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Research paper

Study of Chromatophores of Freshwater Fishes from Gho-Manhasan Tributary of River Chenab (J&K)

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ABSTRACT

The work focuses on the study of chromatophores in three fish speciesof Gho-Manhasan Tributary of River Chenab as these chromatophores are responsible for providing different colouration in fishes. The chromatophores of these fishes were micrographed utilizing the camera through the compound microscope's eye piece under 10X magnification. Three selected species of fishes were Aspidoparia morar, Channa punctatus and Mystus seenghala. The most abundant chromatophores were observed in the body region of C. punctatus. The least number of chromatophores were in caudal region of A. morar. A. morar showed the greatest number of chromatophores in the body region and least number of chromatophores in the caudal region. C. punctatus showed abundant chromatophores in body region followed by the fin region whereas least number of chromatophores was present in the caudal region. M. seenghala showed a greater number of chromatophores in fin region as compared to body.

1. Introduction

Fishes are cold- thoroughbred submarine invertebrates. They live in different types of territories which includes freshwater bodies, marine, brackish water, lakes and estuaries (Press and Delong, 2002). They have a pharyngeal gill which helps them in respiration. They come in colourful shapes, sizes, colours and acclimations allowing them to enthrall different ecological niches and fulfil colourful ecological places. While both plastic and inheritable traits contribute to the adaptation in new niche, phenotypic plasticity permits species to persist in an expansive range of conditions, facilitates irruption into the new territories and provides hastily response to the environmental changes (Agarwal, 2001). One apparent illustration of phenotypic plasticity in the creatures is their capability for colour change. Many cold-blooded creatures and invertebrates have gorgeous colouration, unusual patterns, and stunning shifts. Among the invertebrates, these are largely evolved in the fishes as attractive colouration determines the fish's commercial worth.

Fish are able to change their colour thanks to pigment-bearing cells called chromatophores. It occurs quickly as a result of crystal and pigment organelle intracellular rearrangements that coincide within the chromatophores. Also, it may happen

gradually throughout the course of the season or during development as a result of morphological colour change, which is caused by variations in the quantity of pigment organelles and/or chromatophores. Additionally, it can happen when the distance between crystals changes, which results in a physiological colour change in the reflecting wavelength (Aspengren *et al*., 2009). In fishes, chromatophores are not only set up in the skin, but they're also present in the eyes as well as internally around colourful organs (Skold *et al*., 2013). They are present in the skin of fishes, substantially in the dermis and rather sporadically in the epidermis.

Fish have six distinct forms of chromatophores, which can be identified by their respective colours. Melanophores give cells their distinctive brown or black colour as these are made up of melanosomes, which are basically granules packed with melanin. Xanthophores give the cells their yellow colour as they have xanthosomes or carotenoid vesicles that carry polytene pigments called carotenoids. Erythrophores are the ones that give skin its red colour. Pteridines and carotenoids are pigments found in erythrophores; they absorb light and produce a red colour in an organelle known as a pterinosome or a carotenoid vesicle, respectively. Cyanophores are present in the organelle named cynosomes that give fish their blue colour. Only two Callionymidae species have been reported to have cyanophores (Goda and Fujji, 1995).The chromatophores that absorb light are these four. Iridophores provide fish with their iridescent colour. Leucophores give fish their silvery or white colour. These chromatophores are responsible for dispersing light. Leucosomes are the name for the cellular organelles that are in charge of the cellular reflecting activity. They disperse visible light in all directions (Fujii, 1993a). Iridophores and Leucophores reflect light (Fujii, 2000).

In the present study, three species of the fishes were collected from the Gho-Manhasan River of Jammu and Kashmir. These three species were - *Aspidoparia morar*, *Channa punctatus* and *Mystus seenghala*.

2. Material and Method

Union Territory of Jammu and Kashmir is a region in the northern section of the Indian subcontinent which is centered on the plains surrounding Jammu to the south and Kashmir to the north. Situated on the banks of the Tawi River, Jammu serves as the winter capital of the state. In J&K, there are several rivers, lakes, and glaciers. The Tawi, Liddar, Poonch, Jhelum, Chenab, Sutlej, Ravi, and Indus are some of the principal rivers that flow through the UT.Wular Lake, Nageen Lake, Dal Lake, and Manasabal Lake are a few of the bigger lakes. In all, UT has about 1230 bodies of water.Gho-Manhasan is the chosen stream for the study. Gho-Manhasan is one of the several tributaries that the River Chenab produces. The majority of the Jammu region of J&K is covered by the Chenab River, one of the largest rivers in the Indus basin. It is located roughly eighteen kilometres from Jammu. For domestic and irrigation uses, the adjacent areas rely on the creek as their only source of water.

To gather fish from the study site, a fisherman was employed. The fishermen utilized throw nets or cast nets to catch the fish. Small weights are positioned all around the perimeter of the circular net. By hand, the net is tossed or cast so that, before sinking into the water body, it spreads out in midair. After casting, the fisherman turned over the river stones in the net-covered area, causing fish to become entangled in the net's outer pockets. The fish were taken to the laboratory for identification after being gathered and put in different buckets filled with water. The fish were recognized using their morphometric and meristic characteristics. Then we removed the scales of the collected fish species: *Aspidoparia morar*, *Channa punctatus* and *Mystus seenghala* by using forceps and then quickly transferring them into petri plates that contained 0.7% NaCl. Scales of *A. morar* and *C. punctatus* were taken from the body region, the caudal region and the fin region, whereas the scales of *M. seenghala* were taken from the body region and the fin region.Subsequently, the chosen fish's scale was placed on the slide for chromatophore analysis using a compound microscope set to 10X magnification.The same samples were also micrographed utilizing the camera through the compound microscope's eyepiece. Chromatophores underwent 10X magnification analysis.

3. Results

Identified fishes and microphotographs of their chromatophores:

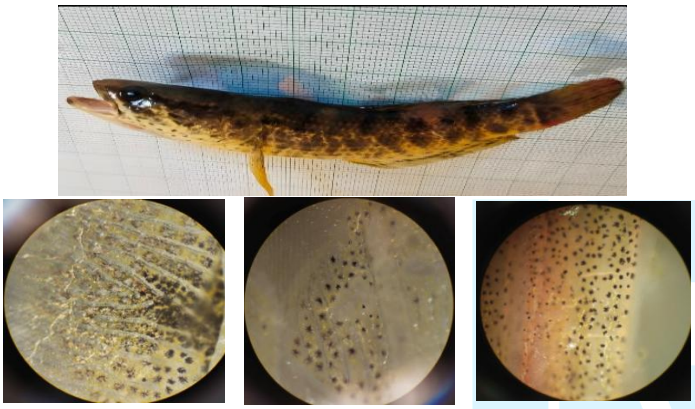
3.1 Aspidoparia morar (Chaal)

1) Body region 2) Caudal region 3) Fin region

Fig. 1 Microphotographs of scales of Chaal showing the presence of chromatophores from body, caudal and fin region

In scales of Chaal, we observed four types of chromatophores: melanophores, xanthophores, erythrophores and iridophores.The body region of the *A. morar* showed abundant dark pigmented melanophores.Another type of chromatophore called xanthophores were also present in this region in ample amounts.The caudal region had a relatively smaller number of melanophores.The number of xanthophores was greater than melanophores in this region.Iridophores were also observed in this region. The fin region possessed a greater number of melanophores.Yellow pigmented xanthophores were relatively lesser in number in this region.Red pigmented erythrophores were also present in this region in an aggregated form.

3.2 Channa punctatus (Spotted snakehead)

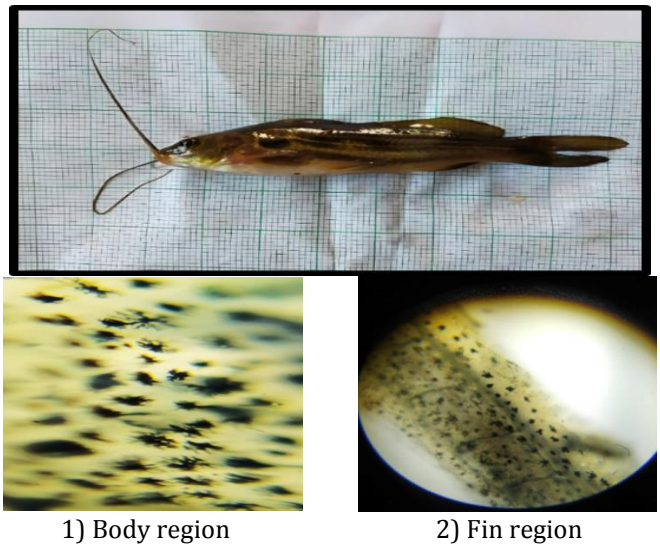


1) Body region 2) Caudal region 3) Fin region

Fig. 2 Microphotographs of scales of Spotted snakehead showing the presence of chromatophores from body, caudal and fin region

In scales of Spotted snakehead, the body region had an abundant number of xanthophores and melanophores.The xanthophores were greater in number and were present in an aggregated form.Few erythrophores were also observed in this region.Iridophores were also present in the body region of*C. punctatus*.The Caudal region of *C. punctatus* mainly showed two types of chromatophores – melanophores and xanthophores. Xanthophores were present in an aggregated state.Few iridophores were also observed.Dark pigmented melanophores were present in a dispersed state.Four types of chromatophores were observed in the fin region – melanophores, xanthophores, erythrophores and iridophores.Melanophores were most abundant in number and they were present in a dispersed state.Erythrophores and xanthophores were present in an aggregated form. Iridophores were least in number.

3.3 Mystus seenghala (Singhara)



1) Body region 2) Fin region

Fig. 3. Microphotographs of scales of Singhara showing the presence of chromatophores from body and fin region

Scales of Singhara were observed from two regions, i.e., the body region and the fin region.Therewere two types of chromatophores present in the body region of *M. seenghala* – melanophores and xanthophores. Melanophores were abundant in number andwere present in a dispersed state. Xanthophores were present in an aggregated form. In fin region,a large number of black pigmented melanophores were observed. Xanthophores were also observed in the fin region. Thefin region also had some erythrophores.

4. Discussion and Conclusion

The present study focused on the chromatophores of the fishes of the Gho-Manhasan River. Three species of fishes were used to carry out the study – *A. morar*, *C. punctatus* and *M. seenghala*. Present observations showed that among the fishes undertaken for study, the most abundant chromatophores were observed in the body region of *C. punctatus*. The least number of chromatophores were in the caudal region of *A. morar*.

Along with the difference in numerical quantity of chromatophores in different fish species, it was also observed that different quantities of chromatophores were present in different regions of the body of the same fish. *A. morar* showed the greatest number of chromatophores in the body region and least number of chromatophores in the caudal region. *C. punctatus* showed abundant chromatophores in the body region, followed by the fin region, whereas the least number of chromatophores were present in the caudal region. *M. seenghala* showed a greater number of chromatophores in the fin region as compared to the body region. Chromatophores were also observed in two different states – either the dispersed state or the aggregated state. The different types of chromatophores that were observed in different

fishes during the present studies include melanophores (black or brown), xanthophores (yellow), erythrophores (red/orange) and iridophores (reflective/iridescent). These chromatophores were noticed on the basis of their colours.

Melanophores were present in all the three species of fishes, i.e., *A. morar*, *C. punctatus*and *M. seenghala*. Xanthophores were also seen in these fishes. They were mostly present in an aggregated form in these fishes, except in the body and caudal region of *A. morar,* where they were present in a dispersed form. Erythrophores were observed fin region of *A. morar, C.punctatus* and *M. seenghala.* They were also observed in the body region *of C. punctatus*. Iridophores were observed in only two species of fishes – *A. morar*, *C.punctatus*. They were seen in the caudal region of *A. morar,* whereas in *C. punctatus,* they were seen in the body as well as the fin region.

Fish colour is primarily determined by their diet. To improve the colour of fish, we can add some natural pigmentsto their diets. The colour of fish may also be altered by the quality of the water. Stress levels of the fishes might rise due to poor water quality, which can also cause the fish's colour to fade.

Hence, it was inferred from the study that chromatophores are the cause of the fascinating colouration and patterns of fishes and that they could be impacted by fish adaptability as well as environmental or seasonal changes. Thus, the present study aimed at the colour pattern of the fishes of the Gho-Manhasan River of Jammu and Kashmir.

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