

The Caudal Urophysis of *Carasobarbus luteus* and *Capoeta trutta* caught from river Tigris passing through Mosul city



Nabela M.S. Al-Shatter*, Zohair I.F. Rahemo*

*Department of Biology, College of Science, University of Mosul, Mosul, Iraq-
zohair_rahemo@yahoo.com

Abstract:

Two freshwater fish models were selected, to study their caudal neurosecretory system, caught in river Tigris passing through Ninawa province. A total of 45 *Carasobarbus luteus* and 32 of *Capoeta trutta* were examined to study their caudal neurosecretory system of gross morphological and histological aspects. The caudal spinal cord in *B. luteus* is a lobulated organ, possesses (3-5) lobules which are oval or ovoid, each lobule measures (450-675) μm and average diameter is (270) μm , situated in postero-ventral part of the spinal cord in the caudal region at the level of the last 5th vertebrae, while spinal cord in *C. trutta* lacks these lobules. The caudal spinal cord possesses three types of neurosecretory cells which appeared, after staining by three different stains. These cells are situated at ventro- and ventro-lateral region of spinal cord with respect to the central canal. These cells can be classified into three types, small, median, and large cells. Noteworthy, Dahlgren cells are associated with blood capillaries and it is easy to trace these cells with bulbous axons rich in secretory materials as a large amount of neurosecretory material deposited in them. Furthermore, neurosecretory material were deposited in the ventral part of the spinal cord which are known as Herring bodies, and blood vessels were observed near them, some axons of Dahlgren cells seen directed toward the blood capillaries

Keywords: fishes, urophysis, histology

I. Introduction

Fishes possess a neurosecretory system in their caudal spinal cord in addition to hypothalamo-hypophyseal system [1].

Enami was the first who studied the caudal neurosecretory system of *Gillichthys mirabilis* and correlate its function to the storage of secretory material and gave the term, urophysis [2, 3]. In general the caudal neurosecretory system (CNSS) is the accumulation of Dahlgren cells whose cytoplasm contains neurosecretory materials or hormones [1]. Dahlgren cells

are of three types, the small situated at the distal end of the spinal cord in the dorsal region of urophysis, median sized situated anterior to the urophysis and the anterior to the median [4]. Dahlgren cells appear in some fishes in the last 8th vertebrae in vertebral column as in the *Platyichthys flesus* [5], in other such as *Liza abu* in the last three vertebrae [6]. It is known now that Dahlgren cells possess secretory granules which are 800- 2500 \AA in diameter in addition to Golgi bodies which participate in the synthesis of these

secretory material and surrounding them by membrane[7]. Furthermore, three types of neuropeptides known to be present in these secretion: urotensin I(UI), urotensin II(UII) and corticotropin releasing factor(CRF), UI and UII have osmoregulatory mechanism, ionic equilibrium and arterial pressure activity in many species of fishes[3], [8] and [5].Furthermore,CNS possess Glial cells, ependymal cells, and glial fibers which reach urophysis along the spinal cord[9]. Between axons of Dahlgren cells there are swelling known as Herring bodies which represent the neurosecretory materials coming from neural cell as colloidal droplets accumulated at the periphery of these bodies leaving central region. From above it is clear the existence of differences between fishes in the position of Dahlgren cells as such the present study is aimed to explore the gross morphology of the urophysis of two freshwater fishes namely *Carasobarbus grypus*(Fig.1) and *Capoeta trutta* (Fig.2)in addition the morphological and histological structures of the urophysis using different stains.

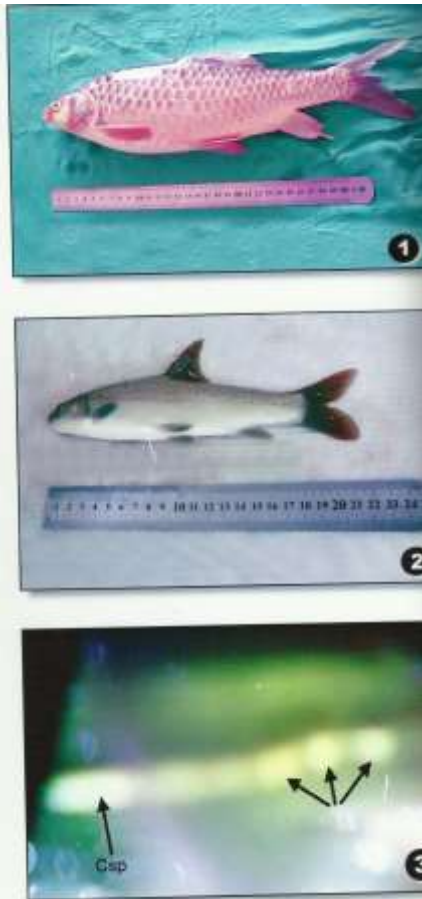
II. Materials and Methods:

A total of 45 *Carasobarbus luteus* (31 females+ 14 males) and 32 *Capoeta trutta* (21 females+ 11 males)-[Figs 1,2], caught from River Tigris passing through Mosul city. Tails were cut by sharp knives and spinal cord removed and fixed and examined under microscope to locate the urophysis ,then fixed either in Duboscq-Brasil or alcoholic Bouins fluid[10], or in buffered neutral formaline solution[11], then dehydrated using ascending series of alcohol, cleared in Xylole, embedded in

paraffin wax, sectioned by 6-8 microns in thickness, stained with Haematoxyline-eosin, Aldehydefuchsin and ammonical silver nitrate [12].Prepared slides were examined, photographed using digital Camera or drawn using Camera lucida.

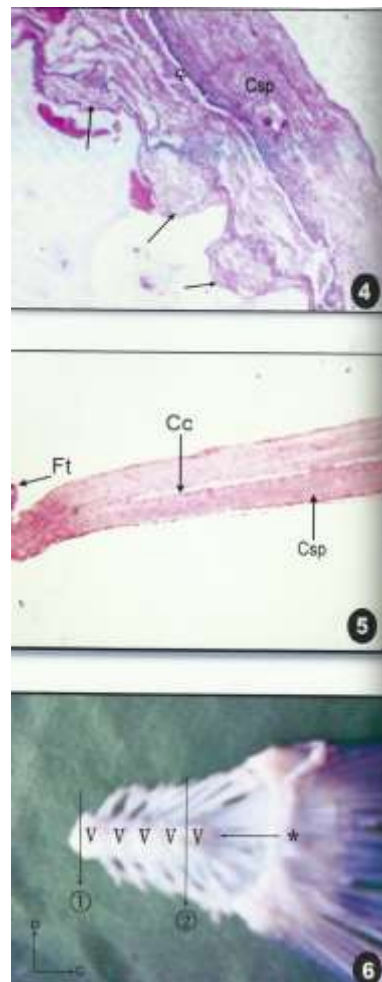
III. Results and Discussion

After removal of vertebrae in *C. luteus* urophysis appear as multilobulate(3-5 lobules) organ situated in the 5th vertebra before the last (Fig.3,4), while in *C. trutta* it is not lobulated (Fig.5,6) .So it differs from that found *Platichthys flescusin* which is located in the 8th vertebra before the last[5] and it differ from that in *Liza abue* which is located in the 3rd vertebra before the last [6], and that of *Chondrostoma regius* which is located in the last 8th vertebra before the last [13],or the last 4 vertebrae in Zebra fishes [14].Histological examination of the spinal cord of both fishes examined in this study revealed that the spinal cord is surrounded by myelin sheath(Fig. 5), and the Dahlgren cells(Figs 7-9) seen laterally or ventrolaterally to the central canal which measure 121 – 150 μ m in diameter this canal become reduced to 50 μ m at the end of the spinal cord to end as filum terminale (Fig.10). Three types of Dahlgren cells were noticed , with distinct secretory materials and nerve fibers were also observed after using ammonical silver nitrate impregnation technique. Storage organs or Herring bodies were also observed filled with spherical bodies which are colloid droplets. Blood capillaries were also observed near these Herring bodies in addition to Glial cells or supportive cells.



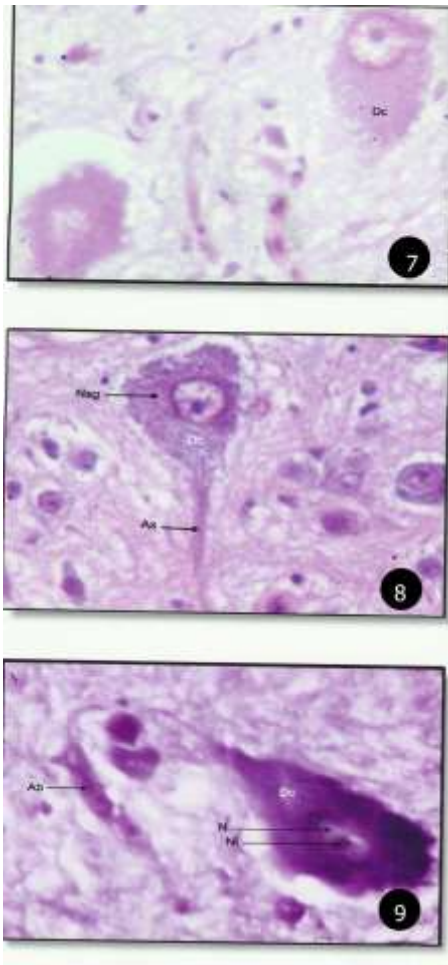
Figs(1-3):

Fig.(1);Photograph of *Carasobarbus luteus*, Fig.(2). Photograph of *Capoeta trutta* Fig(3): Photograph of the spinal cord of *C. luteus* with multilobulated urophysis (Csp) .



Figs.(4-6):

Fig.(4).Longitudinal section in the caudal spinal cord(Cps) of *C. luteus* showing the central canal(Cc), multilobulations (arrows),Haematoxyline-eosin (H-E). X40. Fig.(5).the caudal spinal cord(Cps) of *C. trutta* showing no lobulation of urophysis, notice the last end of the spinal cord, filum terminale(Ft). H-E. X40. Fig.(6). Photograph of the caudal vertebrae of *C. trutta*, caudal vertebrae(V), zone 1 -2 represent the site of appearance of Dahlgren cells, * represent the position of felium terminale.



Figs-(7-9). Different types of Dahlgren cells

Fig.(7)- large Dahlgren cell(DC) of *C. luteus* , H-E X400

Fig.(8)-Dahlgren cell(Dc) of *C. luteus* with neurosecretory granules(Nsg), notice secretory materials in Axon(Ax).H-E.,X400.

Fig.(9).Large Dahlgren Cell(Dc) of *C. trutta* with neurosecretory granules appear in axial bulb(Ab),with clear nucleus(N), and nucleolus (NI),Aldehyde Fucsin(AF), X400.

It is well known that distribution of Dahlgren cells is not related to its size as also found [14] as they found that Dahlgren cells at the level of the 4th vertebrae before the last and the small at the level of urophysis which is oval in shape with many blood vessels situated near the end of the spinal cord[15] observed large Dahlgren cells in *Platichthys flesus* named as magnocellular, become small as proceed posteriorly. It appear from our study that neurohaemal organ is present in both fishes examined as

seen at ends of axons in other cyprinid fishes [6] with numerous secretory materials are in contact with blood vessels a condition which was found in many fishes[16]. Anyhow, some Dahlgren cells were observed near the spinal fluid which means the neurosecretion of Dahlgren cells may be released directly into cerebrospinal fluid which is similar to the finding of [17] in which they studied these Dahlgren cells which synthesize UII which are in contact with cerebrospinal fluid of *Carassius auratus*.

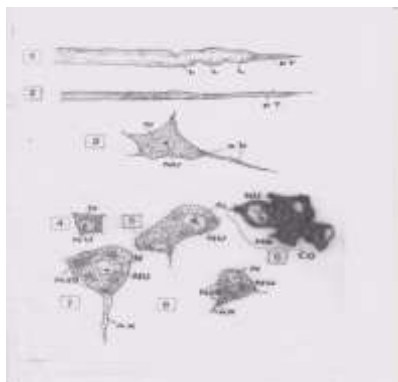


Fig.10 .Drawings of the Urophysis and Dahlgren cells of Two Examined fishes.

1. Lateral view of the spinal cord of *C. trutta* ending in filum terminale(FT) [X 5].
2. Dahlgren cell of *C. trutta* with clear axon(AX) and its dendrites with nucleus(N) and nucleolus(Nu), [X 400].
3. Small Dahlgren cell of *C. luteus* with clear nucleus(N) and nucleolus(Nu), [X400].
4. Medium sized Dahlgren cell of *C. trutta* with multipolar and pear-shaped and cytoplasm intensively stained while nucleus(N) unstained, nucleolus(Nu), [X 400].
5. Herring bodies (HB) of *C. luteus* with colloid material (CO) which is usually situated near Dahlgren cell [X 400].
6. Dahlgren cell of *C. luteus* in secretory state with neurosecretory materials (Nsg), nucleus(N), nucleolus (Nu), axon(Ax), [X 400] .
7. Lateral view of the spinal cord of *C. luteus* with clear lobes (L) and at its end filumterminale(FT), [X 10].

IV. Conclusion:

It can be concluded that the caudal spinal cord of two fishes investigated have some peculiar characters especially in *B. luteus* as it is a lobulated organ, possesses (3-5) lobules which are oval or ovoid, situated in postero-ventral part of the spinal cord in the caudal region at the level of the last 5th vertebrate, while spinal cord in second species, *C. trutta* lacks these lobules. Furthermore, the caudal spinal cord possesses three types of Dahlgren cells or neurosecretory cells, these cells are

situated at ventro- and ventro-lateral region of spinal cord with respect to the central canal. Neurosecretory material were deposited in the ventral part of the spinal cord which are known as Herring bodies, and blood vessels were observed near them. Although investigation on Iraqi fishes were scarce. From the above histological results revealed these two fishes were more or less similar to most of freshwater fishes investigated previously in other parts of the world.

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