STUDY ON THE FISH DIVERSITY AND DISTRIBUTION OF CHROMATOPHORES IN SOME FISHES INHABITING MANAWAR TAWI, RAJOURI (J&K)

Abstract:

The present study on fish diversity fromManawarTawi, Rajouri (J&K) was carried out for the period of three months from September 2023 to November 2023. Fishes are very important from biodiversity point of view. Therefore, during the present survey, total six fish species belonging to five genera and two families were collected andidentified in this region. Also the distribution of different chromatophores was studied in the fish *Labeoboga.*

ADD IMPORTANCE OF PRESENT INVESTIGATION AND PROCEDURES FOLLOWED TO STUDY IN BRIEF

Keywords: Diversity, ManawarTawi, freshwater, Chromatophores

Introduction:

India is rich in biodiversity which is reflected in its fish diversity, there are 3231 species of fishes of which 2443 are marine fishes and 788 are fresh water fish spices. India is home to around 10% fish species of the world(Gopi and Mishra, 2015 and Jena et al. 2023). Fishes are one of the most important components of aquatic ecosystem as the help in maintaining the ecological balance, fishes are also the indicator of aquatic health. For human beings it is an essential source of nutrition and an important part of our diet. Moreover, it is critical in sustaining national and rural incomes throughout the world. Biodiversity affects the capacity of living systems to respond to changes in the environment and is essential for providing goods and services from ecosystems nutrient cycling and clean water (Rahbek and Colwell,2011)

Further, fishes show various morphological features including different pigment patterns. The striking beauty and diversity of colour patterns attract the biologists also. Colour patterns are the traits that emerge during post embryonic development. The cellular interactions involved in formation of colour patterns serve as a signal in social behaviour, ability of changing their body colour i.e. camouflage, mimicry and sexual behaviour (Healey, 1999 and Fujii, 2000). The nature's aim in imparting versatile colours to fishes is to facilitate

their survival and act as a mode of communication (Younis and Ajai, 2013). Colouration is displayed in beautiful patterns that are made up of several pigments as well as many nanostructures which provide various colours in skin and appendages. The countless colours and patterns shown by fishes are through genetic mechanism.

Chromatophores not only help in colour generation but also brings about the change in colour of surface coat. Within chromatophores, two types of colours are used- pigment colours and structural colours (Malek, 2008). Pigment colours generate colour by partial absorption and complementary partial reflection of incoming light while structural colours use crystalline structures to generate colours by scattering. The colour of chromatophores depends on the light absorbance of pigments or phenomena of interference based on light reflecting substances (Bagnara and Hadley, 1973;Fujii, 2000). The colour of fish skin is dependent on chromatophores such as melanophores (brown or black), xanthophore (yellow), erythrophore (red), cyanophore (blue), leucophore (white) and iridophore and guanophore (contain guanine that reflect iridescent colour and metallic hues). Fishes develop several chromatophores which produce different colours. In fishes, colour patterns arise as patches of chromatophores found in hypodermis of body and epidermis of scales and fins.

The vast variety of colour in fishes is an important part of life of fish and the colouration and pattern mainly depends on the chromatophores present inside the body of fish. Since, there is less study done on chromatophores of fishes but now it's being a topic of interest. In the Union Territory ofJammu and Kashmir, there is less study done on chromatophores in fishes. A study in seasonal variations in chromatophore Index in fish *Puntius sophore* from Jammu water bodies has been done by Kant et al., (2016) from University of Jammu.

Keeping this in mind the present research work has been designed to study the biodiversity of fishes as the fishes in these areas are under threat due to anthropogenic activities such as overfishing and pollution hence another strongly recommend practical conservation action plan to prevent the loss of fish diversity and to elucidate the structure and arrangement of chromatophores in *Labeoboga* fish of river named ManawarTawi located in Rajouri District (J&K), This study will help us to tell about the different species and their habibat and also the importance of chromatophores in life of fishes and how the colouration in fishes depends on the variety of factors.

Material and methods:

Collection of Fishes: To collect the fishes, cast net or throw net was used in the river which named ManawarTawilocated in Rajouri district.(ADD ManawarTawi River/Coordinates

33.5707° N, 74.3384° E)

It is a circular net having small weights distributed around its edges. The net is cast or thrown by hand in such a manner that it spreads out while it's in the air before it sinks into the water. After casting, the fisherman upturned the stones of river in the area blanketed with net and fishes got caught in peripheral pockets of the net. The collected fishes were placed in separate buckets containing water and were brought to the laboratory for identification. We collected six species of fishes from which the fish named *Labeoboga* also studied for the chromatophores.

Preservation: Collected fishes were preserved in 10% formalin for identification. The fishes on the basis of their morphometric, meristic and diagnostic characters were identified.

Procedure for Analysis of Chromatophores: The scales of fish were removed with the help of fine forceps and were Immediately transferred into the glass petri dishes which contain 0.7% NaCl. Later on, the scales which were put into the slides were kept on the slide to study the chromatophore under the microscope. Photography: The chromatophores were observed under compound microscope and while observing the scales under the microscopes under 10X magnification, photographs were captured by Nikon camera.

Observation and Discussion:

In the present investigation, total of 6 fish species belonging to 5 genera, 5 species and 2 families were collected and identified. The fishes were identified as *Puntius conchonius, Garagotyla, Tor putitora, Onocorhychus mykiss, Barilliusvagra, Labeoboga*. Out of whichOnocorhychus*mykissbelonged*to familysalmonidaewhileothersbelongto family cyprinidae and order cypriniformes(Table 1, Fig. 3,4,5,6,7,8and 9). The family cyprinidae was observed as the most abundantdue tothefactthatitsmembersarefastgrowing,pollutiontolerantandmostculturable.Similar resultswerefoundbyDassandNath(1966&1971);Malhotra *etal*(1975);DuttaandMalhotra(1984);DuttaandKour(2005);Dutta*eta*.(2001, 2002 a & b; 2003 & 2006); Dutta (2003); Dutta and Fayaz (2003); Kaur (2006); Bhakta and

Bandyopadhaya (2008); Nagabhushan and Hosetti (2010); Patra *et al* (2011); Shukla and Singh (2013) and Baro *et al* (2014)

However, possibility of anthropogenic pressure and harsh winter conditions influencing the faunal elements could not be ruled out. As in winter season fish tend to slowdownandgenerallyneedlessfoodtosupportthemselves.Fromthestudyitwas concluded that the status of diversity of fishes shows a marked decline in fish diversity as well as richness as compared to the previous work done on the same river.Thisisreallyalarmingsituationwhichneedsimmediateattentionthatweshould safeguard the highly esteemed fishes for future generation. It is not exactly possible to calculatedecliningrateinthefishdiversity,butthisreportwouldserveasareferencedata for future evaluation.

Further, distribution of the chromatophores was studied in fish named *Labeoboga*which was collectedwithotherfishesfromsamesamplingsite(ManawarTawi)inRajouridistrictof J&K. The fish belong to class Actinopterygii and order Cypriniformes. The fishishavingcycloidscales.Thesescalesaresmoothedged,thin,large,roundorovaland arranged in overlapping pattern. The middle part of scale which develops initially in cycloid scale is called focus. These scales help in protection of themselves and form an interestingpatternonthefishbody.Afterobservingthescalesundermicroscope,themost abundant chromatophores were observed in *L. boga*.Chromatophores are large and stellate cells that derive from the neural crest (Kelsh et al., 1996, Helen et al., 2016).It was also observed that different regions of body have different quantity of chromatophores i.e., the number of chromatophores varies within the body of fish. The difference in the number of chromatophores is due to different genetic makeup of different species.

Maximumnumberofchromatophoreswerefoundinbodyandanteriorregionof*L. boga*. Chromatophores were also observed in two different states-either in dispersed phase or concentrated phase. Thedispersedchromatophoreswereobservedasdendriticshapedcells in different species. The concentrated chromatophores were seen in dorsal region and dispersed chromatophores were seen in the posterior region of *L. boga*. Later it was concludedthatconcentratedchromatophoresgavelightbodycolourtothefishbodyand dispersedchromatophoresgavedarkbodycolourtothefishbody.Thepigmentdispersion increases body pigmentation and pigment aggregation decreases the body pigmentation

(Fuji and Oshima, 1994).

Thereasonbehindoccurrenceoftwophasesofchromatophores-concentratedand dispersedisduetoseasonalvariationandotherisfishadaptabilitytodifferentbackgrounds. Fishes change their colour frequently and this colour change occurs many times in a year as there are many changes in season during year. This was reported by Kant *et al*. (2016) whentheyworkedonseasonalvariationsinchromatophoreindexinfish,*Puntiussophore*duringm onsoonseasonasinmonsoon,thereoccurslotsofrain andfloods andduetothis the chromatophores starts concentrating in scales of fishes and hence the density of chromatophores increases. Light intensity is also responsible for the changes in colour of fish body.

Auerswald *et al*. (2008) and Miner *et al*. (2000) reported that fish colouration is different in different seasons due to background colouration and light intensity. The chromogenic colour changes in freshwater fish, *channagachua*, *Ophiocephalusgachua*wasreportedbyDixit(2016)andshowedthatvariationinenvironmentpla ysanimportant role in pattern development and colouration of body also. Due to change in background,
notonlybodycolourchangesbutsomechangeoccursintheeyecolourationalso.Different types of chromatophores were observed in *Labeoboga*during the present study (Fig. 9 a,b,c). These were melanophores (black or brown), xanthophores (yellow orange) erythrophores (red) and iridophores (reflective or iridescent).

In*Labeoboga*melanophoreswerefound
inhead,body,andcaudalregion.Themelanophorescontainpigmentmelaninwhichgives blackorbrowncolourtobody.Themelanophoreshavemelaninpresentinorganellecalled melanosomes.Thepigmentmelaninissynthesizedfromaminoacid,*L-Tyrosine*(Fujiiand Oshima, 1994).

Theerythrophoreswerealsoobserved.Theyaremainlyredorangecarotenoidsare termed erythrophores.Containing pteridine and carotenoids are sometimes found in the same cell, in which case the overall colour depends on the ratio of red colour pigment. In head region they found in dendritic shape in *L. boga*because granules are spread in cytoplasmic processes.

Xanthophores were also seen in body and caudal regions of *L. boga*. They give

yellowish or orange colour to the body. These chromatophores generate pteridines from guanine triphosphate and possess supplemental biochemical pathways that accumulate yellow pigment.

The iridophores were also observed in *Labeoboga*Iridophores are iridescent pigment cells and they function by reflection and scattering of light from reflecting platelets. These platelets are arranged in stacks. The reason of colouration is due to deposition of crystals of purine, guanine and hypoxanthine.

Hence, it was concluded from the study that chromatophores are responsible for the fascinating colouration and patterns of the fishes and it may get affected due to adaptation of fishes and the seasonal changes or environmental changes. Less work has been done on the chromatophoresoffishesbutitisquiteevidentthatthestudymainlyaimedatthecolourpattern of fishes collected from River named ManawarTawi in Rajouri District of Jammu and Kashmir.

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S.No.	Family	Scientific name
1	Cyprinidae	*Puntius conchonius*
2	Cyprinidae	*Garagotylagotyla*
3	Cyprinidae	*Torputitora*
4	Salmonidae	*Oncorchyncus mykiss*(Rainbow trout)
5	Cyprinidae	*Bariliusvagra*
6	Cyprinidae	*Labeoboga*

Table 1: Fish diversity in ManawarTawi, Rajouri (J&K)

Fig. 1 View of ManawarTawiFig. 2 Fish catch using cast net

Fig. 3 ***Puntius conchonius***

Fig. 4*Garagotylagotyla*

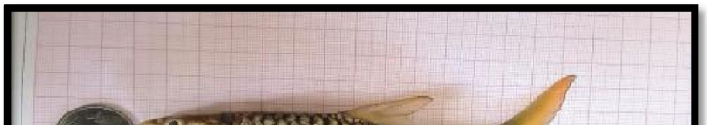

Fig. 5*Torputitora*

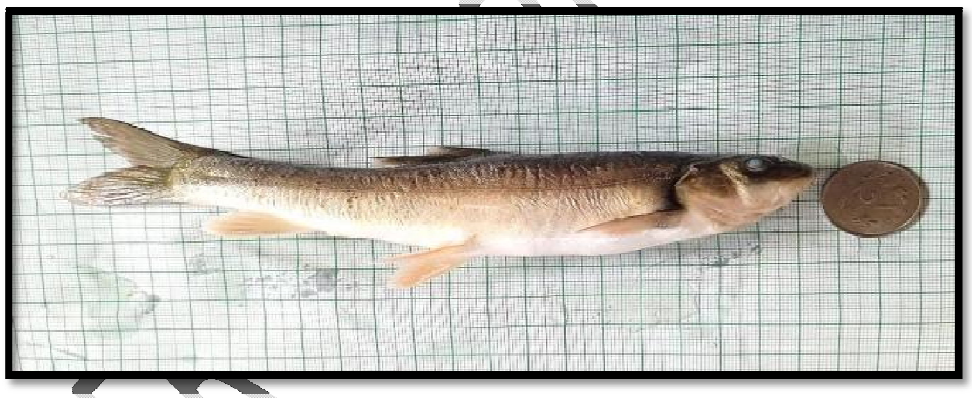

Fig. 6*Oncorchyncus mykiss(Rainbow trout)*

Fig. 7*Bariliusvagra*

Fig. 8*Labeoboga*

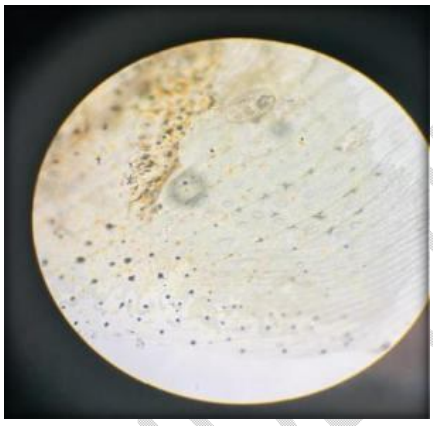

Fig.9 (a)

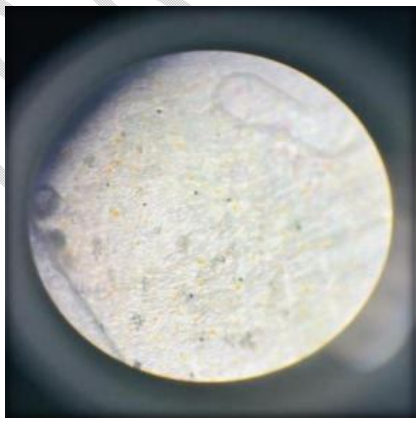

Fig. 9 (b)

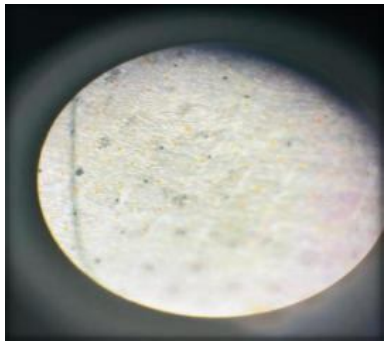

Fig. 9(c)

Fig. 9 Chromatophores observedinthe different region of *Labeoboga*

(a)headregion

(b)bodyregion

(c)caudalregion