International 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)

Original Article **Open Access**

Behavioural Changes in Freshwater Fish *Catla catla* exposed to the root water extract of tree *Balanites aegyptiaca*

Jadhao RG[1] and Kajalkar RR[2]

[1]Department of Zoology, Shri. Shivaji Science College, Amravati Dist. Amravati
[2]Department of Zoology, MSP Art, Science and KPT Commers College, Manora Tq. Manora Dist. Washim

Manuscript details:

Received: 14.02.2020
Accepted: 25.03.2020
Published: 10.04.2020

Cite this article as:
Jadhao RG and Kajalkar RR (2020) Behavioural Changes in Freshwater Fish *Catla catla* Exposed to the root water extract of tree *Balanites aegyptiaca, Int. J. of. Life Sciences*, Volume 8(1): 183-187.

Available online on
http://www.ijlsci.in
ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

ABSTRACT

The aim of the present study is to determine Behavioural Changes in Freshwater Fish *Catla catla* Exposed to the root water extract of tree *Balanites aegyptiaca* for 24to 96 hours.The LC values of 50 the prepared concentration for 24, 48, 72 and 96 hrs were found at 1.00mg/l to 13.00mg/l respectively. At this concentration, loss of reflex, air gulping, erratic swimming, mucus secretion, loss of scale, haemorrhage, jerky movement, leaping out of water and thick mucous covering over the whole body surface were observed during experiments.

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

INTRODUCTION

Acute aquatic toxicity represents the intrinsic property of a substance to be injurious to an organism in a short-term exposure to that substance. Static acute toxicity tests provide rapidand reproducible concentration-response curves for estimating toxic effects of chemicals on aquatic organisms. With the help of these tests the relative toxicity of large number of chemicals present in the natural aquatic systems due to variety of chemical spills can be determined. There is a vigorous documentation of the use of acute toxicity tests for assessing the potential hazard of chemical contaminants to aquatic organisms (Brack *et al.,* 2002).

Fish physiology is now becoming an integral part of aquatic toxicology. The pollutants in the environment at sub-lethal concentrations are an important variable to which a fish respond physiologically. Although the amount of environmental information collected to date is impressive, there are still gaps in our knowledge of agrochemicals, affected organisms and the related environmental conditions. The qualitative and quantitative description of harmful toxic effects is essential for an evaluation of the potential hazard posed by a particular chemical.

Fishes constitute economically vary important group of animals. The nutritional and medicinal value of fishes has already been recognized (Jhingran, 1982). A number of large artificially constructed fish water impoundments have come into existence in India, especially during last four decades, adding considerably to the already existing rich water potential for the development of the country's fishery resources fish fauna of various reservoirs has been reported by (Sharma *et al.,* 2004).

Mortality is obviously not the only end point to consider and there is growing interest in the development of behavioural markers to assess the lethal effects of toxicants. Abnormal behaviour is one of the most conspicuous endpoints produced by these toxicants, but until recently it has been under used by ecotoxicologists.(Amiard-Triquet, 2009),states that "bridging the gap between early, sensitive responses to stress at the infra-organismal levels and the long-term, ecologically relevant responses at the supra-organismal levels is a challenge for a better assessment of the ecological status of our environment." Behavioural ecotoxicology provides, an approach to observe in aquatic biota at concentrations of contaminants that can exist in the field, the sensitivity of these responses can allow improving environmental risk assessment." Therefore, "to use behavioural biomarkers, associated to biochemical and physiological markers in carefully selected species that are key-species in the structure and functioning of ecosystems because impairments of their responses, used as biomarkers, will reveal a risk of cascading deleterious effects at the community and ecosystem levels." Thus, behaviour can be considered as a promising tool in ecotoxicology.

Fish are ideal sentinels for behavioural assays of various stressors and toxic chemical exposure due to their constant, direct contact with the aquatic environment where chemical exposure occurs over the entire body surface, ecological relevance in any natural systems, ability to come into reproductive readiness and long history of use in behavioural toxicology. The behavioral patterns vary widely with different species of fish and exposure conditions. Fishes exposed to toxicants undergo stress, which is a state of re-established homeostasis, a complex suite of mal-adaptive responses. Fishes in a contaminated environment show some altered behavioural patterns which may include avoidance, locomotors activity and aggression and these may be attempts by the fish to escape or adjust to the stress condition(Gormley *et al.,* 2003). Avoidance and attractance behavior in fish has proven to be an easy and realistic behavioural endpoint of exposure.

Moreover from the past 50 years the utility of avoidance behavior has been demonstrated an indicator of sublethal toxic exposure (Gabriel *et al.,* 2009). Avoidance behavior is a fusion of much behaviour that may culminate in a single endpoint.

MATERIAL AND METHODS

After the test fish were exposed to various concentrations of the root extract, the behavioural responses and the mortality rate of the fish were observed and recorded at the intervals of 24, 48, 72 and 96 hours, for lethal concentration and behavioural response of the fish were observed and recorded at interval of 4days, 8days, 15days and 15days for sub-lethal concentration according to the method. The fish in the control tank were monitored and they served as a reference to the behavioural responses observed in those exposed to the different concentrations of the test tanks. The responses to be observed if any occurred were general activity, hyperactivity, hypoactivity, loss of equilibrium and death of fish. Mortality Observations on mortality rate of *Catla catla* were made at 24, 48, 72 and 96hours. *Catla catla* were considered dead when there were no signs of movement and response to external stimuli. Dead fish were removed immediately to prevent pollution in the tanks that could lead to depletion of dissolved oxygen which will affect the remaining fish adversely.

RESULT AND DISCUSSION

Lethal effects of the root water extract of ***B.aegyptiaca***on the behaviour of the fish ***Catla catla*** at different exposure period (Table). Behavioural and biological responses of ***Catla catla*** to root extract of ***B.aegyptiaca*** are displayed on (Table 1 to Table 4) for lethal test. Behaviour of the control fishes*:* ***Catla catla*** in the control set were normal in behaviour with gentle body movement. They remained active and vigorous throughout the experiments. All the fishes were morphologically and physically well balanced. Their swimming movement, gulping for air, body colour, eyes and fins were normal. No mucus secretion and mortality was observed.

Table 1: Behavioural exposure time- 24 hrs.

Conc. mg/l Behaviours	Control	1	3	5	7	9	11	13
Loss of reflex	-	-	+	+	+	+	+	+
Air gulping	-	-	+	+	+	+	+	+
Erratic swimming	-	-	+	+	+	+	+	+
Mucus secretion	-	-	+	+	+	+	+	+
Loss of scale	-	-	-	-	-	-	+	+
Haemorrhage	-	-	-	-	-	-	-	+

+ = Present**- =** Absent

Table 2: Behavioural exposure time- 48 hrs

Conc. mg/l Behaviours	Control	1	3	5	7	9	11	13
Loss of reflex	-	-	+	+	+	+	+	+
Air gulping	-	-	+	+	+	+	+	+
Erratic swimming	-	-	+	+	+	+	+	+
Mucus secretion	-	-	+	+	+	+	+	+
Loss of scale	-	-	-	-	-	-	+	+
Haemorrhage	-	-	-	-	-	-	+	+

+ = Present**- =** Absen

Table 3: Behavioural exposure time- 72 hrs.

Conc. mg/l Behaviours	Control	1	3	5	7	9	11	13
Loss of reflex	-	-	+	+	+	+	+	+
Air gulping	-	-	+	+	+	+	+	+
Erratic swimming	-	+	+	+	+	+	+	+
Mucus secretion	-	+	+	+	+	+	+	+
Loss of scale	-	-	-	-	-	+	+	+
Haemorrhage	-	-	-	-	-	+	+	+

+ = Present**- =** Absent

Table 4: Behavioural exposure time- 96 hrs.

Conc. mg/l Behaviours	Control	1	3	5	7	9	11	13
Loss of reflex	-	-	+	+	+	+	+	+
Air gulping	-	+	+	+	+	+	+	+
Erratic swimming	-	+	+	+	+	+	+	+
Mucus secretion	-	+	+	+	+	+	+	+
Loss of scale	-	-	-	+	+	+	+	+
Haemorrhage	-	-	-	-	+	+	+	+

+ = Present**- =** Absent

There were loss of reflex at concentration of 3.00 mg/l to 13.00 mg/l in 24hrs, 48hrs, 72hrs and 96hrs respectively. There were air gulping in the concentrations 3.00mg/l to 13.00mg/l within 24hrs, 48hrs, 72hrs while, in 96hrs at the concentration of 1.00mg/l to 13.00mg/l respectively. Erratic swimming occurred at concentration 3.00mg/l to 13.00mg/l in the 24hrs, 48hrs while, in72hrs and 96hrs at 1.00mg/L to 13.00mg/l. There were mucus secretions in the concentrations 3.00mg/l to 13.00mg/l within 24hrs, 48hrs, 72hrs while, in 96hrs at the concentration of 1.00mg/l to 13.00mg/l respectively. In 24hrs, there were losses of scales at concentration 11.00 mg/L to 13.00mg/l, scale loss occurred in 48hrs at concentration of 11.00 mg/L to 13.00mg/l, in 72hrs at 9.00mg/l to 13.00mg/l while, in 96hrs 5.00mg/l to 13.00mg/l loss of scale occurred. There were haemorrhages in 24hrs. at 13.00mg/l concentration, in 48hrs. at 11.00mg/l to 13.00mg/l, in 72hrs at 9.00mg/l to 13.00mg/l while, in 96hrs at 7.00mg/l to 13.00mg/l concentration respectively (Table 1 to Table 4).

In the present study, early behavioural patterns observed in the fish such as erratic swimming, air gulping, loss of reflex starting from 24hrs lower concentration (3.00 mg/l) in lethal effect (Table 1 to Table 4). Mucus secretion starting from 96hrs at concentration 1.00 mg/l for lethal effect (Table 1). Loss of scale and haemorrhage were starting from higher concentration for exposure period, while for 96hrs exposure period it is starting from lower concentration 5.00 mg/l in lethal effect. Jumping to the water surface to gulp air could be traced to two possible causes namely: oxygen depletion as a result of root extract concentration and irritation caused by dermal contact. This causes irritation of gills as well as hampering gaseous exchange. During the experiments the acutely toxicated fishes exhibited high excitability and various abnormal reactions which included jerky movement, quick surfacing, erratic swimming, gulping for air, loss of balance and paralysis

The exposed fishes exhibited violent swimming activities within half an hour of exposure to the toxicant. Gulping activity increased with increased opercular movement. This abnormal behaviour continued for a while. There had been a gradual decrease in the swimming activity with time until the fish appeared calm and then died. The dead fishes with wide mouth openings stiff and floated at an angle of 45 or 90º. Mucus secretion was prominent. Finally most of the dead fishes were found to lie at the bottom of the aquaria. The dead fishes floated at various angles which were also remarkable and mucus secretions were evident over the body observed in the present study. More or less similar types of behaviour were observed in fishes treated with various plant extracts (Latifa *et al.,* 2002).

The effects of *B. aegyptiaca* root water extract on the behaviour of *Catla catla* were studied. The fish used in the study displayed irrational behaviour on the application of the plant (*B. aegyptiaca*) extract to *Catla catla*. These include loss of reflex, erratic swimming, mucus secretion, gulping for air, loss of scales, haemorrhages. This observation agreed with the findings of (Abalaka and Auta, 2010), on *Oreochromis niloticus* exposed to trichloroform. (Omitoyin *et al*., 1999), reported similar observation in *Sarotherodon galilaeus* (Tilapia) fingerlings exposed to piscicidal plant extracts of *Tetrapleura tetraptera*. Also similar report of (Agbon *et al.,* 2002), when Nile tilapia (*Oreochromis niloticus*) was exposed to aqueous extract of dry tobacco dust *(Nicotiana tobaccum*).

Fish *Catla catla* exhibited a range of abnormal behaviours at higher concentrations of the *B. aegyptiaca* extract normally, fish exposed to toxicants exhibit different behavioural changes such similar observation was observed by (Adesina, 2008; Olaifa *et al.,* 2008) that adapt them to the toxin. Here, fish exposed to higher concentrations exhibited toxic reactions that later resulted in death (Omitoyin, 2006).The abnormal behaviour in relation to fish stress included erratic swimming, mucus secretion, gasping for air, loss of scales, haemorrhages. The abnormality observed could be due to nervous disorder to impaired metabolism, but could in addition be due to nervous disorder reported by (Aguigwo, 2002).The stressful and erratic behaviors of the test organism also indicate respiratory impairment probably due to the effect of the chemical on the gills (Okomoda and Ataguba, 2011). Experiment conducted on acute toxicity of glyphosate on *C. gariepinus* fingerlings by (Auta and Ogueji, 2007) reveals several abnormal behaviours such as restlessness, uncoordinated movement, loss of equilibrium, air gulping and staying motionless findings of (Aderolu *et al.,* 2011) who observed similar response on fish subjected to varying toxicants.

CONCLUSION

In the present study, lethal effect of the root water extract of *Balanites aegyptiaca* were toxic to fresh water fish *Catla catla* the behavioral study revealed that, there were loss of reflex, air gulping, erratic swimming, mucus secretions, loss of scales and haemorrhage at different concentration of 1.00 mg/l to 13.00 mg/l in different time intervals for 24hrs, 48hrs, 72hrs and 96hrs respectively.

The various responses were observed in present study and concluded that, various concentrations of the stimulant present in the plant extract showed initial reaction of fish to include swim actively due to the effect on the nervous system; the rapidity of swimming was directly proportional to the concentration of the chemical. The experimental fish in this study are indications that mortality of the exposed fish may have been due to impaired respiratory activity probably due to the effect of the chemical on the gills.

Conflict of Interest

The author declares that there is no conflict of interest.

REFERENCES

Abalaka SE and Auta J (2010) Toxic effects of Aqueous and Ethanolic extracts of *Parkiabiglobosa* pods on *Clarias gariepinus* adults. *World J. Biol. Res.,* 3(1): 9-17.

Aderolu AZ, Aarode OO, Akonu AA and Jimoh WA (2011) The effect of substituting maize with graded level of biscuit waste on growth, nutrient utilisation, carcass composition, haematological parameter and economic performance of African catfish (*Clarias gariepinus*). *Journal of Natural Science, Engineering and Technology*10(2): 111-120.

Adesina BT (2008) Toxicity of *Moringa oleifera* (Lam.) extract to *Oreochromis niloticus* fingerlings and juveniles. PhD Thesis, University of Ibadan, Nigeria. 272pp.

Agbon, A. O., Omoniyi, I. T. and Teko, A. A. (2002): Acute toxicity of tobacco (*Nicotiana tobaccum*). Leaf dust on *(Oreochromis niloticus)* and Haematological changes resulting from sublethal exposure*. Journal of Aquatic Sciences 17(1): 5-8.*

Aguigwo JN (2002): The Toxic Effect of Cymbush Pesticide on growth and survival of African catfish, *Clarias gariepinus* (Burchell, 1822). *J. Aquat. Sci*. 17(2): 81-84.

Amiard-Triquet C (2009) Behavioural disturbences: The missing link between suborganismal and supraorganismal responses to stress? Prospects Based on aquatic research. Human and Ecological Risk Assessment 15: 87–110.

Auta J and Ogueji EO (2007) Acute Toxicity and behavioural effects of chlorpyrifos-Ethyl pesticide to juvienile of *Clarias gariepinus* Teugels. *Procceeding, 22nd Annual Comferenceof Fisheries Society of Nigeria (FISON) held at School of Nursing, Birnin Kebbi, 12th -16thNovember, 2007.* 264-272.

Brack W, Schirmer K, Kind T, Schrader S, Schuurmann G, Rack W, Schirmer K, Kind T, Schrader S, Schuurmann G (2002) Effect directed fractionation and identi irected fractionation and identification of cytochrome P450A-inducing halogenated aromatic cation of cytochrome P450A-inducing halogenated aromatic hydrocarbons in contaminated sediment. Environ. Toxicol. Chem hydrocarbons in contaminated sediment.*Environ. Toxicol.Chem*. 21, 2654-2662. 1, 2654-2662

Gabriel UU, Obomanu FG and Edori OS (2009) Haematology,plasma enzymes and organ indices of *Clarias gariepinus*after intramuscular injection with aqueous leaves extracts of*Lepidagathis alopecuroides*. *Afr. J. Biochem. Res.*, 3(9) : 312-316.

Gormley KL and Teather KL (2003) Developmental, behavioral, and reproductive effects experienced by Japanese medaka (*Oryzias latipes)* in response to short-term exposure to endosulfan. Ecotoxicology and Environmental Safety, 54: 330–338.

Jhingran VG (1982) Fish and Fisheries of India. Hindustan Pub.Corporation India.

Latifa GA, Hamid A and Sharma G (2002) Study of piscicidal activity of dry bark of *Diospyro sebenun* (Koen) on *Heteropneustes fossilis* (Bloch) and *Anabas testudineus* (Bloch).*Bangladesh J. Life. Sc.* 14(1 and 2): 107-118.

Okomoda VT and Ataguba GA (2011) Bloodglucose response of *Clarias gariepinu s*exposed to acute concentrations of glyphosate-isopropyl ammonium (Sunsate®).*Journal of Agricultural and VeterinarySciences*.3(6): 69-75.

Olaifa, FE, Hamzat RA and Oyetoyan OO (2008) Acute toxicity of ethanol extracts of cocoa bean shell on *Sarotherod ongalilaeus* juveniles. *Journal of Fisheries International*.3: 56-60.

Omitoyin BO, Ogunsami AO and Adesina BT (1999) Studies on acute toxicity of Piscicidal plant extracts (*Tetrapleura tetraptera*) on tilapia (*Sarotherodon gailiaeus*) fingerlings. Trop. *J. Anim. Sci*., 2(2): 191- 197.

Omitoyin, B.O.(2006): Haematological changes in blood of *Clarias gariepinus* (Burchell 1822) juveniles fed poultry litter. Livestock Res Rural Dev, 18(11)

Sharma Archana, Mudgal LK, Sharma Anajana, Sharma Shailendra (2004) Fish diversity of Yashwant Sagar reservoir, Indore (M.P.), *Him. J. Environ. Zool.*, 18(2): 117-119.