



Development of Spotted Barb (*Puntius binotatus*) Eggs

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ABSTRACT: Spotted Barb (*Puntius binotatus*) is one of Indonesia's endemic fish which have not been cultivated. This study aimed to determine the development of spotted barb eggs. Development of spotted barb eggs was morula, blastula, gastrula and organogenesis. Morula stage reached in 2 hours 23 minutes after fertilization, then after 6 hours of entering stadium blastula, gastrula stage at 7 hours after fertilization and stage of organogenesis at 9 hours after fertilization. Spotted barb eggs hatched at 24 hours after fertilization at 28oC.

Key Words: Spotted Barb, Temperature, Eggs Development

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INTRODUCTION

National aquaculture production has increased. 1.2 to 9.5 million tones aquaculture production in 2001-2011. Target in 2012 amounted to 9.4 million tons. Target by 2013 aquaculture production could reach 13.09 million tons [1], while the average consumption is only 6.2 kg / person / year. In addition to improving the system and cultivation techniques, exploitation of new aquaculture species is also important to maintain the stability of aquaculture production as well as increased efforts to introduce the cultivation of exotic species and to domesticate wild species. Based on annual data is there are about 465 species of cultivated aquatic organisms. However, success in the domestication only achieved on a small number of species, such as carp, catfish and tilapia and freshwater prawns [2].

Indonesia has many endemic fish of high economic value, such as snakehead (*Chana striata*), jelawat (*Leptobarbus hoevenii*), snakeskin gourami (*Trichogaster pectoralis*), clow knife fish (*Notopterus chinata*), fish uceng (*Nemachilus fasciatus*), nile tilapia (*Oreochromis niloticus*), wader fish (*Puntius binotatus*), seluang fish (*Rasbora argyotaenia*), fish bilih (*Mystacoleucus padangensis*), and so etc. [3].

Has not been much research on spotted barb fish. Rahmawati [4] conducted a study of biological aspects of reproduction *Puntius binotatus* in Ciliwung watershed, West Java. Research on cultivation *Puntius binotatus* has never been done, so that should be domesticated *Puntius binotatus* especially on aspects of reproduction. Preliminary studies is to know about fish farming is spotted barb knowledge of reproduction, egg development and larvae as well as larvae handling in order to get good results, including the study of embryonic development. The purpose of this study was to determine the development of spotted barb (*P. binotatus*) eggs from fertilized egg to become larvae.

MATERIALS AND METHODS

Preparation

This research was conducted in the Laboratory of Technical Development, Division Freshwater Cultured (UPT PBAT) Umbulan Pasuruan, Department of Fisheries and Marine Resources of East Java Province from January to March 2013. Spotted barb parent taken from public waters or rivers, then adapted in a concrete pool. The tools that used in this study was a single binocular microscope, laptop computer and a set of connecting the camera to the computer microscope for data retrieval to get images and movie, basins, thermometers, pH meters and five aquariums 40x30x30 cm. Natural spawning process is done after the election of a mature parent fish gonads. Materials used in the natural spawning process consist of fibers as a substrate. Egg hatchery uses water sources are placed in five aquariums.

Observation procedure

Parent obtained from the wild in the pool adapted to the temperature range 25° C - 27°C for 3 weeks and given artificial feed or pellets. The parents is selected to get the spotted barb mature gonad parent. After getting

the mature gonad parent, the parent was placed into the tank that had been prepared. Aquarium sub start were fibers as a medium to attach their eggs. Male and female ratio of 1:1 and 1:2. Flow of water was given to supply oxygen. Fish that had spawned in the lift of the aquarium and the eggs were observed to form the larvae under a dissecting microscope with a magnification of 1000 times.

RESULTS AND CONCLUSION

Spotted barb eggs including adhesive eggs. Spotted barb eggs attached to the substrate binotatus made of palm fiber. According to Effendie [5], characteristic adhesive egg is after this hardened, the eggs are sticky so it will be easy to stick to the leaves, the roots of plants, garbage, etc. Figure 1 shows the cakul wader fish eggs that have been fertilized.

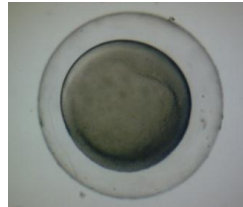


Figure 1. Fertilized spotted barb egg

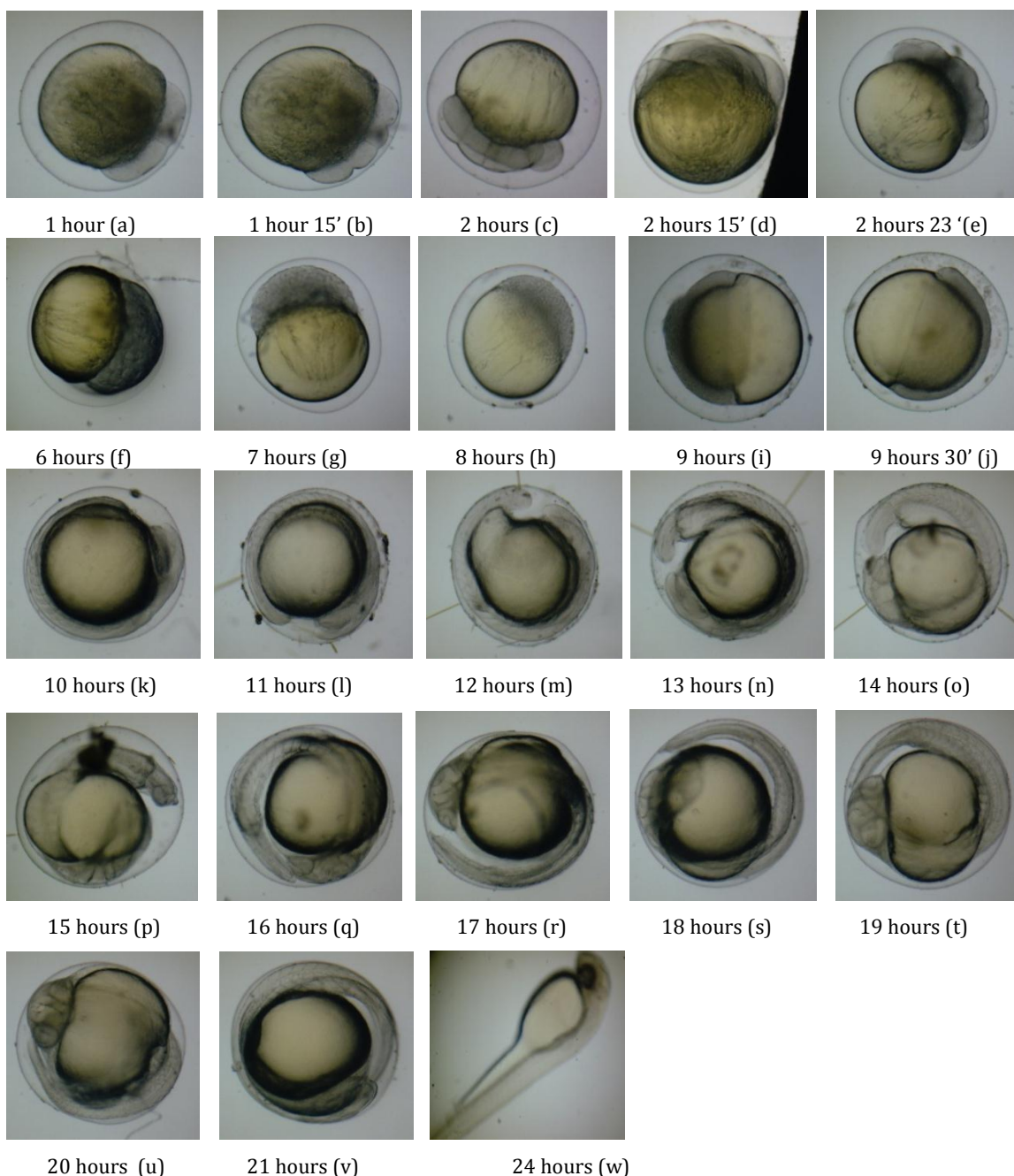


Figure 2. Spotted barb egg development

Spotted barb eggs characteristic that have been fertilized were translucent color while unfertilized fish eggs were white. Blaxter [6], state that the signs of conception are forming of perivitellin space due to the absorption of water after the egg is released and hits the water resulting in swelling of the egg. Figure 2 shows the phases of embryonic development until hatching. According to Lagler [7], fertilization is a coalition eggs and sperm cells, forming a zygote. Cell development occurs after fertilization of the zygote stage until hatching stage.

The development of spotted barb consists several phases, namely: cleavage stage, morula stage, blastula stage, gastrula stage, organogenesis, and hatching. Cleavage stage starts from the first mitotic division until the fifth division. Nelsen [8], state that cleavage is a process developments in embryonic cells, which are cells increasingly become smaller or small units called blastomeres.

One hour after fertilization, eggs for the first division are the formation of 2 pieces of the same blastomeres (Fig. 2a). According to Haniffa et al. [9], the first mitotic division in Koi Carp (*Cyprinus carpio*) occurred in twenty minutes after fertilization, whereas according to Ghosh et al. [10], the first mitotic division occurs in one hour and twenty minutes after fertilization. Mihalace et al. reported that the first cleavage in ornamental carp occurred at 40 minutes after fertilization.

The second cleavage occurs about one hour 15 minutes produced four blastomeres at spotted barb egg (Fig. 2b). According Haniffa et al. [9], the second mitotic division that produces four blastomeres in Koi Carp (*C. carpio*) occurred in thirty minutes after fertilization, while according to Ghosh et al. [10], the second cleavage occurs at one hour and fifty minutes after fertilization. The third division on fish eggs wader cakul produce eight blastomeres occurred at 2 hours post-fertilization (Fig. 2c). The third division in ornamental carp eggs by Mihalache et al. occurred in fifty minutes after fertilization.

Division into four blastomers on spotted barb eggs occurred at two hours fifteen minutes after fertilization that produces 16 pieces blastomeres (Fig. 2d). Haniffa et al. [9], stated that fish eggs Koi Carp (*C. carpio*) have cleavage fourth at 39-40 minutes after fertilization while Ghosh et al. [10], stated that Koi Carp (*C. carpio*) eggs have cleavage to four at one hour, 50 minutes after cleavage.

Morula stage begins with the fifth division that produces 32 blastomeres and further into many cells. This phase reached in two hours and twenty three minutes after fertilization (Fig. 2e). According to Ghosh et al. [10], this phase of the fish eggs Koi Carp (*C. carpio*) occurred in five hours ten minutes after fertilization. Morula is a stage of embryonic development at the time of cell division reaches 32, the characteristics of the morula stage shaped like a mulberry [3].

Blastula stage on spotted barb eggs occurred at 6 hours (Fig. 2f). Koi Carp eggs (*C. carpio*) through a phase blastula at 3 hours after fertilization and ends at 5.26 hours after fertilization [8]. According to Ghosh et al. [10], blastula stage on fish eggs Koi Carp (*C. carpio*) takes 7 hours and ended at 12 hours 30 minutes after fertilization. This stage is characterized by the blastomeres begin to cover the egg yolk (the yolk invation). According Efendie [12], at the blastula stage, there are two kinds of cells, namely formative and non-formative cells. Formative cells into embryonic body composition while nonformatif cells as tropoblast that has related to nutrition embryo.

Gastrula stage begins at 7 hours after fertilization (Fig. 2g) and ends at 8 hours (Fig. 2h). According Haniffa et al. [9], gastrula stage on fish eggs Koi Carp (*C. carpio*) starts at 18 hours and ends at 24 hours. Ghosh et al. [10], stay that gastrula stage on fish eggs Koi Carp (*C. carpio*) takes 19 hours which is characterized by widespread areas of the head and the brain could be distinguished while the late gastrula achieved at the 26 hours.

According to Efendie [12], there are two kinds movement of cells in the gastrula stage epiboli and embolism. Epiboli is the movement that would become epidermal cells and neurological areas. The movement forward, backward and to the side of the axis that will become the embryo. Embolism is the movement of cells whose direction toward the inside, especially at the end of the embryonic axis wills [13].

Organogenesis stage spotted barb eggs starts at 9 hours after fertilization (Fig. 2i) to 21 hours (Figure 2v). Organogenesis is the formation of organs (organs) [14]. According to Haniffa et al. [9], the formation of embryonic shield in fish eggs Koi Carp (*C. carpio*) occurred 42 hours 20 minutes after fertilization. According to Ghosh et al. [10], early embryonic development of fish Koi Carp (*C. carpio*) occurred 45 hours 30 minutes after fertilization is characterized by individual shape encircling the yolk. According Mihalache, et al. [13], head and tail of the embryo can be distinguished in the gastrula stage.

The hatching stage occurred at 24 hours after fertilization and become larvae (Figure 2w). According to Ghosh et al. [10], hatching Koi Carp eggs (*C. carpio*) occurred at 75 hours 20 minutes after fertilization. According Haniffa et al. [9], Koi Carp eggs (*C. carpio*) hatched in 71 hours and 20 minutes after fertilization at 28°C.

CONCLUSION

Observations spotted barb embryogenesis (*Puntius binotatus*) from egg to larva requires 24 hours in medium temperature 25-27°C. Spotted barb eggs through a phase of cleavage, morula stage, blastula stage, gastrula stage, organogenesis in development until hatching. Development phase of spotted barb eggs was morula at 2 hours 23 minutes after fertilization, the blastula at 6 hours after fertilization, gastrula at 7 hours after fertilization and organogenesis at 9 hours after fertilization.

REFERENCES

1. Anonymous. 2013. <http://www.kkp.go.id/index.php/arsip/c/9001>

2. Lagler, K.F. 1972. *Freshwater Fishery Biology*. WMC. Brown Company Publisher. USA.
3. Sukra, Y., Rahardjo, L. & Djuwita, I. 1989. *Embriology I*. Inter-University Life Science. Bogor Agricultural University. Bogor.
4. Rahmawati, I. 2006. *Biology Aspect of Benteur Fish (Puntius binotatus) in the Upper Watershed (DAS) Ciliwung, West Java*. Fisheries and Marine Science Faculty. Bogor Agricultural University. Bogor.
5. Effendie, M.I. 1997. *Fisheries Biology*. Yayasan Pustaka Nusatama. Yogyakarta.
6. Blaxter, J.H.S. 1969. *Development of Egg and Larvae*. In *Fish Physiology*. W.S Hoal and Randall (Eds). Vol III: *Reproduction and Growth*. Academic Press. New York.
7. Lagler, K.F. 1972. *Freshwater Fishery Biology*. WMC. Brown Company Publisher. USA.
8. Nelsen, O.E. 1953. *Comparative Embriology of Veterbrata*. Mc. Graw Hill-Book. Co.Inc. New York.
9. Haniffa, M.A et al. 2007. *Breeding Behavior and Embryonic Development of Koi Carp (Cyprinus carpio)*. *Taiwania*, 52 (1): 93-99.
10. Ghosh, A.K., Biswas, S., Sarder, L., Sabbir, W. & Rahaman, S.M.B. 2012. *Induced Breeding, Embryonic and Larval Development of Koi Carp (Cyprinus carpio) in Khulna, Bangladesh*. *Mesopot. J. Mar.Sci.*, 27 (1): 1-14.
11. Balinsky, S.I. 1970. *An Introduction to Embriology*. W.B. International Review of Cytology, 12 : 361-403. Saunders Company. London.
12. Efendie, M.I. 1985. *Fisheries Biology. Part I: Study Natural History*. Fisheries Faculty. Bogor Agricultural University. Bogor.
13. Mihalache, A., Oprea, L., Grecu, I., Cristea, V., Badalan, C., Enache, I. & Ion, S. 2011. *Artificial Reproduction and Embryonic Development of the Jappanese Ornamental Carp (Cyprinus carpio Linnaeus, 1758)*. *Journal of Enviromental Protection and Ecology*, 12 (4): 1835-1839.
14. Liao, I.C., dan Chao, N.H. 1983. *Development of Prawn Culture and Its Related Studies in Taiwan*. In *Proceedins of Internatinal Cofferece on warm water aquaculture*, Rogers.G.L., Day.R and Lim ,A, Hawaii, 9-11 Februari, pp 127-142.