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A Note on The Fish Pituitary with Special Reference to its Shape, Position, Lodgement, Orientation, and Attachment with The Brain

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Nisha Manish*

Abstract

As in other vertebrates, fish pituitary or hypophysis is the master of endocrine orchestra. A number of studies have been carried out to study the morphology, anatomy, and physiology of the gland in fishes. Investigations have also been carried out on the rhythms of the hormones secreted by the pituitary gland in relation to the reproductive cycle of fishes. Further, the shape of the gland, its shape, position, lodgement, orientation, and attachment with that of the brain are of great importance. So, in the present study, an attempt has been made to discuss the shape disposition, lodgement, orientation, and attachment of the pituitary gland with that of the brain.

Keywords: *Fish, Pituitary, Lodgement, Orientation, Attachment.*

*Associate Professor, Dept. of Zoology, Meerut College, Meerut.

Introduction

For a long time, pituitary in fish has been a topic of great interest amongst researchers. A classical work of Herring(1908, 1913), Tilney (1911), Stendell (1914), de Beer,(1926), Bell (1938), Levenstein (1939), Woodman (1939), Kerr (1942), Atz (1953), Bock (1928), Matthews (1936), Lee (1942), Bretschneider and de Wit (1947), Scruggs (1951), Olivereau (1954), and Pickford and Atz (1957) led the foundation for the researchers to investigate various morphological and physiological aspects of fish pituitary. In the present review, the shape, lodgement, position, orientation of the gland, and its attachment with the brain have been discussed.

The pituitary is variously shaped in a different groups of fish species. A number of fish species have shown oval pituitary gland viz. *Pangasius pangasius* (Scruggs,1939), *Schizothorax esocinus* (Daftari and Das,1966), *Rasbora daniconius, Clarias batrachus, Heteropneustes fossils, Trichogaster fasciatus, Mystus bleekeri, Mystus aor, Labeo rohita, Labeo calbasu, Labeo bata* (Rao,1969,1971,1972), *Xenentodon cancila* (Singh And Sathyanasen,1962; Pandey and Pandey,1977) *Pseudecheneis sulcatus*(Gill and Punetha,1977), *Bagarius bagarius* (Pandey and Pandey,1986), *Wallago attu* (Sathyanesan,1961).

A pear-shaped pituitary has been observed *Ctenopharyngodon idella* and *Hypophthalmichthys molitrix* (Khan *et al.,*1979), *Amphipnuous cuchia* (Rao,1969).A rounded pituitary has been observed in *Nandas nandas* (Raizada and Bhargava,1974). A bilobed pituitary has also been observed in *Notopterus chitala* (Sathyanesan,1961). A conical gland has also been observed in Eel (Scruggs,1939).

A small constriction has been observed by a number of workers in *Chasmichrhys dolicognathus*(Honma,1958) and *Clarias batrachus (*Lehri,1966). Rao (1969) also observed the same in *Heteropneustes fossilis* and *Ompok bimaculatus*

Kerr (1949) observed the notched outer surface of rostral pars distalis in the pituitary of *S. trutta* and *Esox lucinus* . Similarly, in the middle region of the pituitary gland of *Notopterus chitala* a small notched has been observed by Rao (1969). He further observed a transverse furrow between the three lobes of the adenohypophysis.

Distinct variations have been observed as far as lodgement and disposition of the gland in fishes is concerned.-

1. As described by Rao (1969) in a number of fish species viz. *Clarias batrachus, Mystus cavasius, Mystus bleekeri* and *Ompok pabda* (Sunderaraj,1959), the pituitary is simply lodged with parasphenoid bone without any depression.

2. in certain species, the gland is lodged into a shallow concavity formed by parasphenoid bone. This concavity is known as sella turcica (De Beer,1926). A number

of studies reveal this type of lodgement in fishes (Rao,1969).

3. In some species, the gland is lodged in a depression formed by prootic and parasphenoid bone just below the brain. The cavity is filled with areolar tissues This type of cavity is found in *Fundulus* (Matthews,1939), *Lebistes reticulatus,* and *Xiphophorus helleri* (Potts,1942). Similar observations have also been made by Rao (1969), Gill and Punetha (1977), and Pandey and Pandey(1986) in a variety of fish species

4. In certain species, the gland is lodged in a cavity formed by prootics and parasphenoid dorsally and parasphenoid ventrally. (Bretshneider *et al.*,1947).

It may be assumed that variation in disposition and lodgement may be due to the variations in the shape of the gland.

As far as location is concerned, similar to other vertebrates, the gland is situated just below the brain and attached to the infundibulum posterior to the optic chiasma. Further, the gland may lie in an anteroventral or midventral, or posteroventral on the floor of the infundibulum (Rao,1969; Pandey and Pandey,1977).

Variations are also found in the attachment of the pituitary gland to the brain. According to Kerr (1942), two ways of attachment of the gland with the brain have been observed. He has termed these two types as A and B types. In the platybasic type of attachment, the gland is attached to the brain without any definite stalk while in leptobasic type of attachment, the gland is attached with a definite stalk. (Charripper, 1937; Bretschneider and de Wit 1947; Sathyanesan, 1958).

The platybasic attachment, in which no definite stalk is present, has been found in a number of fish species viz, *Anguilla anguilla* (Stendeall, 1914), *Gasterosteus aculeatus* (Bock, 1926), *Micropterus* (Bretschneider and Duyvene de wit,1947), *C.dolicongnathus, Chaenogobius uroteinia* (Honma, 1958), *Notopterus chitala*, *Mystus armatus* (Sathyanesan, 1961) *Channa marulius* (Das and Khan, 1962), *Channa gachua*, *Notoptetrus chitala*, *Mystus armatus, Nandus nundus Channa punctatus* (Rao,1969), *Colisa fasciatus* (Khan,1970), *Nandus nandus* (Raizada and Bhargava,1974) and *Channa straitus (*Srivastava *et al*., 1977). However, a different type of platybasic type of attachment has been observed in *Glossogobius giuris* in which an inverted cup-like cavity is formed by the infundibulum in which the gland is embedded (Rao,1969).

On the basis of the entrance of the stalk in the gland (Bretschneider and de Wit,1947), the leptobasic type may further be divided into three categories-

1. Cranio- leptobasic type- in this type the stalk enters from the anterodorsal side of the gland. This type of attachment has been observed in *P.phoxinus, C.barbatula* (Kerr,1942), *A. nebulosus* (Scruggs,1939), *Heteropneustes fossilis*

(Sunderaraj, 1959), *M. vittatus*, *C. pubda* (Singh and Sathyanesan,1962) *Clarias batrachus* (Lehri,1966), *Oxygaster bacaila, Rasbora deniconius*, *Osteobrama cotio, C. pubda ,C. batrachus , Ompok bimaculatus, Mystus aor,Mystus cavasius,Mystus tengara, Mystus bleekeri, Notopterus punctata* (Rao,1969) .

2. Dorso-leptobasic type-In this type, the stalk enters the gland mid-dorsally.Such condition has been observed, in a number of fish species viz. *Fundulus* (Matthews,1936), *Xenentodon hellar*i, *L reticulatus*, *M. latipinna* (Potts,1942),*C. paliatus* (Miller, 1944), *X. cancila* (Singh and Sathyanesan,1962), *C. reba* (Sathyanesan, 1958), *Mystus seenghala, Barbus stigma* (Sathyanesan, 1961), *C. Mrigala* (lal, 1964), *C. Mrigala*, *S. Silonia,* (Rao, 1969), *Glyotothorax pectinopterus* (Pant and Khanna, 1968), and *Pseudoecheneis sulcatu*s (Gill and Punetha, 1977).

3. Caudo-leptobasic type- in this type, the stalk enters from the posterior side of the gland on its dorsal side This type of condition has been observed in Nemacheilus (Daftari, 1966) Tor tor (Rai, 1967), *Labeo calbasu*, *Labeo Bata*, *Puntius sarana, Amphipnuous cuchia* (Rao, 1969) and Valsella et al., 1977).

As far as the orientation of the gland in relation to the brain is concerned, linear, horizontal, or vertical orientation has been observed by a number of authors. According to Stendall (1914), the various lobes of the gland are arranged vertically along the brain axis. Similar observations have also been made in *Cyprinus carpio* (Scruggs,1939), *Carassius auratus* (Bell,1938; Levenstein,1939), *Cirrhinus reba* (Sathyanesan, 1958), *Labeo rohita* (Khan,1962), *Cyprinus carpio, Labeo dero* (Daftari and Das,1966)

The horizontal arrangement of lobes of the pituitary in relation to the brain has been observed in *Heteropeuestes fossilis* (Sunderaraj, 1959).

Three types of orientation have been described by Sathyanesan (1961). in type one, the three lobes viz. Rostral pars distalis, proximal pars distalis, and pars intermedia are arranged one behind the other in the dorsoventral axis in relation to the brain. This orientation has been seen in *Notopterus chitala* (Sathyanesan ,1961) *Xenentodon cancila* (Pandey and Pandey 1977). In type two, the lobes of the gland have been oriented in an anteroposterior direction in relation to the brain axis. Such type of orientation has been investigated in *Chela bacaila* and *Bagarius bugarius* (Sathyanesan,1962). In type three,rostral pars distalis and proximal pars distalis are present at the peripheral region while pars intermedia occupies the central position as described by Sathyanesan(1961) in *Wallago attu.*

A linear arrangement of the three lobes i.e. rostral pars distalis, proximal pars distalis, and pars intermedia has been termed as craniocaudal and observed in a

number of fish species by Lehri (1966), Gill and Punetha (1977), and Pandey and Pandey (1986). Further, it has been postulated that variations in the orientation of the pituitary gland are due to its rotation through various angles (Rao,1969). Moreover, rotation of the gland is caused due to the growth of the brain in the posterior direction (Charripper, 1937; Rao, 1969).

Conclusions

From the above discussions, it may be concluded that the shape, position, orientation, and attachment of the gland to the brain is quite variable in fishes and varies from species to species. Further, it may be assumed that shape, position, lodgement may be correlated with the shape and size of the gland and skull present in a variety of fish species.

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