an increase in opercular movement and an increase in air jerking due to Diazinon exposure rather than a decrease in rest time. Pesticide-treated fish showed reduced oxygen consumption, slowed feeding, and swam vertically on the water's surface, spreading throughout the aquarium.

Hulya et al. (2006) found behavioural changes similar to those seen in *Oreochromis niloticus* after sublethal exposure to Diazinon. They found that the toxin fenvalerate caused behavioural abnormalities such as a change in swimming technique, loss of equilibrium and an increase in mucus secretion in Indian main carps *Labeo rohita*, *Catla catla* and *Cirrihinus mrigala*. A research by Shahi and Singh (2010) found that *Channa punctatus* exhibited anomalous behaviour when exposed to rutin, taraxerol, or both in varying quantities.

Table-1 Oxygen consumption rate in catla catla to varying concentrations of Diazinon at 96hrs.

Sr. No.	Concentrations (ml/l)	Oxygen consumption rate per fish (mg.h-1)
1	Control	5.65±0.03
2	0.002	4.68±0.03
3	0.004	4.07±0.04
4	0.006	3.05±0.02
5	0.008	3.01±0.04
6	0.01	2.10±0.03

Table-2 Oxygen consumption rate in catla catla of Diazinon after 96hrs

	24hr	SD	48hr	SD	72hr	SD	96hr	SD
Control	5.65	±0.03	5.48	±0.27	5.49	±0.05	4.95	±0.21
24hr	4.51	±0.03	4.2	±0.27	4.47	±0.05	4.17	±0.21
48hr	4.07	±0.03	3.44	±0.03	3.85	±0.08	3.67	±0.25
72hr	3.3	±0.02	3.41	±0.24	3.48	±0.16	2.74	±0.12
96hr	3.1	±0.04	2.79	±0.11	2.7	±0.11	2.42	±0.11

6. CONCLUSION

As an important toxicological method, catla catla is utilised to produce substantial results in the scientific sector and aid in the monitoring of aquatic lower to higher species. Catla catla is employed This review approach may be used in the food chain to relate to humans and aid in the formulation of new ideas and innovations by reputable studies.

7. REFERENCE

1. Abdallah, G.M., El-Sayed,S.M.and Abo-Salem,O.M. 2010. Effect of lead toxicity on coenzyme Q levels in rat tissues. Food Chem. Toxicol., 48: 1753-1756.
2. Rajusing Jadhao(2021),” Behavioural Changes in Freshwater Fish Catla catla exposed to the root water extract of tree Balanites aegyptiaca,” nternational Journal of Life Sciences International Peer Reviewed Open Access Refereed Journal Int. J. of Life Sciences, 2020; 8 (1):183-187 ISSN:2320-7817(p) | 2320-964X(o)
3. Omitoyin, B.O.(2006): Haematological changes in blood of Clarias gariepinus (Burchell 1822) juveniles fed poultry litter. Livestock Res Rural Dev, 18(11)
4. Jalali, B and Molnar, K., 1990: Occurrence of monogeneans on freshwater fishes in Iran: Dactylogyrus spp. on cultured fish. Acta Vet. Hung., 38: 239-242.
5. Ramakrishna Prasad P, Gopala Rao N, and Sundara Rao G(2021),” EFFECT OF DELTAMETHRIN, A SYNTHETIC PYRETHROID ON OXYGEN CONSUMPTION IN THE FISH CYPRINUS CARPIO (COMMON CARP),” International Journal of Recent Scientific Research Vol. 12, Issue, 05 (D), pp. 41823-41830, May, 2021
6. Priyanka Kumari* and M. M. R. Nomani(2021),” Study of Parasitic Effect of Dactylogyrus sp. on Indian Major Carps of Pond Culture in Darbhanga,” International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 10 Number 06 (2021)
7. Tristan J. McArley,Erik Sandblom,Neill A. Herbert,(2021),” Fish and hyperoxia—From cardiorespiratory and biochemical adjustments to aquaculture and ecophysiology implications,” Volume22, Issue2March 2021Pages 324-355
8. M. Ilavazhahan and R. Tamilselvi (2015),” Studies on Oxygen Consumption of the Fish Catla catla (Hamilton) as Influenced by Toxic Synergism,” Toxic Synergism. Biomed Pharmacol J 2012;5(2)
9. Graham R. Scott, Katherine A. Sloman (2004).the effects of environmental pollutants on complex fish behavior: integrating behavioural and physiological indicators of toxicity. Aquatic Toxicology 68:369-392(review).
10. Gupta SK, Pal AK, Sahu NP, Saharan N, Mandal SC, Chandraprakash, Akhtar MS, Prusty AK (2012) Dietary microbial levan ameliorates stress and augments immunity in Cyprinus carpio fry (Linnaeus, 1758) exposed to sublethal toxicity of fipronil. Aquac Res. doi:10.1111/are.12030.
11. Kumar, A., Sharma, B., Pandey, R. S. (2010) Toxicological assessment of pyrethroid insecticides with special reference to cypermethrin and λ-cyhalothrin in freshwater fishes. Int. J.Biol. Med. Res,1: 315-325.
12. Tilak, K.S., Veeraiah, K.and Koteswara Rao. Histopathological changes observed in the Gill, Liver, Brain and Kidney of the Indian Major Carp Cirrhinus mrigala exposed to Chlorphrifos. Res., 24(1):101-111(2005).
13. Tripathi, N.K. Latimer, K. S, and P. M. Rakich. Columnaris disease in freshwater fish Labeo rohita. Compendium on continuing Education for the practicing Veterinarian. 25(7):528-536 (2003).

14. Logoswamy, S. and Remia, K.M. (2009). Impact of cypermethrin and ekalux on respiratory and some biochemical activities of a freshwater fish *Tilapia mossambica*. *Journal of current Biotica*. 3(1): 65-73.
15. Maharajan, A., Usha, R., Paru, P.S., Ruchamani, Vijaya kumar, B.S., Ganapriya, V. and Kumarswamy, P. (2013). Sublethal effects of profenofos on the Indian major carp *Catla catla* Hamilton. *International Journal of Pure and Applied Zoology*. 1(2): 196-204.

