International Journal of Basic and Applied Biology
p-ISSN: 2394-5820, e-ISSN: 2349-5839, Volume 6, Issue 3; July-September, 2019, pp. 204-206

http://www.krishisanskriti.org/Publication.html

Heavy Metal Bioaccumulation in *Duttaphrynus Melanostictus* Tadpoles from Two different Types of Wetlands in Cachar District, Assam

Henashree Sharma[1] and Mithra Dey[2]

[1]Research Scholar, Assam University
[2]Professor, Assam University
E-mail: [1]henashrees@gmail.com, [2]mithradey@gmail.com

Abstract—*Amphibians are key indicators of the overall quality of habitat; they are important biomonitors and indicators of ecosystem health. Tadpoles are particularly sensitive to environmental fluctuations and are influenced by various factors. Considering the global concern for the rapid decline of Amphibian population, a growing number of studies have focused on anuran larval stages. In this study investigations were made on the heavy metal bioaccumulation of Chromium, Copper, Lead, Nickel and Zinc in the tadpoles of Duttaphrynus melanostictus from Phulbari anua (Oxbow lake) and Barkinagar (Floodplain Marsh). Heavy metal bioaccumulation of water and sediment were also studied. From this study we came to know that Nickel content is high in tadpole body i.ie 2.875 and 1.937, in water 0.405 and 0.601 and 4.355 and 4.881 in sediment samples in both Phulbari and Bariknagar respectively. This may be due to the pipings and fittings in the waterbodies and also due to dissolution of metal from rocks.*

Introduction

Anura is an order of the class Amphibia that includes frogs and toads. Worldwide, there are around 5,280 species currently described in the order. Anuran survey in northeast India is far from complete due to inaccessible terrain/habitats of anurans. Ecologically the anurans are an important group because of their biphasic life style, high sensitivity to environmental changes, their position in the food web, being a prey as well as a predator, and their widespread distribution. Anuran ecology has received a great deal of attention in other parts of the world, especially in the temperate region. A growing number of studies provide many information regarding larval stages and tadpole studies. Some of the heavy metals are widely distributed in aquatic reservoirs in many parts of the world. Metal pollution is a major problem because of their toxicity, their persistence and their tendency to accumulate in organisms and undergo food-chain amplification. Heavy metal pollution plays an important role in global biodiversity decline. However, there is paucity of information concerning the effects of metals on amphibians. (Singh et al 2016). The objective of the study was to estimate the levels of heavy metals; chromium, copper, lead, nickel and zinc in tadpoles of *Duttaphrynus melanostictus* in two different types of wetlands in Cachar district, Assam.

Materials and Methods

Study Site

Phulbari anua is an oxbow lake in Silchar, Assam with an area of 119.9 ha with longitude $90^0$41”E and latitude $24^0$51”N.

Bariknagar is a floodplain area situated near Silchar, South of Assam. This site is located near a brick kiln. Its longitude is $92^0$47”E and latitude $24^0$45”N.

Method of Analysis

Water: For estimation of heavy metals in water, 500mL of water sample (pre acidified) was filtered and subjected to nitric acid digestion. For digestion, 5mL of 6NHNO_3 was added to 50mL of the sample followed by heating to slow boil till the digestion completes which was indicated by a light coloured clear solution. The digested samples were used for metal estimation using atomic absorption spectrophotometer (EC 4100) as per [1].

Sediment: Sediment samples was dried at 40^0C in the oven, ground and passed through mesh sieves (2mm pore size). 10 gm of the dried sample was digested with 40mL of acid mixture (HNO_3: H_2SO_4::3:1) for half an hour, and the samples were cooled, decanted and filtered at room temperature. Distilled water was added to bring the solution to 50mL which was used for heavy metal determination by atomic absorption spectrophotometer (EC 4100) as per [1].

Tadpole: Tadpoles were collected, washed and dried to reach constant weight. Digestion of tadpole was done. To each sample (0.1g), 10mL of perchloric acid and Concentrated HNO_3 was added and the mixture was heated at 60^0 until a clear solution is formed. The resulting solutions were cooled and the volume was made up to 50mL using double distilled water. The samples were then stored in plastic bottles until analysis. The sample was used for estimation of heavy metal concentration with atomic absorption spectrophotometer.

Results and Discussion:

Table1: Heavy metal Concentrations (ppm) in Phulbari anua.

Sample	Cr	Cu	Pb	Ni	Zn
Tadpole	0.453 ± 0.108	0.438 ± 0.038	0.450 ± 0.045	2.875 ± 0.165	0.602 ± 0.012
Water	0.054 ± 0.006	0.030 ± 0.007	0.259 ± 0.057	0.405 ± 0.009	0.188 ± 0.013
Sediment	0.688 ± 0.053	0.258 ± 0.043	0.862 ± 0.053	4.355 ± 0.594	0.895 ± 0.014

Table2: Heavy metal Concentration (ppm) in Bariknagar.

Sample	Cr	Cu	Pb	Ni	Zn
Tadpole	0.545 ± 0.095	0.637 ± 0.055	0.437 ± 0.039	1.937 ± 0.061	0.307 ± 0.033
Water	0.064 ± 0.006	0.049 ± 0.002	0.292 ± 0.046	0.601 ± 0.015	0.244 ± 0.023
Sediment	0.782 ± 0.034	0.353 ± 0.08	0.690 ± 0.025	4.881 ± 0.086	0.748 ± 0.034

The heavy metal concentration of Cr and Cu in tadpoles was higher in the samples from Bariknagar in comparison to the samples from Phulbari anua. Pb, Ni and Zn accumulation in the tadpoles were higher in the samples from Phulbari anua.

The metal accumulation of the water samples were higher in Bariknagar in the sequence of Ni>Pb>Zn>Cr>cu.

And for the sediment samples concentration of Cr, Cu and Ni were higher in Bariknagar and that of Pb and Zn were higher in Phulbari anua.

Nickel is found to have the highest accumulation in many of the samples comparing to the other heavy metals.

The Bioaccumulation factor was calculated according to the formula

$$BAF = \frac{Concentration\ of\ heavy\ metal\ in\ tadpole}{Concentration\ of\ heavy\ metal\ in\ abiotic\ media\ (water\ and\ sediment)}$$

Table 3: Bioaccumulation factors of heavy metals in tadpoles from Phulbari anua

BAF	Cr	Cu	Pb	Ni	Zn
Tadpole/ Water	8.38	14.6	1.73	7.09	3.2
Tadpole/ Sediment	0.65	1.69	0.52	0.66	0.67

Table 4: Bioaccumulation factors of heavy metals in tadpoles from Bariknagar

BAF	Cr	Cu	Pb	Ni	Zn
Tadpole/ Water	8.51	13	1.49	3.2	1.25
Tadpole/ Sediment	0.69	1.8	0.63	0.39	0.41

The results of Bioaccumulation factor from Phulbari anua shows that tadpole/water were greater than that of tadpole/sediment for all the heavy metals in the sequence Cu>Cr>Ni>Zn>Pb. That means the tadpoles' bioaccumulate these heavy metals from the water in which they are found.

In Bariknagar the Bioaccumulation factor of Cr, Pb, Ni and Zn were higher in tadpole/water and only for Cu the Bioaccumulation factor was high in that of tadpole/sediment.

The present study concludes that tadpoles can be considered a good bioindicator for heavy metal contamination in waterbodies. The sources of heavy metals in waterbodies are disposal of waste, agricultural drainage water, domestic sewage, fitting of pipes for water supply purposes and dissolution of metals from rocks. We should take up measures and spread awareness to stop disposal in the waterbodies and keep it clean. Regular monitoring is also recommended.

Acknowledgements:

The authors are grateful to the Government of Manipur, Directorate of Environment, Porompat, Imphal for allowing the use of AAS. The authors are also grateful to the Department of Ecology and Environmental Science, Assam University, Silchar where the work was done.

References:

[1] APHA, "Standard methods for the examination of water and waste water analysis", 21st ed. Washington DC, 2005.

[2] Barron, M. G., "Bioaccumulation and concentration in aquatic organisms", In: Hoffman, D. J., Rattner, B. A., Burton, Jr., G. A., Cairns, J. (Eds.), Handbook of Ecotoxicology, Lewis Publishers, Boca Raton, 1995, pp.652- 666.

[3] Barron, M.G., and Woodburn, K. B., "Ecotoxicology of chlorpyrifos", Rev Environ *Contam Toxicol*, 1995, 144: 1- 93.

[4] Das, A., Chetia, M., Dutta, S. K.., and Sengupta,,S. A., "New species of *Duttaphrynus* (Anura : Bufonidae) from Northeast India". *Zootaxa*, 2013.

[5] Dutta, S. K., "Amphibians of India and Sri Lanka", *Odyssey Publising House, Bhubaneshwar*, 1997, pp. 22.

[6] Flyaks, N.L.L., and Borkin, L.J., "Morphological abnormalities and heavy metal concentrations in anurans of contaminated areas, Eastern Ukraine", Applied Herpetology, 2004, 1: 229-264.

[7] Hayes, T.B., Falso, P., Gallipeau, S. and Stice, M., "The cause of global amphibian declines: a developmental endocrinologist's perspective", *J. Exp. Biol*., 2010, 213: 921- 933.

[8] IUCN, "IUCN Redlist of Threatened Species", Verion, 2013,1.

[9] Kar, D. "Wetlands, Rivers, Fish, Plankton Resources and Fish disease and aquaculture in North East India: An Overview", 2016.

[10] National Wetland Atlas, Assam. SAC/RESA/AFEG/NWIA/ATLAS/18/2010, Space Applications Centre (ISRO), Ahmedabad, India, pp. 174.
[11] Singh, et.al., "Bioaccumulation of heavy metals in anuran tadpoles: A study in Barak Valley, Assam", *International Journal of Aquatic Biology*, 2016, 4(3): 171-178.
[12] Singh, P., Dey, M., and Ramanujam, S. N., "A Study on Bioaccumulation of Heavy Metals in two Anuran Tadpoles: Clinotarsus alticola and Leptobrachium smithi from Rosekandy Tea Estate, Cachar, Assam", Curr World Environ, 2016; 11(1).