CHAPTER - IX

BOTIA BIRDI CHOWDHRY

GROSS MORPHOLOGY

Anatomical relations of the pituitary.

The pituitary gland can be seen through the translucent parasphenoid bone, when the buccal lining is removed ventrally. The pituitary gland is ensased in a transparent bony capsule - the sella turcica. The pituitary foramen, through which the pituitary stalk enters the brain case, is covered by a thin tough extension of the endocranial membranes, completely covering the foramen, except where it surrounds the stalk.

The gland is situated ventral to infundibulum,
immediately behind the optic chiasma closely applied to the floor of the brain, lying in between the lobi inferiores (Pl. LXXXVI, fig. 48 a,b). It has a membranous covering.

**Shape and size of the gland.**

The shape of the gland is conical, tapering towards the anterior and (Pl. LXXXVI, fig. 48 c), and has a mean antero-posterior length of one mm. Being very small, none of the lobes of the gland are distinct externally.

**Attachment and Orientation.**

The pituitary is stalked and thus of leptobasic type; being attached with the infundibulum postero-dorsally - a caudobasic type rarely found in teleost fishes.

The arrangement of the lobes is linear.

**Extent of the regions.**

The extent of the pro- is as a small patch of cells lying antero-dorsally. The meso-adenohypophysis is the largest part of the gland forming the base of the cone. The metaadenohypophysis is ventral to the other two regions forming the apex of the cone. The neurohypophysis trunk passes through the mesoadenohypophysis, and arborizes in it upto the junction of the mesoadenohypophysis and
and metaadenohypophysis. The neuro-does not extend up to
the lip of the metaadenohypophysis (Pl. LXXXVI, fig. 49).
Such a condition is absent in the other fishes studied.

**HISTOLOGY**

**Proadenohiphysis.**

The proadenohiphysis is formed mainly of
acidophils, basophils being absent. The acidophils are
8 micra-10 micra in size. Only a few blood vessels and
neurohypophysial strands are seen. A few chromophobes are
absent in the post-spawning period (Pl. LXXXVIII, mp. 113).

**Mesoadenohiphysis.**

The mesoadenohiphysis is made of basophils,
acidophils, chromophobes, capillaries and neurohypophysial
strands.

The basophils are of three types. The first
type of basophils (cyanophil type 1) are 14 micra to 16 micra
in size. These are globular in shape but their shape
changes with seasonal cycle. They become elongated and
granular (Pl. LXXXVIII, mp. 114). These are PAS and AF
positive. These granulations are stained deep red with
PAS and MTS stains; the cytoplasm being stained blue by
MTS. These are present throughout the mesoadenohiphysis,
in scattered cell-clusters.

The second type of basophils (cyanophil type 2)
is 10 micra in size. These are conical in shape, the nucleus being rounded and placed centrally; but shift to one side in the mature as well as in spent specimens. The cytoplasm is non-granular, and stains more lightly with alginine blue than do the cyanophil cell type 1. These cells have a tendency to lie towards the periphery of the meso-, being found singly or in groups. Individual cells with similar features may be seen lying in other parts of the mesoadenohypophysis as well. Cyanophil type 2 cells are also seen as conspicuous groups lying close against the branches of neurohypophysis.

In addition to these two well defined types of chromophil cells, smaller cells averaging 4-6 micra constitute cyanophil cell type 3. These are stained lightly with PAS, and with AF, after oxidation with Potassium permanganate solution. Their nuclei are usually small and irregular in shape. They lie scattered among the deeply staining cyanophil cell type 1 cells (Pl. XLI, mp. 117).

The chromophobes are few and are interspersed singly or in clusters among basophils and acidophils. The blood vessels are present as a capillary network in this region. The acidophils are only of one type being rounded with a distinct nucleus. They are PAS negative cells, and are stained red with acid fuchsin. These cells lie in clusters more towards the centre and aggregated along the neurohypophysial strands, being interspersed among basophil cell clusters (Pl. LXXXVII, mp. 112).
**Metaadenohypophysis.**

The metaadenohypophysis is made up of acidophils, and blood capillaries are in abundance. A few basophils are however present near the junction of meso- and metaadenohypophysis in ripe phase. The acidophils are 10 micra in size and may be rounded or irregular in shape, but the nuclei are always rounded (Pl. XCIV, mp. 121). Acidophils are not stained deep by any of the stains used in the present studies, although some cells around the neurohypophysis show a darker acidic stain than the rest. The neurohypophysial strands are present in the metaadenohypophysis but not in an arborized fashion, and do not reach the apex of the lobe.

**Neurohypophysis.**

There is no hypophysial cavity present in the neurohypophysis. Few branches are given to the proadenohypophysis, but a number are given to the mesoadenohypophysis, after which the neuro- then passes down to the metaadenohypophysis where there is little arborization.

The colloid secretory droplets and neurosecretory cells are scanty as compared with other fishes, but there are stout long fibres running throughout the axis of the neuro-
This fish is a summer breeder and thus its maturity stages are quite different from those of Schizothorax esocinus, which is a spring breeder.

Its seasonal changes are studied under the following heads:

1. Resting and Immature phase (October-middle of April).
2. Mature phase (Middle of April-May).
3. Ripe phase (June-July).
4. Spent phase (August-September).

**Resting and Immature phase.**

This stage is from October-to middle of April. The cells in the pituitary gland are not well-marked, there being no distinct cell walls. The number of acidophils in meso-adenohypophysis, although indistinct, are more numerous than basophils (which are not separable from acidophils in this season). The acidophils are about 60% and basophils 30% (Pl. XCVI, fig. 52, 53). Actually this is the resting period in this fish. Neurohypophysial strands are not distinct (Pl. LXXVIII, mp. 113); and blood capillaries or sinuses are also scanty. Period-acid-Schiff (PAS) gave negative results with all the cells of the pituitary in this period. The cells also appear evenly distributed throughout the gland, without the basophils being differentiated into the 3 types. Acidophils measure 8 micra, while basophils when distinct measure 10 micra.
Mature Phase.

This stage is from 15th of April to middle of May. The gland has reached its maximum length, measuring 1.0 mm. Three types of basophil cells are distinct in this phase, the largest measuring 12 micra in size. The type 1 granulated basophils are seen in clusters with prominent nuclei. The second type of basophils measuring 8 micra in size are elliptical and the nucleus near the periphery. These cells are found scattered here and there. Basophil cells are stained deeply by PAS stain, and conspicuous at the sides of the gland. During the later-part of this period, basophils are also seen bordering the line of demarcation between mesoadenohypophysis and metaadenohypophysis. Chromophobes are few. Branches of neurohypophysis are distinct and reach down to the meta-. Blood capillaries are common throughout the gland (Pl. LXXXIX, mp. 115). The percentage of basophils in the mesoadenohypophysis has increased from 30% to 50%, while the percentage of acidophils has decreased from 60 to 50% (Pl. XCVI, fig. 52, 53).

The mesoadenohypophysis is the largest part of the gland now, and the acidophil cells are found more in the middle of the gland lining the walls of the neurohypophysis. The largest basophil cells found in this phase measure 16 micra in size.
Neurohypophysial strands have colloid droplets, neurosecretory cells, and numerous blood capillaries (Pl. XCI, mp. 129).

**Ripe phase.**

This phase extends from June-July. The pituitary has the maximum number of basophils in mesoadenohypophysis. The percentage of basophils has reached to 70% and that of acidophils has decreased to 30% which is exactly the reverse of these cell percentages in immature phase. Some basophils in this phase become vacuolated. The granulation of the cytoplasm of the basophils has so much increased that the nuclei are not easy to distinguishable, the nuclei becomes excentric. Some of these granulated cells are also migrated into the neurohypophysis. Average basophils is 14-16 micra, 12 micra and 6 micra. Acidophils of the mesoadenohypophysis are only represented by few cell patches of a few cells.

**Spent phase.**

From August-September, this phase is entirely different from the other phases and is distinct due to the presence in mesoadenohypophysis of large vacuoles in most basophils (Pl. XCl, mp. 118). These vacuoles are formed by the degranulation and disappearance of the globules in the basophils, some of which become extra-cellular. This vacuolation gives a sieve like appearance to the
mesoadenohypophysis, although fissures and extra-cellular cavities are also present. Vacuolation is more in the centre, nearer to the cell-clusters adjacent to neurohypophysis, than towards the periphery of the meso-. The number of chromophobes are seen to increase and the number of basophils decrease proportionately, the acidophil/basophil percentages being 50/50. The meta-acidophils (no amphiphils being present in Botia) become loosely arranged with indistinct outlines at this stage.

The number, percentage, diameter and cell counts of the cells of the pituitary in different months of the year are shown in Table No: 3.

SEASONAL CHANGES IN OVARY CORRELATED WITH PITUITARY

The ovary of the fish is in resting and immature phase from October to middle of April. The fish remains in a dormant condition. The diameter of ova, if present, is .2 mm; the diameter of acidophils and basophils is much less (Pl. XC VIII, fig. 55,56; Pl. XCIX, mp. 123).

The maturing phase of ovary (middle of April - middle of May), the diameter of ova rises to .6 mm. Diameter of basophils also rises to 10 micra. Ova are now visible in the ovary.

In the spawning phase which extends from June to July, the diameter of ova has risen from .6 to 1 mm. along with the increase in the diameter of basophils which has new reached to 15 micra. There is overall in increase
in the size of the ovary, which is in spawning condition. The percentage of basophils has increased from 30% to 70%.

From August to September, the fish is in spent condition, the percentage of basophils has fallen from 70% to 50% and then to 30%. No ova are present.
<table>
<thead>
<tr>
<th>Month</th>
<th>Area</th>
<th>Acide-</th>
<th>Base-</th>
<th>Acide-</th>
<th>Total cell</th>
<th>Total cell</th>
<th>Total cell</th>
<th>% Acide -</th>
<th>% Base -</th>
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<tbody>
<tr>
<td>Aug.</td>
<td>.2mm²</td>
<td>.19mm²</td>
<td>450</td>
<td>960</td>
<td>1410</td>
<td>1.4</td>
<td>3.1</td>
<td>68%</td>
<td>32%</td>
</tr>
<tr>
<td>Sept.</td>
<td>.19&quot;</td>
<td>.13&quot;</td>
<td>506</td>
<td>869</td>
<td>1375</td>
<td>1.5</td>
<td>2.7</td>
<td>65%</td>
<td>36.8%</td>
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<tr>
<td>Oct.</td>
<td>.17&quot;</td>
<td>.12&quot;</td>
<td>584</td>
<td>503</td>
<td>1167</td>
<td>2.0</td>
<td>2.0</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Nov.</td>
<td>.17&quot;</td>
<td>.12&quot;</td>
<td>883</td>
<td>432</td>
<td>1235</td>
<td>2.8</td>
<td>1.5</td>
<td>35%</td>
<td>65%</td>
</tr>
<tr>
<td>Dec.</td>
<td>.16&quot;</td>
<td>.15&quot;</td>
<td>756</td>
<td>369</td>
<td>1125</td>
<td>3.0</td>
<td>1.4</td>
<td>32.8%</td>
<td>67.2%</td>
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<tr>
<td>Jan.</td>
<td>.18&quot;</td>
<td>.17&quot;</td>
<td>696</td>
<td>325</td>
<td>1021</td>
<td>3.1</td>
<td>1.4</td>
<td>31.9%</td>
<td>68.1%</td>
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<tr>
<td>Feb.</td>
<td>.19&quot;</td>
<td>.18&quot;</td>
<td>761</td>
<td>339</td>
<td>1100</td>
<td>3.2</td>
<td>1.4</td>
<td>30.9%</td>
<td>69.1%</td>
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<tr>
<td>March</td>
<td>.19&quot;</td>
<td>.19&quot;</td>
<td>875</td>
<td>360</td>
<td>1235</td>
<td>3.4</td>
<td>1.4</td>
<td>29.1%</td>
<td>70.9%</td>
</tr>
<tr>
<td>April</td>
<td>.2&quot;</td>
<td>.17&quot;</td>
<td>690</td>
<td>308</td>
<td>998</td>
<td>3.2</td>
<td>1.0</td>
<td>30.9%</td>
<td>69.1%</td>
</tr>
<tr>
<td>May.</td>
<td>.2&quot;</td>
<td>.19&quot;</td>
<td>609</td>
<td>708</td>
<td>1217</td>
<td>1.8</td>
<td>2.0</td>
<td>50.8%</td>
<td>49.2%</td>
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<tr>
<td>June</td>
<td>.23&quot;</td>
<td>.19&quot;</td>
<td>312</td>
<td>1010</td>
<td>1322</td>
<td>1.3</td>
<td>4.2</td>
<td>69.8%</td>
<td>30.2%</td>
</tr>
<tr>
<td>July.</td>
<td>.24&quot;</td>
<td>.2&quot;</td>
<td>300</td>
<td>750</td>
<td>1050</td>
<td>1.4</td>
<td>3.5</td>
<td>71.4%</td>
<td>28.6%</td>
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