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EFFECACY OF PROSTAGLANDIN ON OVARY REGARDING REPRODUCTION IN THE FISH, *CYPRINUS CARPIO* (L.)

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ABSTRACT:
Prostaglandin plays an important role in ovulation, luteal function, implantation and maintenance of gestation. It is a class of fatty acids which are traditionally associated with variety of autocrine and paracrine functions in vertebrate body. Ovary has a definite role in the reproductive physiology. Prostaglandin was injected 1.5ml/kg body weight at every alternate day for one week intramuscularly in the fish, *Cyprinus carpio*. It has been observed that due to prostaglandin, oogenesis stimulated in the ovary which was mediated through the gonadotrophic hormone. Thus, it had been concluded that prostaglandin is an inducer of spawning reflexes in the fish, *Cyprinus carpio* that induces gonadal maturity and used to achive early breeding.

Keywords :- Autocrine, paracrine, prostaglandin, reproductive physiology, spawning reflexes.

INTRODUCTION :

Prostaglandins were first discovered and isolated from human semen in 1930s by Ulf Von Euler and colleagues of Sweden. Prostaglandin is a wonder biomolecule derived from 20 c atoms polyunsaturated fatty acids (PUFA), mainly released from membrane phospholipid like phosphatydylcholine or choline phosphoglycerides. They are basically derived from prostanoic acid, a 20 c fatty acid with cyclopentene ring. Prostaglandin F reaches a maximum in ovulated follicle at the time of ovulation (Yang *et al.*, 1974 and Yaoye et al., 2020.).Prostaglandin also improves sperm quantity in the canine ejaculate would benefit all assisted reproductive techniques used in all species (Milan Hess, 2002). In fish, exogenous prostaglandins also show stimulatory effect on the induction of ovulation. Stacey and Pande (1975 and Jean D. N. et al., 2018) showed that indomethacin blocks ovulation induced by HCG injection in goldfish, but exogenous prostaglandin overcome the indomethacin blockade. Jalabert and Szollosi, D., 1975 observed that ovulation of trout follicles matured in vivo could be induced in vitro by adding prostaglandin $F_2\alpha$.The effects of prostaglandin on the spawning behavior of female goldfish were also observed by Stacey, 1976.Recently, existence and role of prostaglandin in fishes have been studied by several authors in many fishes. F prostaglandins also function as a hormone that stimulates female sexual behavior (Sorensen *et al.*, 1988; Davidson *et al.*, 2008; Federica et al., 2019 and P. W. Sorensen and Haudem Levesque, 2021.).At the time of ovulation female goldfish produce large quantities of prostaglandin (PGF2) which acts as hormone to trigger spawning (oviposition) behaviors (Stacey 1976; Stacey and Peter, 1979) before being metabolized and released where males recognized it as a releaser pheromone (Sorensen and Goetz, 1993; Sorensen *et al.*, 1995; Stacey and Sorensen, 2002).Female sexual behavior apparently is synchronized with ovulation by mechanisms which respond to elevated plasma prostaglandin as an indicator of the presence of ovulated eggs (Stacey,

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2003).Prostaglandin plays important role in ovulation, luteal function, implantation and maintenance of gestation. They are used to synchronise estrus and induce parturition. F prostaglandin rise at the time of ovulation and travel to the brain where they elicit female sexual behavior. Thus, the effect of prostaglandin on ovary in relation to reproduction in the fish, *Cyprinus carpio* (L.) is meagre. Moreover, such studies are limited to foreign species and hence, the study is undertaken on these aspects in locally available carp. The present work is an attempt in this direction to assess the suitability of prostaglandin as an inducer for breeding purpose

MATERIALS AND METHODS :

Cyprinus carpio were collected, reared in a fibre glass tanks and acclimatized to the laboratory conditions. The experiment was carried out for one week. Control and experimental groups were formed. Fishes from control groups were injected with 1.5ml of distilled water and experimental groups were injected with 1.5ml of prostaglandin intramuscularly at every alternate day for one week. At the end of the experiment, fishes from control and experimental groups were scarified to study the histomorphological changes in the ovary.

OBSERVATIONS/ RESULTS :

CONTROL GROUP: At the end of the experiment, the survival rate of control fish was 100%. The average weight length and girth of female was 610gm, 28cm and 26cm. The ovary was in the maturing form and histologically, reorganized into young oocytes, early maturing oocytes, advanced maturing oocytes and few mature oocytes (prespawning oocyte). The ovaries were yellowish in colour. Histologically oocyte showed small clear yolk vesicles and nucleus with undulated nuclear membrane.

EXPERIMENTAL GROUP: At the end of the experiment, the survival rate of the fish was 100%. The average weight, length and girth of female were 620gm, 28cm and 27cm. At the end of the experiment, the ovaries were in prespawning phase. The entire body cavity was occupied by the ovaries which were turgid and deep yellow in colour. The number of ova could be seen by the nacked eye through the thin ovarian wall. The ova were opaque as well as translucent. The fish was gravid with rounded abdomen. On pressing, eggs oozed out. At the end of the experiment, histologically, a large number of oocytes with fused yolk vesicles, yolk globules and migrating nucleus along with ripe eggs were seen in a section and became ready to spawn A fully ripe gravid female has soft bulging rounded abdomen with swollen reddish vent.

DISCUSSION :

The exact biochemical mechanism of ovulation in fish has not been fully elucidated. Very little information is available on ovarian maturation in fishes (Hirose, 1976 and Jalabert, 1976). It is indicated that corticosteroids derived from the ovary may act as a local hormone mediating pituitary gonadotropins induce ovulation in *Orizias latipus*, (Hirose, 1976 Stacey N, E, and Fredricks Goetz, 2011.) but in rainbow trout, northern pike and gold fish 17α hydroxy-20β-dihydroprogesterone plays a preferencial role in initiating maturation and ovulation may be triggered in vitro by prostaglandin $F_2\alpha$ action on mature follicles. The present results reveal that prostaglandin $F_2\alpha$ plays an important role in maturation and ovulation of fish *Cyprinus carpio*. Male and female both exhibit an increased frequency of courtship behavior following prostaglandin $F_2\alpha$ treatment which is also supported by the views of Cole K. S and Smith R. J. (1987). They also reported that prostaglandin $F_2\alpha$ appears to induce the release of a female specific chemical in fathead minnows that triggers courting behavior in conspecific male also supported by(Yukihiko sugimoto et al.,2015.) Present study investigated the

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possibility of prostaglandin $F_2\alpha$ may have pheromonal role in *Cyprinus carpio* as it stimulates both male and female to breed easily by exhibiting vigorous courtship. In the presence study, $PGF_2\alpha$ also stimulates oocyte maturation in *Cyprinus carpio*. At the time of ovulation female gold fish oviducts synchronise and secrete $PGF_2\alpha$ that induces reproductive behaviour (Stacey and Peter, 1979; Sorensen *et al.*, 1988). $PGF_2\alpha$ and its metabolites mainly 15 keto - $PGF_2\alpha$ are also released into water as post ovulatory pheromone that induce male spawning behavior and further increase male GTH – II and sperm production to stimulate the GTH – II (Sorensen *et al.*, 1988; Sorensen *et al.*, 1989; Sorensen and Goetz 1993). Present studies also indicate that F prostaglandin is metabolised and released to the water where it functions as a sex pheromone. Therefore, $PGF_2\alpha$ also plays a dual role as a para hormone and hormone, synchronising male and female sexual behavior in *Cyprinus carpio*. Davidson *et al.*, 2008 and Victoria G. A. and Maria P. Sepulcre, 2016,) Maria have found that exposure to water borne $PGF_2\alpha$ increased neurogenesis and GnRH concentration in male goldfish brain and modulate brain plasticity associated with behavioral changes during spawning season via the neuroendocrine (GnRH) and motor components of the pheromone-reproductive system. This finding confirms the above view in *Cyprinus carpio* in relation with increased number of gonadotrops, olfactory secretion, increased secretary activity in thyroid and adrenal gland. GSI and fecundity is also increased significantly.

SUMMARY :

The objective of the present study was to evaluate the effect of prostaglandin on ovary in relation to reproduction in the fish, *Cyprinus carpio*. The effect of prostaglandin on ovary showed stimulatory effect. Particularly, the gonads (ovary) were excessively stimulated resulted into early maturity.Thus, prostaglandin had stimulatory effect on the gonadal secretion. Thus, the results obtained from the present study, it can be concluded that utility prostaglandin in the fish breeding technology will be effective as it stimulates the oogenesis in the ovary of *Cyprinus carpio* which is mediated through the gonadotrophic hormone resulted in to the secretion of estrogen which is essential for the sexual behavior in the fish breeding and prostaglandin used as the stimulant in the fish breeding. Prostaglandin also used to achive early maturity.

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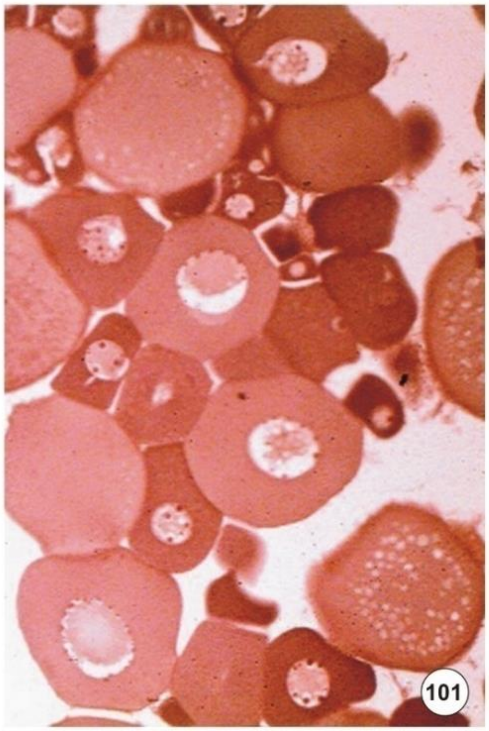

Fig. 101 : Section of ovary showing oocytes at different stages of development including developing oocyte, Primary oocyte, Maturing oocyte, yolk vesicles, yolk granules, and atretic oocyte. X10.

Fig. 102 : Maturing ooctye with nucleus showing outer zona granulosa and inner zona radiata. Iron haematoxylin. X10.

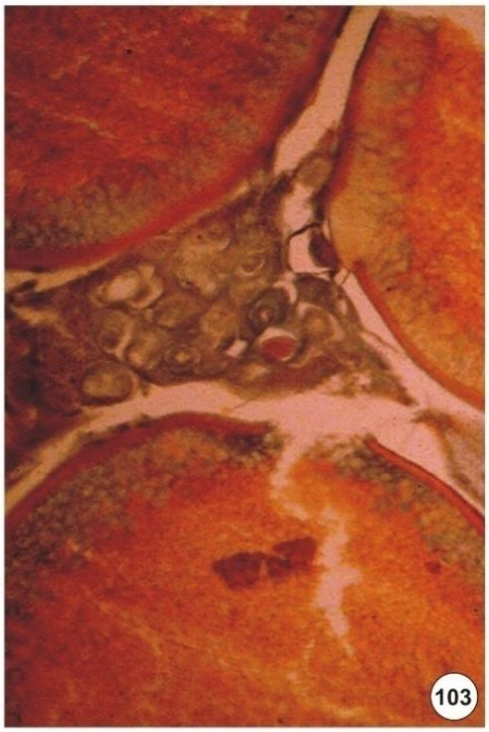

Fig. 103 : Mature oocytes showing interstitial cells. Mallory's triple stain. X10.

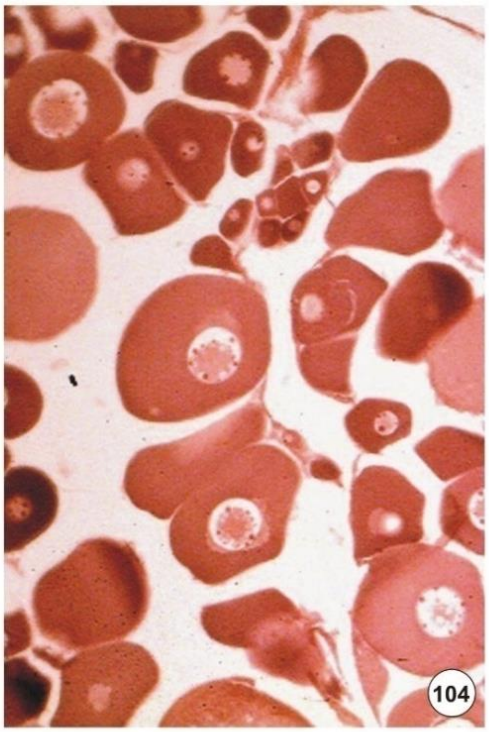

Fig. 104 : Section of ovary showing different stages of developing oocytes. Iron haematoxylin.

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