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Research Paper Zoology

Evaluation of Toxic Effects of Pollutants on Scales of Fish *Catla Catla* (Hamilton-Buchanan) From Harike Wetland

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ABSTRACT

Harike wetland is an internationally important aquatic ecosystem. It is the main source of drinking, irrigation, natural fertilization of fields, fishing and navigation. It also supports valuable flora and fauna. It continuously receives waste water discharge from agricultural, sewage and industrial sources. The present study aimed to evaluate deleterious effect of pollutants on scales of fish Catla catla through Scanning Electron Microscopy. The obtained results revealed that abundant pollution cause calcareous damage in the scale structure. Uprooted lepidonts and broken circuli were observed in the anterior part of the scale resulted in loosening of scale from fish body.

KEYWORDS : Harike wetland, Pollution, Scale, Lepidonts.

Introduction

Major adverse effects on environmental quality, ecosystem integrity and human health have often been associated with mismanagement of chemical materials and the eliminations of hazardous substances. Contamination of aquatic ecosystem with heavy metal is one of the biggest environmental concerns (Agrahari, 2009). Heavy metals reach to the aquatic environment from natural and anthropogenic sources and distributed in the water bodies, suspended solids and sediments during the course of their transportation (Olajire and Imeokparia, 2001; Ahmed and Siddiqui, 2007; Aderinola et al. 2009). These heavy metals accumulate within the bodies of aquatic organisms. The growth, osmoregulation, sexual maturation and reproduction of fish are affected by exposure to these metals (Kim et al. 2004; Jezierska and Witeska, 2006; Dietrich et al. 2011).

Fishes constitutes major components of most aquatic habitats acting as bio-indicator of heavy metal levels in aquatic environment. They have been recognized as good bio-accumulators of organic and inorganic pollutants (King and Jonathan, 2003). Although several adverse effects of pollution have already been known, exposure to heavy metals is increasing in many parts of the world, particularly in developing countries (Jarup, 2010). An increase of metal toxicity and its bio-accumulation in various tissues of aquatic organisms threatens the biodiversity of ecosystems and health of consumers (Adeniyi et al. 2008; Vinodhini and Narayanan, 2008; George et al. 2011).

The earlier studies related to the effects of heavy metal pollutants (Jindal and Sharma, 2011; Kaur and Dua, 2012) have indicated the effect of waste water on scales and chromatophores on freshwater fish *Channa punctatus* from Tung Dhab drain and observed significant alterations in scale structure and dispersal of chromatophores. Due to rapid industrialization and urbanization, a negative impact is exerted on highly productive Harike wetland. The present studies take into account the deleterious effects of pollutants on scale structure of fish *Catla catla* (Hamilton-Buchanan) and enabling them pollution indicator at Harike wetland.

Study area

The present study was carried out in internationally important manmade Harike wetland. This wetland ecosystem rich in aquatic flora and fauna with a rich genetic pool spreads into three districts Ferozpur, Tarn Taran and Kapurthala in Punjab, India. It was created in 1953 by the construction of a barrage at the confluence of the Sutlej and Beas rivers. Harike wetland was declared a wildlife sanctuary in 1982. Considered a wetland of international importance and it was included in the list of Ramsar sites in 1990. It is located between latitudes 31°13'N and longitudes 75°12'E and covers an area of 41 sq. km (Fig.1).

Material and Methods

The scales of fish were removed with the help of forceps from the second row above the lateral line and below the dorsal fin on the spot from the collection site. The scales were cleaned with distilled water and mucous left on the scale is completely removed by rubbing between finger tips. The cleaned and air dried scales were mounted on the carbon stubs with the help of double adhesive tape, keeping the dorsal surface of scale upwards and ventral surface sticking to the tape. Scales were sputter coated with a thin layer of gold to make the surface of scale conductive in gold coating unit. The scale specimens were studied under vacuum using JEOL JSM-6610LV scanning electron microscope at an accelerating voltage of 20kv.

Result and Discussion

The normal scale of fish *Catla catla* consists of circuli which bear pointed tooth like lepidonts in the anterior part of scale. These lepidonts are regularly placed in deep sockets on the circuli (Fig.2).

Various alterations were observed in scale structure of fish taken from Harike wetland by employing Scanning Electron Microscopic technique. The pollutants present in water have adverse effect on scale structure resulted in uprooting of lepidonts from their point of attachment to circuli in rows (Fig.3). Circuli were broken and disorganized (Fig.4). At some places the damage was so prominent that not only individual lepidonts was uprooted but whole row of lepidonts were sloughed off from the circuli (Fig.5) and this might result in the loosening of the scale from the body of the fish. Thus on the basis of present studies, it is demonstrated that due the damaged calcareous structure, fish scale can be considered as pollution indicator in the waters of Harike wetland.

Several past studies investigated metal accumulation and its distribution in organs of fishes, which resulted in impaired respiratory and osmoregulatory functions through structural damage to gill epithelium (Heath, 1991, Handy, 1992) changes in intestine epithelia (Giari et al. 2007; Isani et al. 2009). Cd and Pb accumulation in liver (Lange et al. 2002; Vetillard and Bailhache, 2005). Adverse effect of Cd and Pb on the scale structure of Cyprinus carpio, Tilapia nilotica and Atlantic cod fish have been recorded (Rishi and Jain, 1998; Rashed, 1999; Basu et al. 2007).

Similar observations of damaged scale structure and altered elemental composition of the fish scale were reveled (Dua and Gupta, 2005; Brraich and Jangu, 2012; Brraich and Jangu, 2013, Jangu and Brraich, 2014). Therefore, the purpose of present study was to investigate the bioaccumulation and adverse effect of pollutants on the fish scale in the internationally important Harike wetland where the pollution increase at an alarming level.

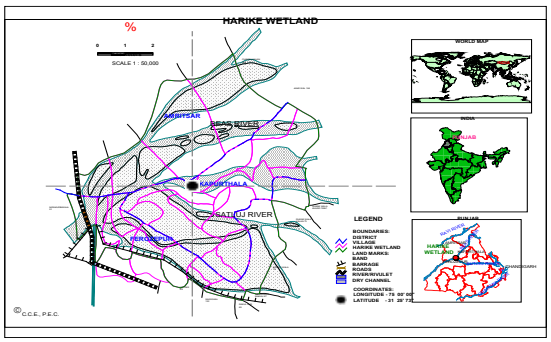


Fig. 1: Map showing the location of Harike wetland.



Fig.2: Scanning electron micrograph of scale of *Catla catla* taken as control showing regularly placed lepidonts on circuli.

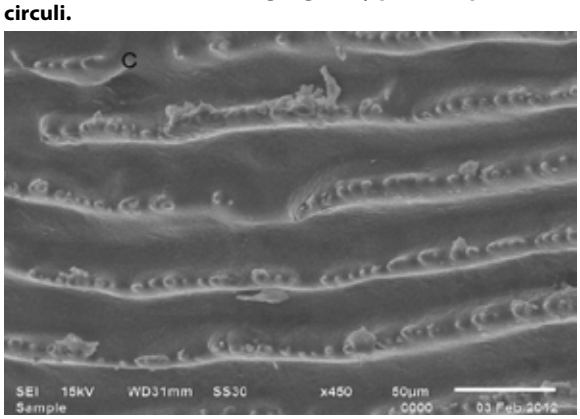


Fig.3: Scanning electron micrograph of scale of *Catla catla* showing uprooted lepidonts from circuli.

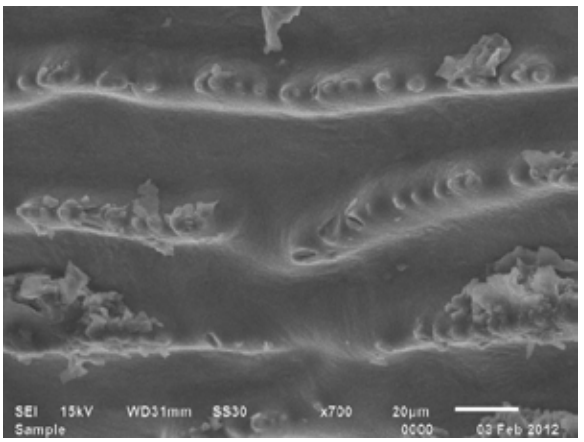


Fig.4: Breakage and disorganized circuli in the anterior portion of scale of *Catla catla*.

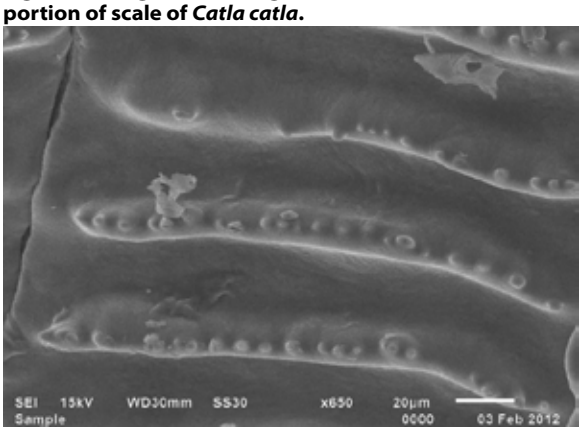


Fig.5: Individual displacement of lepidonts and whole row sloughed off in the scale of *Catla catla*.

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