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GONADAL MATURATION OF ASIAN CATFISH IN CAPTIVITY WITH STAGNANT WATER POND SYSTEM

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Introduction

Since the Asian catfish (*Pangasius hypophthalmus*) has a high economic value both for consumption and ornamental fish, studies to promote and develop its culture in captivity become highly important [3].

In nature, Asian catfish can reach for more than 24 kg weight, and more than one meter in length. In addition, this fish have high resistance to disease and very tolerant to changes in chemical and physical water conditions so that make it easier to care.[8]

Fingerlings of the fish usually available in a limited period since Asian catfish spawns once a year in rainy season from October to March.[2] Artificial spawning of this fish with hormonal manipulation has been conducted. Hormones that are often used include combination of HCG (Human Corionic Gonadotropin) and Carp Pituitary Extract (CPE). Other hormone used are GnRH, and a combination of PMSG and HCG.[1] But artificial spawning technique with hormonal manipulation always face obstacles because the physiological condition of fish was neglected.

Naturally, fish gonad development is influenced by gonadotropic hormone produced by pituitary as a response of hypothalamus to environmental cues such as water temperature, fluctuation of water level, rainfall. Generally, Asian catfish was mature in the rainy season from October-April. While in the Asian catfish,[5)] annual cycle of gonad development could be divided in three periods. Spawning period (May-August), pituitary gonadotropin was to reach maximum levels. Resting period (September-February), gonadal steroidogenesis is much reduced, gametogenesis remain absent, pituitary gonadotropin decreases to low value. And prespawning period is characterized by an increase in pituitary gonadotropin content. In such condition, it was clear that African catfish have discontinuous reproduction cycle; meanwhile similar research for Asian catfish has not been conducted.

The aim of this research was to study reproduction physiology status of Asian catfish in captivity with stagnant water pond system.

Materials and methods

The experiment was carried out for twelve months from June 1999 to May 2000. The place of research is faculty of fisheries and marine science IPB pond. Analysis of blood plasma was conducted in Physiology Lab., IPB. Measurement of egg diameter was done in Genetics Lab., Faculty of Fisheries and Marine Science IPB, Bogor. Water quality measurement was conducted in Environmental Science Lab. IPB.

Twelve immature females Asian catfish (*Pangasius hypophthalmus*) (All three years old catfish) of 1.5-3 kg in body weight were reared pond with the size of 7 x 10 x 1 m. Each fish were tagged with colored nylon string at the dorsal fin. Broodstock were fed with commercially available pellets “SINTA” with daily ration of 3% of body weight. Sampling was conducted monthly.

Blood samples 3 ml was taken from the caudal peduncle with a heparinized syringe. Then put in 1.5 ml a polyethylene tube and centrifuged for 5 minutes of 3000 rpm and 5^0C. Then, plasma blood was put in polyethylene tube and stored in -20^0C. Steroid hormone content was measured as Testosterone and Estradiol-17β by RIA method.

Sampling of oocytes was conducted using canulation method. Oocytes sample about 200 eggs per female were drawn and fixed in 70% ethanol solution, Oocytes diameter were measured by light microscope completed with ocular micrometer at 40x and 100x magnification.

Water quality measurement consists of DO, ammonia, pH, temperature, alkalinity and total hardness. Rainfall data were obtained from Meteorology Station, Sindang Barang, Bogor, Indonesia.

Oocytes diameter, hormonal profile, were analyzed and presented in figures.

Results

Means Testosterone (T) and Estradiol-17β (E_2) (Figure 1). Means T levels increased from June (0.4 ± 0.23 ng/ml) and reached high level in September (6.2 ± 0.98 ng/ml) and then decreased in October 3.1 ng/ml, but in November increased 4.2 ng/ml. The decrease occurred in December to January. After that T levels increased again but lower than that in June. T levels increase after January remaining at the value in April (2.2 ± 0.70 ng/ml) and decreased at the end of experiment.

Mean Estradiol-17β (E_2) levels were the same with T levels, increased from June (0.6 ± 0.47 ng/ml) and peaked in September (1.8 ± 0.23 ng/ml). And than, the level gradually decreased in December (0.3 ± 0.1 ng/ml). After that E_2 levels fluctuated to low levels and increase in April.

Means oocytes diameter (Figure 2) in June were 668.6 ± 6.68 µm with females weight 2.3 ± 0.19 kg. But in July oocytes diameter slightly decrease to 602.2 ± 43.03 µm. and than gradually increased and reached the highest size in December with means oocytes diameter 1085 ± 26.68 µm, with females weight 3.2 ± 0.27 kg. In this research, spontaneous spawning did not occur and oocytes started to show atretic indication in January with the appearance of distinctive white color. Oocytes atretic became severe in April.

Pond temperature (Figure 3) was fluctuating with small range, maximum temperature was between 31 – 32^0C and minimum temperature 25 – 28^0C. Highest rainfall was in October to February and lowest in March and May.

Discussion

Plasma T is a biosynthetic precursor for E_2. Changes in T levels normally occurred at the same moment with changes E_2 concentration, although monthly increases of E2 were not as high at vitellogenesis stage. At vitellogenetic stage, most of T was converted into E_2 caused by high activity of aromatase enzymes. In contrast to vitellogenic stage, postvitellogenic activity of aromatase enzymes decreased. T levels higher than E_2 until postvitellogenetic stage occurred in ovarian of African catfish.[9)]

Generally in teleostei, maturation of oocytes will change hormonal status, environmental cues caused surge in T levels, for example in rainbouw trout. High surge of T occurred prior to ovulation and dropped to lowest levels after ovulation.[7)] In this research, there were surge of T in mature fish because the desire environmental cues did not exist in culture condition.

Estradiol-17β (E_2) was mainly ovarian estrogen in most teleostei. E_2 were increase gradually at vitellogenic stage, where in this stage oocytes size increase in diameter. It has been accepted that E_2 stimulated liver to produce vitellogenin that absorbed by oocytes.[6)] In this research, means of E_2 increased at the beginning of experiment in June to September, and then decreased to lowest levels in January. It can be predicted that vitellogenesis process continues to September and than stopped at postvitellogenetic stage from September to December.

Mature oocytes can obtain in October to February. In March to May oocytes quality decreased in all female that were observed. Oocytes exhibited atretic indication in January with the appearance of white color. In April, most of oocytes underwent atretic process in all females. Atretic process occurred when environment cues that trigger final maturation and spawning do not exist. When mature oocytes do not meet environment cues that triggered maturation, then oocytes will be degraded and reabsorbed by ovarian follicle.[4)]

Environmental cues that perceive in this research are rainfall influence; postvitellogenic stage was occurred at high rainfall (October-February). T levels that dropped in October presumably influenced by seasonal changes; where in September (dry season) were signed with lowest rainfall and than increased in October with the appearance highest rainfall during reproduction cycle. These changes gave a direct influence to oxygen content so that oxygen was very low in October (0.96 ppm) causing stress in fish which in turn decreasing of oocytes diameter in October.

Water quality like oxygen, ammonia, alkalinity and hardness, pH was in normal condition for supporting of Asian catfish.

Conclusion

T and E_2 increase at the same time with oocytes development to vitelogenetic stage in July to September. Spawning season goes on September to April with seasonal peak in October to December.

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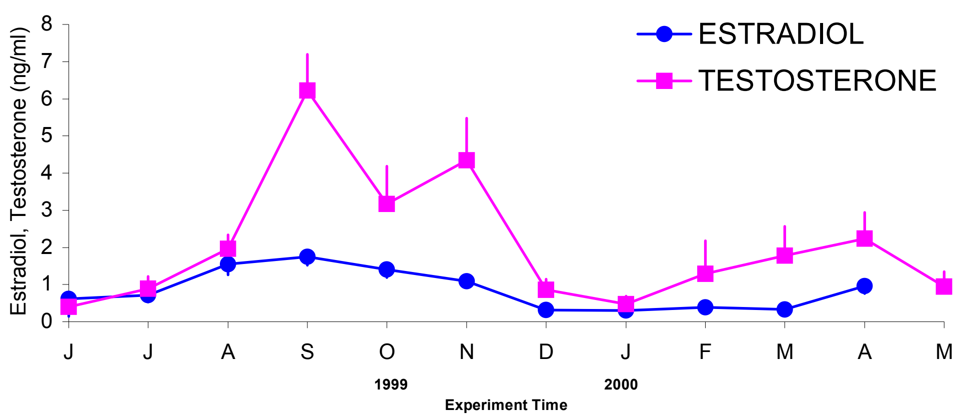

Figure 1. Changes in Plasma Testosteron and Estradiol 17βLevel in Female during experiment

Figure 2. Changes in Oocyte Diameter During Experiment

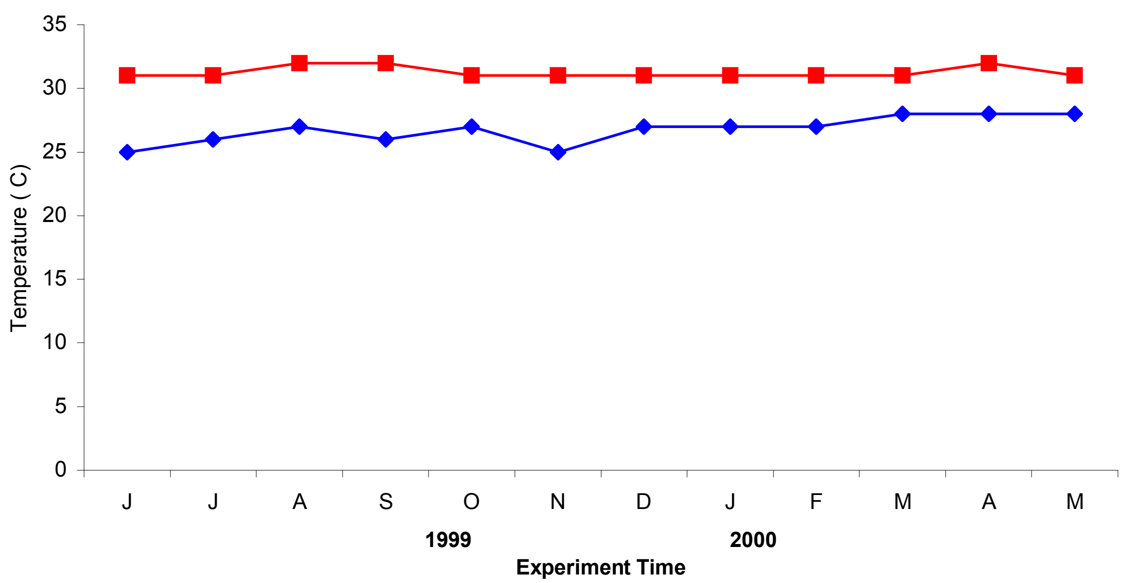

Fig 3. Changes Minimum and Maksimum Temperature of Pond Water During Experiment.