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COMPARATIVE STUDY OF MESENCEPHALON OF TWO CYPRINIFORMES IN RELATION TO FEEDING HABITS

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ABSTRACT

In vertebrates like fish, mesencephalon or mid brain consists of two regions optic tectum (OT), that act as centre for processing visual impulses and generating motor response and tegmentum containing nerve tracts. Both structural and physiological properties of OT helps to know the mechanism of organizing behaviour. Present paper analyses the midbrain (mesencephalon) of two different fishes, *Carassius auratus* and *Botia striata* with respect to its feeding behaviour. Both these aquarium fishes belongs to cypriniformes order, but exhibit different feeding behaviours. The OT of *Carassius auratus* were large with well-developed Optic Tectum, Torus longitudinalis (TL), Tectal commissures, tegmentum, and torus semicircularis (TS). The nuclear areas found are nucleus isthmi (NI) and nuclear interpeduncularis (NI). Five well developed tectal layers are Stratum opticum (SO), stratum griseum fibrosum superficialis (SGFS), Stratum griseum Centrale (SGC), Stratum album Centrale (SAC) and Stratum griseum periventricularis (SGPV) with three sub divisions of SGC. This mid brain structures have critical roles in vision in surface feeding *Carassius auratus* while in *Botia striata* the optic lobes possess poorly developed structures. The nucleus isthmi and nucleus interpeduncularis are not developed. In *Botia striata* tectal layers are also not well developed as in *C.auratus* indicating less vision use for feeding.

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INTRODUCTION

Because of its diverse sensory orientation, fishes possess greatest variation of brain anatomy and function with diverse size, and forms. As seen common in any vertebrates, fish brain in teleosts is divided into three major regions, Prosencephalon (forebrain), Mesencephalon (midbrain) and Rhombencephalon (hindbrain) (Kotrschal & Kotrschal, 2020). Forebrain is again subdivided into telencephalon (cerebrum) and diencephalon, and hind brain to metencephalon (cerebellum) and myelencephalon (medulla oblongata) (Yamamoto, 2009). In some other studies, brain regions are divided into four major regions, forebrain (Prosencephalon), between brain (diencephalon), midbrain (Mesencephalon) and hindbrain (Rhombencephalon) (Li *et al*., 2024; Vindas *et al*., 2017). Studies in *Carassius auratus* (gold fish) shows the involvement of forebrain region telencephalon in learning and memory (Yamamoto, 2009), which include the receptor olfactory bulbs attached to telencephalic hemispheres by olfactory tract (Manju *et al*., 2025). The cerebellum (skin brain) in the hind brain region coordinate muscular activity and is involved in equilibrium. Nerve tract present in medulla oblongata (visceral brain) helps connecting spinal cord to all other brain parts (Hilal & Hilal, 2019).

Mid brain or mesencephalon consists of tectum (roof) that covers midbrain with paired optic lobes, and tegmentum in the ventral part that is followed by cerebellum (metencephalon), part of hindbrain (Northcutt & Davis, 1983; Nieuwenhuys *et al*., 1998).

Mid brain (mesencephalon): In an elaborate study of zebra fish brain, the midbrain is divided into multisensory optic tectum in the dorsal area and torus semicircularis and tegmentum in the ventral side. Optic tectum, is further classified to 4 distinct zones, periventricular grey, central zone, grey and white zone, and white zone. The torus semicircularis present on top of the lateral tegmentum is seen protruding into tectal ventricle. The tegmentum located at ventral mesensephalon is separated by ventricles has major role in coordinating motor functions by integrating visual information from different sources and coordinate behaviour. (Daroff & Aminoff, 2014; Ostrander, 2000; Wulliman *et al*., 2012). It links sensory, and integrative parts of the hind brain with fore brain and is concerned with visual, auditory and coordination of responses. In different teleost species, optic tectum was studied by Butler (1992) to analyse variations of OT in different species.

Optic tectum: Optic tectum (Superior Colliculus) or optic lobes is crucial for vision and receives visual input from the retina and plays role in visual reflexes, orientation, and visual spatial information. It is referred as the primary visual center in fishes and are also involved in somatosensory, and electro sensory modalities (Northmore, 2011). The optic tectum (lobes) are made of neural tissue, and tectal commissure connect these two lobes and at the bottom, optic lobes merge with the floor of midbrain, tegmentum (Northmore, 2011). In teleostean brain, it processes visual information connected to shape and color of objects as well as movement (Mueller, 2012).

Tegmentum: The tegmentum is attached dorsally to the valvula cerebelli, laterally to optic tectum and ventrally to the inferior lobe of the hypothalamus (Abdelnaeim Hussein, & Cao, 2018). This region consists of rostral continuations of the areas present in the hind brain, the reticular formation, the oculomotor cranial nerve nuclei and ascending and descending fiber systems. Additional nuclear areas are also involved in various types of functions performed by it (Butler (1992). Acting as a neural pathway for senory information to and from forebrain, it also interacts with dorsal part of the brain for analysing and modulating of sensory information (Butler, 2005). Tegmentum is separated from the hindbrain by a transitional area called isthmal tegmentum.

Torus semicircularis (TS): Torus semicircularis is involved in processing auditory information, and localization of sound (McCormick, 1992). TS, composed of two nuclei, central and ventrolateral nuclei that are distinct due to its afferent connection nature (Yáñez *et al*., 2024). Centrally and laterally to TS there is medium sized same type of scattered cell groups that shows rostrocaudal extensions towards nuclear areas (Tripathi, 2021). In Barbus meridionalisn two portions pars lateralis' and the 'pars medialis was identified in lateral nuclei that is 4 layered namely subependymal, small cells layer, fibrillar layer; and disperse cells layer (Cuadrado, 1987). In bowfin fish, Amia calva; connections was mapped in torus semicircularis the region involved in sensory processing, particularly auditory and visual (Braford & McCormick, 1979). In Gymnotiform fish, Eigenmannia, torus semicircularis receives lemniscal input from electrosensory, mechanoreceptive lateral line, and auditory systems (Carr, & Maler, 1985).). Dorsal torus receives electrosensory input while auditory and mechanoreceptive systems are projected to ventral torus.

Torus longitudinalis: A small and paired structure, TL are longitudinal ridges protruding from the optic tectum into tectal ventricle (Folgueira, *et al*., 2020). It is an extension of medial part of the tectal greymatter into the mesencephalic ventricle and consists of densely packed granule like cells. Early studies of the torus longitudinalis with the Golgi method (Ramen, 1899) revealed small neurons projecting to the superficial fiber layers of the tectum, as well as fibers entering from the tectal commissure. Studies have shown a close relationship between the torus longitudinalis and optic tectum (Ito and Kishida, 1978; Vanegas *et al*., 1979; Grover and Sharma, 1981; Wulliman and Northcutt, 1990). TL was studied in four teleosts, 3 surface feeders such as Carassius auratus, Ophiocephalus striatus, and Aplocheilus lineatus and a bottom feeder Noemacheilus rupicola and structural variations was identified. Moreover size of the torus was not always found to be directly proportional to the optic tectum size (Manju *et al*., 2011). The involvement of TL-optic system in directing selective visual attention and maintaining attention on a visual target between saccadic eye movements is been explained (Folgueira *et al*., 2020; Northmore, 2017). Other structures that contribute to its overall function includes Midbrain Central Arteries, that receives blood supply from central arteries, are significantly larger than those in other parts of the brain, Reticulospinal Neurons; involved in coordinating movements and reflexes and Facial Motor Tract involved in controlling facial movements (Plachta *et al*., 2003). The other area includes the rostral continuations of the areas present in the hind brain. In all fishes, the optic tectum form the larger border and the tegmentum forms the smaller border. Optic tectum which is larger than telencephalon and cerebellum is connected with telencephalon, diencephalon and pretectal areas (Northmore, 2011).

Mid brain and feeding behavior: This mid brain consists of dorsal optic tectum, ventral tegmentum and isthumus and the patterns differ according to their feeding habits. The optic tectum also show structural variations among different habits and habitats. The surface or column dwelling visual feeders possess larger optic lobes than others feed by taste and other mechanisms. The cytoarchitecture and fiber architecture of teleostean optic tectum are studied by many researchers. The cytoarchitecture of the optic tectum in two fishes having different feeding habits was studied and observed that surface dwelling visual feeder *Ophiocehalus striatus* possess well developed optic lobes than bottom dwelling taste feeder *Nemacheilus rupicola (*Manju *et al*., 2011). Moreover optic tectum varied in size and shape among different fishes in different habits and habitats and number of layers in optic tectum vary by species (Sreekala *et al*., 2011). Present paper analyses the midbrain (mesencephalon) of two different fish, *Carassius auratus* and *Botia striata* and a comprehensive analysis of brain regions are done with respect to its feeding behaviour.

MATERIALS AND METHODS

Live specimen of *C.auratus* and *B.Striata*, collected from nearby shop were anaesthetised and the dissected brains were fixed in 10% Neutral Buffered formalin. After fixation and dehydration with different percentages of alcohol and also cleared in xylene, the brain tissues are embedded in paraffin. Brain (8 μ) serial section taken using rotary microtome and deparaffinization or de-waxing in xylene followed by rehydration with different percentages of ethanol was done. After water rinsing to enable stain absorption by double staining using haematoxylin followed by eosin and dehydration with 100% ethanol to remove excess water, the tissue was again rinsed in xylene several times and cover slipped with DPX mounting medium. Further the specimens was stained with Cajals Silver staining method to discover further details.

RESULTS

The observation results obtained by the histological analysis of *C.auratus* and *B.striata* is discussed. Figure 1 and 2 shows brain as observed in *Carassius auratus* and *Botia striata*. Here optic lobe represents midbrain and dorsal side of optic lobe is optic tectum and ventral side is tegmentum.

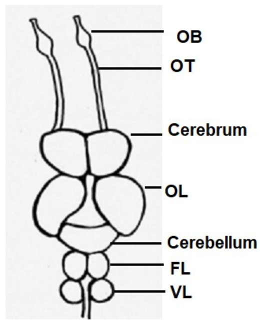

Figure 1. Dorsal view of optic lobe of *C.auratus* is given here. In the figure dorsal side of optic lobe (OL) i.e. the optic tectum is visible while the tagmentum is on ventral side

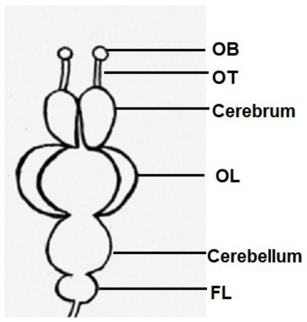

Figure 2. Figure 1a. Dorsal view of optic lobe of *B.striata* is given here. In the figure dorsal side of optic lobe (OL) i.e. the optic tectum is shown

Mid brain in *Carassius auratus:* The mesencephalic region comprises of a pair of large well developed optic lobes. tectal commissures and the tegmentum are well developed. Each optic lobe is closely positioned and can be demarcated by a median dorsal furrow. The cross section of midbrain of *C.auratus* is depicted in Figure 3. Different regions such as optic tectum, tegmentum, TL, and TS are shown in the figure.

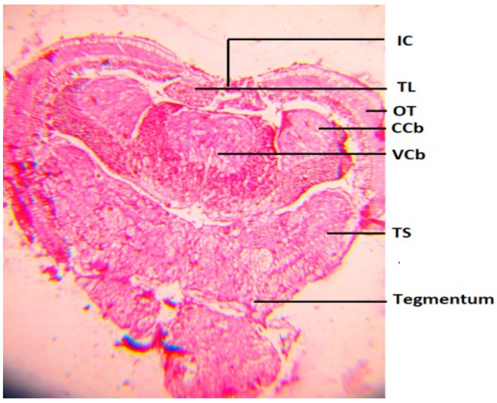

Figure 3. Cross section of the midbrain of *C.auratus*. IC-Intertectal commissure, TL – Torus Longitudinalis, OT-Optic Tectum, CCb- Corpus Cerebellum, VCb-Valvula of Cerebellum, TS-Torus Semicircularis and Tegmentum are shown in the figure

Optic Tectum: The optic lobes of the *Carassius auratus* were large with well-developed optic tectum and torus longitudinalis. The diameter of optic tectum was 52-55 µ and five distinct layers was seen in this region. Stratum opticum (SO) is the outermost layer. This is fibrous in nature and consists of many rounded and oval shaped neurons. It measures about 10 µ in width. Stratum griseum fibrosum superficialis (SGFS), main visual centre having branched axons as fiber layers. It measures about 9-11 µ in width. The next layer is thicker layer of optic tectum, Stratum Griseum Centrale (SGC) consisting of both fibers and neurons with thickness of about 15-16 µ. The motor functioning neurons arise from this layer. In *Carassius auratus* three sub divisions of this layer was seen. Central Grey Stratum (CGS), Internal Plessiform Stratum (IPS) and External Grey Stratum (EGS). The CGS consists of both small and multipolar neurons, and IPS is constituted by a mesh fibers and External Grey Stratum (EGS) medium sized neurons. The deeper layer of OT, Stratum Album Central (SAC) is formed of many fibers coming from various zones. The inter tectal commissure is formed by the fibers of this layer and joins the fibers to other zones. This joins the fibers that terminating in torus longitudinalis. It has a diameter of 12-13 µ. The innermost layer is the Stratum Griseum Periventricularis (SGPV). It consists of fibers and neurons and measures about 8-10 µ diameter. The neurons of this layer extend their axons into the stratum album central (SAC). This layer is continuous with the torus longitudinalis (TL). Figure 4 show cross section of optic tectum in *C.auratus*. Different layers are shown in the figure.

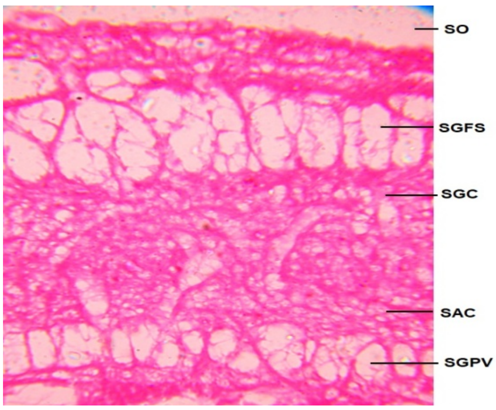

Figure 4. Different layers in the optic tectumof midbrain of *C.auratus*. SO- Stratum opticum, SGFS- Stratum griseum fibrosum superficialis, SGC-Stratum Griseum Central, SAC-Stratum Album Central and SGPV-Stratum Griseum Periventricularis are shown here

Commissura transversa (CT) and commissura horizontalis (CH) are observed in *Carassius auratus*. The corpus glomerulosum pars rotunda (CGPR) or corpus glomerulosum (CG) is well developed in this fish and it has a diameter of about 55 µ. CGPR is associated with visual processing and is connected with inferior lobe of the cerebellum involved in muscular activities. At the region of CGPR, the commissura horizontalis can be observed. This bundle follows a horizontal course and enters in CGPR where it is joined by fibers of the tractus rotundo pretectalis and ascending towards the tectal region.

Tegmentum: The nuclear groups in mesencephalic tegmentum of *Carassius auratus* were moderately stained with Haematoxylin and Eosin. The tegmental region include torus longitudinalis (TL), torus semicircularis (TS), nucleus lateralis valvula (NLV), nucleus Isthmi (NI) and nucleus Interpeduncularis (NIP). The well-developed paired torus longitudinalis (TL), was found located along the medial margins of OT. It is a major visual centre, interrelating visual information between optic tecta. TL consists of compactly arranged rounded neuronal cells and their fibers. The length of torus longitudinalis is about 24 µ and width 60 µ. The neuronal cells are equally distributed in both halves of the torus. The cells of the TL closely resembles with stratum griseum periventricularis of the optic tectum. TL is involved binocularity and spatial orientation (Tesmer *et al*., 2022). Figure 5. Shows the cross section of IC- Intertectal commissure, TL – Torus Longitudinalis, TS – Torus Semicircularis and VCb-Valvula of the Cerebellum *in C.auratus* and Figure 6 shows the reduced cross section.

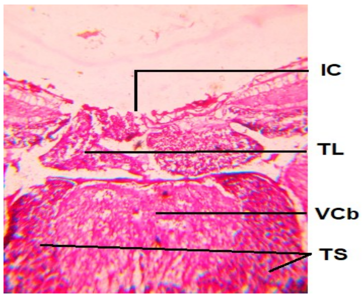

Figure 5. Cross section of IC-Intertectal commissure, TL – Torus Longitudinalis, Torus Semicircularis and VCb-Valvula Cerebelli in *C.auratus*.

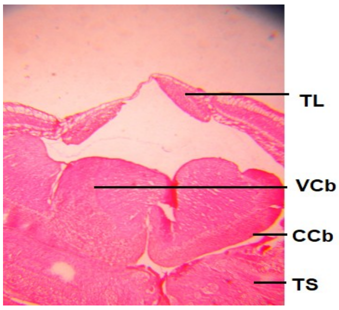

Figure 6. Cross section of reduced TL, and OT projecting Valvula and corpus cerebellum (VCb and CCb) in *C.auratus*.

The Torus Semicircularis (TS) is also well developed in *Carassius auratus*. It lies ventrally to the optic tectum and consists of compactly arranged neurons. The TS in relation with the tectum is indicated by the continuation with certain tectal layers. The length of TS is about 290 µ and width 90 µ. The neurons in the outer part of TS are large compared to those at interior region. From the tectum, the impulses are relayed to the various centers through the TS. On either side of the TS are nucleus lateralis valvulae (NLV) which is moderately developed. Oval or rounded small and moderaley stained neurons were observed in clusters. On its lateral side is the tractus mesencephalon cerebellaris posterior (TMCP). Due to its peculiar staining nature, it can be easily identified. The nuclei are more or less equal in size and discontinuously distributed. The nucleus inter peduncularis (NIP) is ventral to the fasciculus longitudinalis medialis (FLM) and lies below the branchium Conjunctivum anteriors (BCA). The nucleus isthmi (NI) is situated in the dorsal part of the mesencephalon, medial to the tectum (Figure 7 and Figure 8). NI are rounded nuclear areas found accumulated and inter connected with the tectum by isthmo tectal tracts. In the caudal part of the tegmentum nucleus inter peduncularis (NIP) are observed. The neurons are small in size and oval or rounded in shape and showed moderate staining.

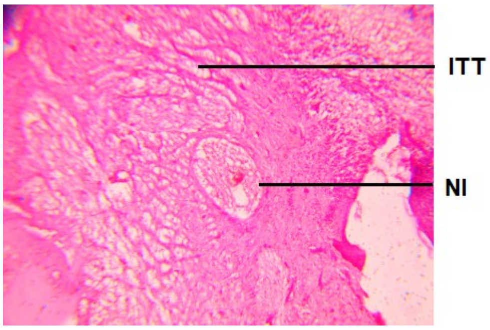

Figure 7. Cross section of tegmentum showing nucleus isthumi (NI) and isthmo tectal tracts (ITT) in *C.auratus*.

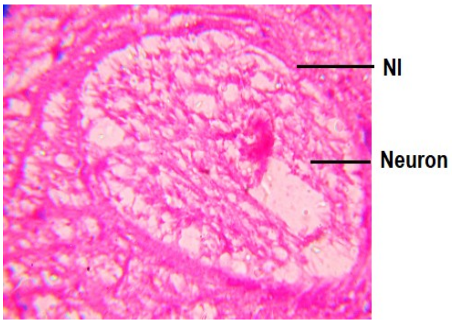

Figure 8. Cross section of tegmentum showing enlarged nucleus isthumi (NI) with Neurons in *C.auratus*.

Mid brain in Botia striata: The mesencephalon represents the optic lobes in *Botia striata* which are smaller than in *Carassius auratus*. *Botia striata* is a bottom dwelling fish and depends on olfaction during feeding. Midbrain cross section of *B.striata* is shown in Figure 9. Different regions such as optic tectum, tegmentum, TL, and TS are shown in the figure.

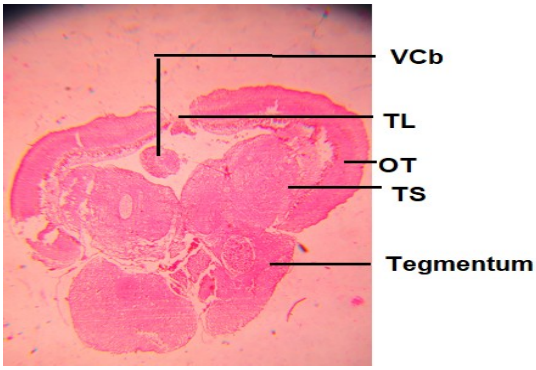

Figure 9. Cross section of the midbrain of B.striata IC-Intertectal commissure, TL – Torus Longitudinalis, OT-Optic Tectum, CCb-Corpus cerebellum, VCb-Valvula of the Cerebellum, TS-Torus Semicircularis and Tegmentum are shown in the figure

Optic tectum: Though optic tectum of *B.striata* is not well developed like in *C.auratus* the cellular layered distinction was able to observe. With a diameter of 35 µ possess 5 layers stratum opticum (SO), stratum griseum fibrosum superficialis (SGFS), stratum griseum centrale (SGC), stratum album centrale (SAC), and stratum griseum periventricularis (SGPV). The outermost layer SO, with diameter of 10 µ consists of bundles of long fibers and neurons. The diameter of thin SGFS layer with small fibers and neurons ranges from 7-8 µ. The thicker layer, SGC contains small and large rounded neurons and has a thickness of 11 µ. From this layer, thick fibers orginate and enters into TL where they breaks up into small fibers. SAC layer is not well developed and measures about 5 -6 µ. The innermost layer SGPV receive fibers from the periventricular system and send dendrites into the stratum fibrosum. This layer of diameter 9-11 µ contains continuous uniform rounded cells. Figure 10 shows cross section of optic tectum in *B.striata*.

Tegmentum: The tegmentum consists of TL, TS, nucleus inter peduncularis, nucleus isthmi (NI) and nucleus profundus mesencephali (NPM). The TL is located beneath the optic tectum and has a length of 1.5 and width 10 µ. The TS originates from the place of union of the tegmentum and tectum and has a length of about 140 µ and width 80 µ. The nucleus inter peduncularis (NIP) is poorly developed. It consists of multipolar neurons and dendrites that goes towards the mid line of the tegmentum. The nucleus isthmi (NI) lies below the fasciculus longitudinalis medialis (Figure 11) and is connected to the adjacent granular layer of the valvula cerebelli. The poorly developed torus longitudinalis and optic tectum are the indication of the non-visual feeding and bottom dwelling habit of the fish.

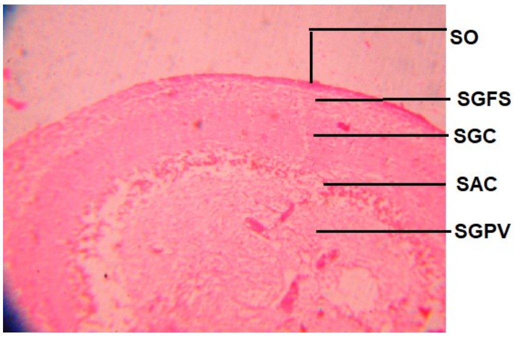

Figure 10. Different layers in the optic tectum B.striata midbrain. SO- Stratum opticum, SGFS- Stratum griseum fibrosum superficialis, SGC-Stratum Griseum Centrale, SAC-Stratum album Centrale and SGPV-Stratum Griseum Periventricularis are shown here

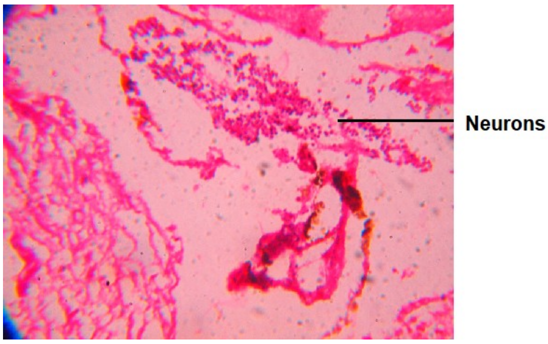

Figure 11. Cross section of tegmentum showing nucleus isthmi (NI) with Neurons in *B.striata*.

DISCUSSION

Carassius auratus (Gold fish) exhibit surface dwelling and column dwelling behaviours and possess well developed optic lobes concerned for vision while it is poorly developed in bottom dwelling feeder *Botia striata*. Fiber connection between optic tectum and other sensory areas have been investigated by Ebbesson & Vanegas, (1976) and Ito (1978) in visual feeders. Small optic lobes and optic tecta are reported in *Noemacheilus* and *Mrighal* (Khanna & Singh, 1966; Mookerjee *et al*., 1950). These fishes being bottom feeders, optic lobes where considerably reduced. In the case of blind fishes, Stefanelli (1954) and Marshall and Thines (1958) found reduction in size of optic lobes. Similarly Khanna and Singh (1966) explained the highly developed optic lobes in *Puntius ticto* and *Channa striatus* due to their surface feeding nature. Midbrain roof, optic tectum is the main visual centre and visual processing in teleost's optic tectum is analysed by many researchers. In vertebrates with a well-developed visual system, the tectum is dominated by retinal inputs. Huber and Crosby (1933) found a direct relation between eye size and development of certain layers of the optic tectum. The tectum presents considerable variation of shape and size among fishes of different feeding habits. The fishes that feed by sight are reported by large optic lobes than the bottom feeders that are mainly fed by gustation. Sanders (1886) have reported that the optic tectum consists of three layers and Ramon (1899) described ten layers. Kappers *et al* (1936) and Khanna and Singh (1970) divided the optic tectum into six layers while Tandon and Sharma (1963) found four zones. Distinct five layers were able to identify in optic tectum of *C.auratus* though these layers are not equally well developed in the fishes in present study. Some layers are well developed in surface feeders than the bottom feeders. Highly developed optic tectum was found in surface feeder *Carassius auratus* where the superficial layers SO and SGFS are clearly demarcated. The superficial layer consists of dense optic nerve fiber terminals and SO receive the afferent fiber from the retina helpful for better vision. According to Butler (2009) visual information carried by retinal cell axons terminates in the superficial zone of the tectum. The central zone of the optic tectum in *Carassius auratus* is divided into three layers indicating the presence of somatosensory function in this fish. The somatosensory information related by nuclei in the hindbrain terminates at the deeper half of the central tectal zone. Huber & Crosby (1933) demonstrated that there exists a direct relation between the size of the eye and the development of certain layers of optic tectum. Each layer contain different neuronal classes and project to different neuronal centers.

Huber *et al* (1997) found in *Cichlids* that piscivorous species and others that utilise mobile prey have larger tectum. Lisney and Collin (2006) found larger optic tecta in reef associated sharks compared to benthic species. In surface feeders, the optic tracts are better developed than in the bottom feeders. Huber and Rylander (1992), found that the superficial layers of the tectum are well developed in surface feeders while the inner layers are well developed in turbid water dwelling fishes where feeding mainly based on olfaction. In *Carassius auratus*, the innermost layer stratum griseum periventriculare is highly developed. This may be due to the high development of central acoustic area in the fish. Impulses from medulla to the optic tectum are passed through fasciculus longitudinalis medialis (Kappers *et al*., 1936). The tractus mesencephalo cerebellaris anterior showed better development in surface feeder, *Carassius auratus* than bottom feeder, *Botia striata*. The torus longitudinalis also show variation in these fishes. In *Carassius auratus*, the two halves of the torus were seen close to each other but in *Botia striata*, TL were widely separated. Electrophysiological studies indicates that torus neurons respond to visual stimulation, but the receptive fields are located only along the equator of the centro lateral visual field (Northmore *et al*., 1984). Functional studies in gold fish indicate that the torus is involved in visual integration and saccadic eye movements. Well-developed TL is found in species existing in turbulent situations (Northmore, 2017). The tectal torus longitudinalis connection may be involved in adjusting the visual processing of tectum under these circumstances (Northmore, 1976). The present investigation also agrees with these findings. In *Carassius auratus*, well developed torus longitudinalis with deeply stained rounded nuclei were present while less developed TL is found in *Botia striata. S*imilarly poorly developed TL has been reported in cave fishes and in deep sea fishes by Ramsey, 1901. According to Tandon and Sharma (1963) TL size depends on the size of the optic tectum. Size of the optic tectum is directly proportional to TL size (Chaturvedi, *et al*., 1979). Both the optic tectum and torus are well developed in *Carassius auratus*, since surface feeding fish depends vision for feeding. The sub tectal part of the tegmentum is the torus semicircularis, its corresponding structure in the mammal is the inferior colliculus, an auditory center. The TS is better developed in *Carassius auratus* than *Botia striata*. A critical optic tectum part TS having neurons with axons sends signals to each OT though OT sends signals to same side TS (Northmore, 2011).TS cells provide input to the deep layers of the tectum. TS has a diverse set of input that are sensory, auditory, lateral line and somato sensory. In electric fishes, the TS is large and well differentiated into lamina or sub nuclei to process the information provided by the electro sensory receptors about surrounding objects. Other input to TS come from the cerebellum and fore brain. Many neurons in the TS of gold fish and trout are visually responsive (Northmore, 2011). The TS and optic tectum of *Carassius auratus* are well developed and agrees that nucleus isthmi neurons project back to the tectum. The cells of the nucleus isthmi involves the complex neurons that are numerous and the tectal cell types in the SGPV and long dendrites that ascend to the superficilal layers ,where they pick up he retinal input. They also have dendritic branches that ramify in deeper layers of SGC. The reciprocal connection between TS and NI is only found in Teleosts. In Cyprinids, NI receive input from the optic tectum as well to the corpus of the cerebellum (Luiten, 1981). In PercomorphNavodon there is flow of information in both directions between the NI and OT (Sakamoto and Ito and ueda, 1981). NI is poorly developed in bottom feeders like *Botia striata*. But Sherly, 2012 found this nucleus in a bottom feeder showing that NI also responds to non-visual stimuli like somatosensory, auditory and lateral line. The nucleus inter peduncularis related with vision is also developed in *Carassius auratus*. The lateral geniculate nucleus is also found in *Carassius auratus*. Schwassmann, 1965, has mentioned work done by Franz in 1912 where there is the presence of Lateral geniculate nucleus in all teleost though it was not identifiable in bottom feeders.

CONCLUSION

The present paper deals with the study of mesencephalon of *Carassius auratus* and *Botia striata* in relation to their feeding habits. The midbrain part comprises a pair of optic lobes with the dorsal part tectum and ventral part tegmentum. In *Carassius auratus*, the tectal layers are well developed having SO, SGFS, SGC, SAC and SGPV. Three sub divisions of the SGC are Central grey stratum (CGS), internal plessiform stratum (IPS) and external grey stratum (EGS). This mid brain structures are involved in vision for surface feeding nature of *Carassius auratus* while in *Botia striata* the optic lobes have poorly developed optic tectum, tegmentum, torus longitudinalis and torus semicircularis. The nucleus isthmi and nucleus interpeduncularis are not developed. The tectal layers are not well developed in *Botia striata* and consists of 5 layers while there are no further subdivision in stratum griseum centrale. This indicates the less use of vision for feeding in *B.striata*. Since TL, is associated with vision, it is well developed and distinctly seen in *C.auratus*.

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