

## STAGES OF EMBRYONIC DEVELOPMENT OF THE “MATRINXÃ”, *Brycon cephalus* (PISCES, CHARACIDAE)

[Estágios do desenvolvimento embrionário de matrinxã, *Brycon cephalus* (Pisces, Characidae)]

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### ABSTRACT

The “Matrinxã” is an indigenous species from the Amazon Basin (Brazil). The development of oocytes is of the synchronic type, i.e., a large number of ovules is released at the same time. The egg development is characterized by a short embryonic differentiation and a larval period ( $26 \pm 2.0$  °C). Metamorphosis ends practically 36 hours after fertilization and individuals reach fingerling stage with a structure similar to that of the adult, 48 hours after fertilization. The larvae hatch approximately 10-11 hours after fertilization, displaying slightly pigmented body, well evidenced eyes, traces of a digestive system, and first swimming movements. At the end of the first day of life, intense cannibalism is observed. Malformation of embryos is also observed in some individuals.

**Key words:** embryonic development, *Brycon cephalus*, matrinxã, fish

### RESUMO

O matrinxã é uma espécie de peixe, cuja ocorrência natural está restrita à Bacia Amazônica (Brasil). O desenvolvimento dos ovócitos é do tipo sincrônico, isto é, inúmeros ovúlos, pequenos, são liberados em conjunto. O desenvolvimento do ovo caracteriza-se por uma diferenciação embrionária rápida e período larval curto, à temperatura de  $26,0 \pm 2,0$  °C. A metamorfose termina praticamente 36 horas após a fertilização, e a fase de alevino, com estruturas semelhantes às do exemplar adulto foi alcançada 48 horas após a fertilização. As larvas eclodiram aproximadamente 10-11 horas após fertilização, apresentavam o corpo levemente pigmentado, olhos bem evidentes, esboço do trato digestivo e primeiros movimentos natatórios. No final do 1º dia de vida observou-se intenso canibalismo. Também, foram registrados embriões malformados.

**Palavras-chave:** desenvolvimento embrionário, *matrinxã*, *Brycon cephalus*, peixe

### Introduction

Matrinxã is a native species from the Amazon Basin, in Brazil. It is a teleost fish of the *Brycon* genus and the Characidae family. The fish farmer have been easily developing the fattening of this species making the results available to everyone who shows interest in the subject. These results make the matrinxã culture increasingly popular in the State of São Paulo (SCORVO FILHO; MARTIN; AYROZA, 1998).

It is a very popular species in sport fishing. It fights hard when hooked, which makes its fishery attractive for the anglers and brings more and more fans to this activity (ROMAGOSA, 1998). Biological aspects of this species bred in captivity have been studied by ROMAGOSA (1998) and the induced repro-

duction of it has been studied by many research Institutions (MENDONÇA and MELO, 1994).

This paper presents preliminary observations on the egg development stages, free embryo and larva of *Brycon cephalus*, obtained in laboratory through hormonal induction.

### Material and Methods

The study was conducted at Centro de Pesquisa em Aqüicultura do Vale do Ribeira (CEPAR)/ Instituto de Pesca, located in the city of Pariquera-Açu, São Paulo, Brazil ( $24^{\circ} 43' S$  and  $47^{\circ} 53' W$ ) during the period of November 1995 to February 1996.

The breeders of *Brycon cephalus* utilized were kept in 200 m<sup>2</sup> ponds at a density of 1 fish/m<sup>2</sup>. Selected breeders, twenty (20) females and ten (10)

males were submitted to induced of the reproduction through hypophysation (BERNARDINO et al., 1993). Soon after fertilization and hydration, the eggs were transferred to 200 L. fiberglass conic incubators, with constant water renewal in a flow rate of 8.0L/sec. and temperature of  $26.0 \pm 2.0^\circ\text{C}$ . Six and eight hours after the second hormonal application an abdominal massage was performed in the female specimens, in order to facilitate the eggs extrusion. Afterwards, the eggs were collected in graduated plastic recipients, in order to be weighed; the semen was softly mixed, and so performing the dry fertilization (VON IHERING and AZEVEDO, 1936). Right after fertilization, samples were taken from the incubator every hour, in order to observe the different stages of egg development until the larvae hatched. The samples were collected in Petri dishes, where they were examined under stereoscopic microscope CARL ZEISS, equipped with a micrometer in the eyepiece and micro-photografic camera. Initially, the eggs were measured, and finally, alterations which occurred since the first cell division until the larvae hatched were described.

## Results and Discussion

The stages of embryonic development of "matrinxã" are similar to other species of *Brycon* (LOPES; SENHORINI; SOARES, 1995). The eggs are spherical, translucent, demersal, surrounded by a gelatinous layer, non-adhesive, and have a large perivitelline space, and a diameter around 1,010 mm. The eggs kept an olive green color until embryo was formed. Similar observation was reported for the same specie by LOPES; SENHORINI; SOARES (1995).

The observation of the sequence of events that occurred in the development process of *Brycon cephalus* the egg allowed the characterization of three stages:

- 1) embryonic stage (cleavage, embryo, free embryo);
- 2) larval stage (larvae);
- 3) juvenile stage (alevine).

### Embryonic stage

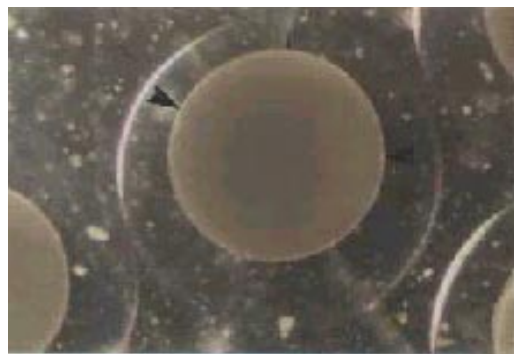
In the cleavage stage it was possible to observe the presence of organized cortical alveolis in the peripheral cytoplasm 40 minutes after fertilization (Figure 1). The cortical alveolis are usually disposed in two layers, with fine and homogeneous granular structure. The fusion and breaking of the cortical alveolis probably happen during the fertilization. The same was reported by HART (1980). The content is

released in the space created between the chorion and the plasmatic membrane (perivitelline space). The process of chorion hardening of the matrinxã egg is very quick, taking approximately 5 to 7 minutes after the insemination. One hour and a half after the fertilization, divisions resulting in 2, 4, 8, 16 blastomeres occurred up to the morula stage (Figure 2a). The eggs were involved by a small perivitelline space and by a clear and relative dense chorion. In this same stage, after intense cellproliferation, the blastodisc expanded over the yolk, and this process of cellular migration formed a germ ring that involved the yolk. It was possible to observe the process of gastrulation, with differentiation of the embrionary tissues, after four hours and thirty minutes.

In the embryo stage, the chorion was still rigid and thick. After five hours and thirty minutes the somatic segmentation and the beginning of the tail and the head differentiation were observed (Figure 2b). After 7 hours, the optical vesicles could be visualized. Afterwards, the first heart beatings and the circulation were visible. The embryo had approximately 20 somites (Figure 2c). The chorion suffered a progressive softening. The hatching occurs 10 to 11 hours after the fertilization, when it was possible to observe the free embryo emerging by the head or the tail region. The just-hatched free embryo presented slightly pigmented body and eyes very evident. The delineation of the digestive system could be seen (Figure 3). In this stage, the animals presented intense horizontal and vertical swimming movements.

### Larval stage

Twenty-three hours, after fertilization, the larvae had denticles and presented continuous movement of the lower jaw (Figures 2 and 4). According to LASKER (1962), the lower jaw is not functional until the complete reabsorption of the yolk sac. In this stage



**Figure 1.** Egg of *Brycon cephalus*, 40 minutes after fertilization. It is possible to observe the presence of cortical alveolis (3,8 X)

the shrinkage of yolk sac is observed. The fins are almost developed. Thirty-six hours after fertilization, the exogenous nutrition (cannibalism) starts. There are just traces of the yolk sac.

The occurrence of cannibalism in teleost fish during the larval and juvenile stages was revised by HECHT and PIENAAR (1991). In this study, an intense cannibalism was also observed at the end of the first day of life, among sibling larvae, as described by LOPES; SENHORINI; SOARES (1995) and SATO et al. (1997) for *Brycon lundii*.

The process of larval growth of “matrinxã” is extremely fast, when compared to other species of freshwater South American teleost fishes. The “matrinxã” embryonic differentiation is quick, with a short larval stage, and the metamorphosis practically ends 36 hours after fertilization (Figure 4). These results are similar to those mentioned by LOPES;



**Figure 2.** Egg of *Brycon cephalus*: 2a- in the cleavage (1 hour half after the fertilization) (3,8 X); 2b and 2c- initial formations of head and tail (3,0 X; 3,8 X)

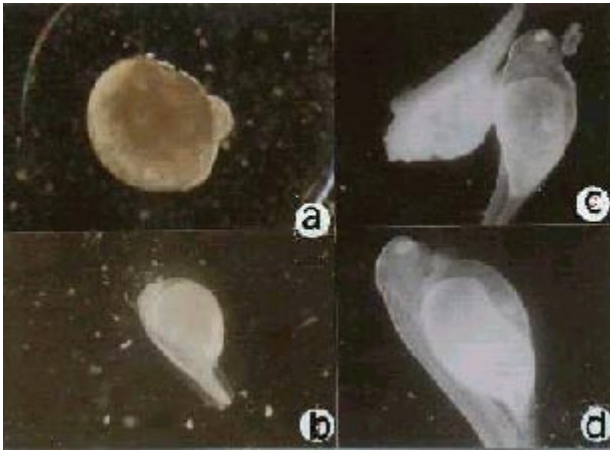
SENHORINI; SOARES (1995), who state that “matrinxã” presents a shorter development, when compared to that of other species, representing an advantage in the production of larvae process.

### Juvenile stage

The alevine presents similar structures to those of adult specimen 48 hours after the fertilization, with a completely pigmented body, silvery scales and well-formed caudal and pectoral fins. In larvae of other species, like *Colossoma macropomum* and *Prochilodus marginatus* the complete reabsorption of the yolk occurs only 72 hours after (JOHNSTON and VIEIRA, 1996). It is important to observe the presence of two spots, one crimson-colored in the operculum region, and a black one near the caudal region. These spots are characteristic of the species. In this study it was observed that the larvae of “matrinxã” started feeding at the end of the first day. TANIGUCHI (1981) verified in *Cynoscion nebulosus* that larger larvae feed specially on copepods and rotifers. In the first two days of life, the larvae of “matrinxã” presented chromatophores of dendritic shape in the cephalic region, spreading all over the body after the second day. The same kind of chromatophores was observed by NAKATANI; BAUMGARTNER; BAUMGARTNER (1997), studying the larvae of *Plagioscion squamosissimus*.



**Figure 3.** Larva of *Brycon cephalus*, where it has been possible to observe the very protusive mouth with the presence of denticles, since the first day of life. In the beginning the pigmentation is more concentrated in the region of the head (4,9 X)



**Figure 4.** Sequence of abnormal larval and embryonic development of *Brycon cephalus*: 4a- (3,8 X); 4b- (3,8 X); 4c- (4,0 X); 4d- (4,0 X)

Occurrences of abnormalities in embryos and larvae of “matrinxã” were verified only in those provenient from spawning of females in the initial regression stage (ROMAGOSA, 1998). Some very apparent alterations have also been observed from the blastula until the organogenesis (when the organs and body systems take a definitive form). The alterations in the embryo are the enlarged yolk sac and spinal cord with curvatures. Most of the larvae were born keeping these defects or abnormalities (Figure 5). However, detailed studies characterizing each malformation and the influence of the environment must be developed in order to better understand its possible causes.

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