

## HISTOLOGICAL CHANGES IN HEPATOCYTES AND OVARIES DURING DIFFERENT PHASES OF SPAWNING IN A MATURED FEMALE CATFISH, *HETEROPNEUSTES FOSSILIS*, (BLOCH 1794)

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### ABSTRACT

The present investigation dealt with the observations made on the effect of different seasons on the histological architecture of the ovary and liver of the catfish, *Heteropneustes fossilis*. The histological results showed that the ovaries of the catfish were degenerated during winter that was considered as the resting season of the catfish ovarian activity. It began to restore its intact and fully matured structure during spring and continued the same during summer where the ovaries showed different developmental stages including mature follicles, therefore both spring and summer seasons considered as the spawning seasons of the catfish. Ovary showed many atretic follicles during post-spawning. During the maturation period, the cytoplasmic granules were observed with a hypertrophied nuclei, in hepatocytes. These granules were scarce during spawning period, and became disappear during post-spawning. The results of GSI- Gonado Somatic Index and HIS- Hepato Somatic Index is coincided with the histological structure as they showed peak value during spring and summer (spawning season) and showed the lowest value during winter (resting season) in *Heteropneustes fossilis*. (Bloch 1794)

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### INTRODUCTION

*Heteropneustes fossilis* is an only one species, under the genus *Heteropneustes*, the air breathing catfish found in India (Fig1). It is found mainly in ponds, ditches, swamps, and marshes, but sometimes occurs in muddy rivers. The fish is very much dreaded for its poisonous pectoral spines which can inflict very painful wounds leading to local inflammation or even fever. It is omnivorous. Confined waters is a comfortable place for its breeding during the monsoon months, but it can also breed in ponds, derelict ponds, and ditches when sufficient rain water accumulates. Its therapeutic value is very high that makes it in a great demand. In India it is highly preferable and commonly known as *singhi*.



Fig 1 Matured female catfish, *Heteropneustes fossilis*

*Heteropneustes fossilis*, the air breathing catfish is considered as the cheapest source of high quality animal protein and rich in calcium, phosphate, iodine, and vitamins. Generally, fish is not only used for human consumption, but also used as a good source of animal meal. The study of the gonads of the different teleost fish attracts the attention of several investigators is the several Asian catfish. It is known that all Indian fresh water fishes are seasonal breeders and the maturation in the gonads takes place in a particular time period after which the spawning takes place (Msiska 2002; Singh *et al.* 2008; Sanwal and Khanna 1972; Yin *et al.* 2012). This study was done according to the breeding and maturation period of the fish.

### MATERIALS AND METHODS

#### Fish

Seasonal samples of female catfish, *Heteropneustes fossilis* were collected from the local fish market of Bhagalpur. Then they were acclimatized in the laboratory for one week.

#### Histological study of liver and ovary

After anaesthetization of the fish, the liver and ovaries were removed carefully and fragments of liver and ovaries of were fixed in aqueous Bouin's fluid. Subsequent to dehydration the tissues were embedded in paraffin wax. All the tissues were serially sectioned at 5-6  $\mu$  m and stained with routine Haematoxylin and Eosin (H& E). This observation shows the

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presence vitellogenin in the section of liver and ovary in a matured female fish.

#### **Gonado-somatic index (GSI)**

For the study of Gonado – somatic index, the gonads from the body cavity will be dissected out and the weight of the gonads will be measured. Then the GSI values will be calculated according to the following formula given by Brooks *et al.* (1997)

$$\text{GSI} = (\text{Weight of the gonad} / \text{Total body weight}) \times 100$$

#### **Hepato-somatic index (HSI)**

For the study of Hepato – somatic index, the liver from the body cavity will be dissected out and the weight of the liver will be measured. Then the Hepato-somatic index will be calculated as

$$\text{HSI} = (\text{Weight of liver} / \text{Total body weight}) \times 100$$

### **RESULTS**

The Histological study of the sectioned tissue of liver and ovary, that were fixed in aqueous Bouin's fluid and were stained with routine Haematoxylin and Eosin (H& E), after going through the dehydration process, shows the following features in different spawning phases :-

#### **Pre- spawning phase**

During the period of maturation, hepatocytes showed hypertrophied nuclei with dense cytoplasmic granules as shown in Fig 3. The binucleated cells increased with its size in hepatocytes. The deposition of yolk and its gradual movement towards center was being noticed during this phase. The majority of the oocytes were developed into yolk granules, and the immature oocytes were decreased in number as shown in Fig 2.

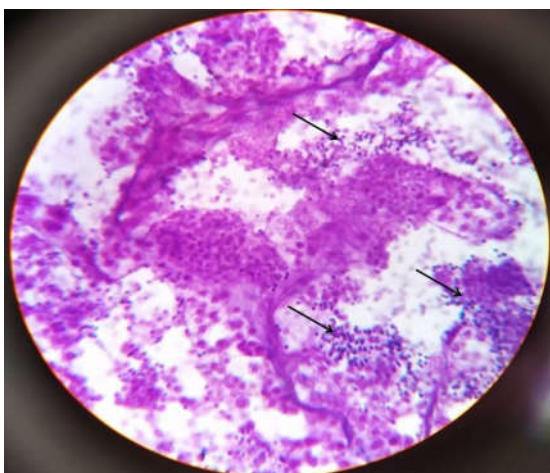


Fig 2 Showing oocyte with yolk granules during pre- spawning phase

#### **Spawning phase**

During the period of spawning, the hepatocytes showed some changes with its enlargement and scarce cytoplasmic granules having hypertrophic nuclei (Fig 5). The vascularisation of hepatic cells were also reduced. The ovaries showed a large amount of riped ova, during this phase as shown in Fig 4. The mature follicles were larger and irregular provided with eccentric germinal vesicle. Some of the matured follicles were collapsed into Zona granulosa and Zona radiata and were broken down in several places, during the end of this phase.

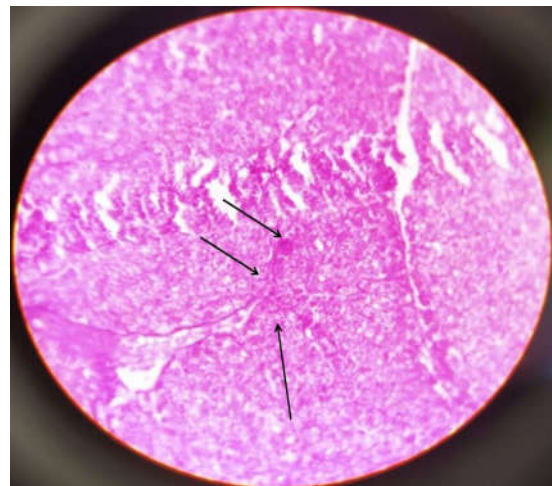


Fig 3 Showing hepatocytes encircled with the central vein with granular cytoplasm during pre-spawning phase

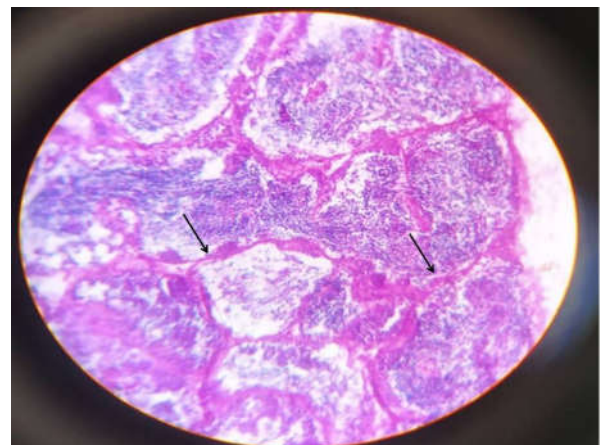


Fig 4 Showing oocyte with full of riped ovaries during spawning phase

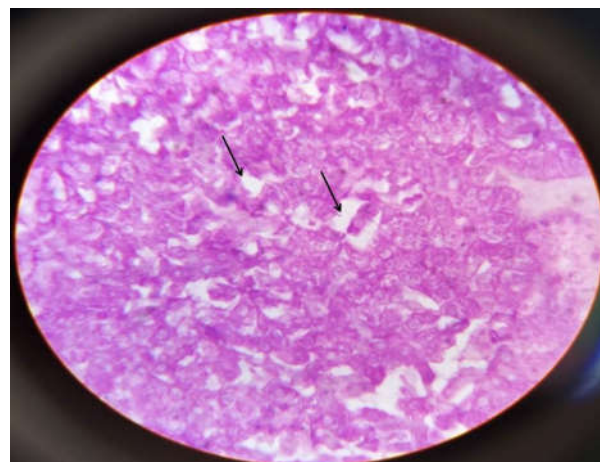


Fig 5 Showing enlarged hepatocytes with scarce cytoplasm, and with some vacuolated cells during spawning

#### **Post- Spawning phase**

During this period, the hepatocytes were observed with centrally placed prominent nuclei. The accumulation of hepatic cytoplasm was started by the basophilic granules. The ovaries showed a very few number of matured ova. By the end of this phase, the early perinuclear oocyte were appeared below the ovarian wall as shown in Fig 6 & Fig 7.

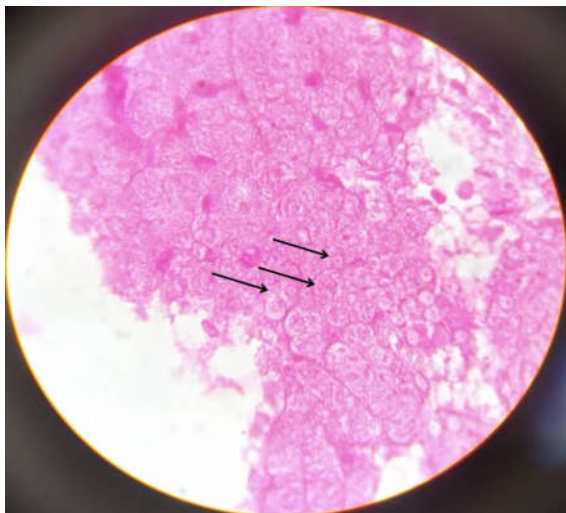


Fig 6 Showing early perinuclear oocytes during post- spawning phase

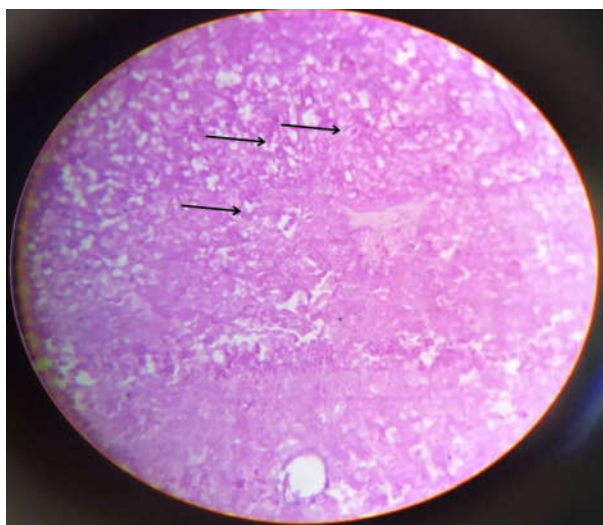


Fig 7 Showing prominent hepatic cells with nuclei and granular cytoplasm in post- spawning phase

## DISCUSSION

In the present study of the gonadal architecture GSI (Gonado Somatic Index) of *Heteropneustes fossilis* during the different spawning stages, showed a cyclic changes. The highest GSI value was observed during spawning phase and it full space was occupied by mature follicles. After the spawning period, the GSI value was started decreasing gradually because of the reabsorbtion of the yolk follicles and the regression state of the ovaries. This declination in GSI values was continued before the pre – spawning phase. After the onset of pre – spawning phase the GSI value started increasing gradually till the spawning phase and again the maturation of the ovarian follicles took place.

The HSI (Hepato Somatic Index) values were also observed with a cyclic growth. The HIS value was lowest during post-spawning phase and was highest in late pre – spawning phase. During the period of spawning the HSI value was started declining.

The histological study of the relative changes in hepatocytes and ovaries in different spawning phases revealed that the hepatocytes had a dense structure of cytoplasmic granules with hypertrophied nucleus, during pre – spawning phase . In the correlation of hepatocytes, cotical alveolus and yolk granules were also observed in the ovary. During spawning phase the

matured follicles were noticed in the ovary with different cytological activities and the granules became scarce in hepatocytes. In post – spawning phase no alteration were observed except the appearance of new germ line in the ovary.

This investigation of the hepatocytes of *Heteropneustes fossilis* showed a hepatic parenchymal arrangement around the central vein . This observation resembled with the studies that were done in different other varities of fishes by Diaz *et al.*1999 and Atamanalp *et al.* 2008. Aida *et al.* (1973) have also studied on gonadal maturation of fishes and the histological changes in liver cells.Ghosh & Kar (1952) have studied the seasonal changes in gonads of the common Indian cat fish *Heteropneustes fossilis*. Jawad *et. al.* (2015) have given a confirmation of the presence of the Indian stinging catfish, *Heteropneustes fossilis* (Bloch, 1794) (*Heteropneustidae*) in Syrian inland waters. Krishnan *et. al.* (1993) have worked on Induced spawning of catfish, *Heteropneuste fossilis*, using D-Lys6 salmon gonadotropin-releasing hormone. Garg (1988) have reported about the post spawning period of the annual reproductive cycle of *H. fossilis*. Aggarwal (2014) have studied circannual gonadal cycle in *H.fossilis*.

## CONCLUSION

The present study reveled that the ovaries and the hepatocytes of thefemale matured catfish, *Heteropneuste fossilis* showed a different cyclic growth during the period of pre – spawning, spawning, post- spawning in respect with cytoplasmis activities in the hepatocytes and matured yolk follicles in the ovaries. During the period of spawning both the tissues showed maximum participation in breeding. But in rest of the phases they were in their normal correlation.

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