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Allometric Growth in Serpae Tetra (*Hyphessobrycon serpae*) Larvae

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Abstract: We describe the allometric growth patterns of *Hyphessobrycon serpae* (Serpae tetra) larvae raised under aquarium conditions from hatch to day 30 (metamorphosis). Allometric growth patterns of some morphometric characters (total length, head length, trunk length, tail length, body depth, pre-anal myomer length, post-anal myomer length, pre-anal length, eye diameter and snout length) were modeled by a power function and were described by the growth coefficient.

Key words: *Hyphessobrycon serpae*, tetra, allometric growth, larval development, aquarium, Turkey

INTRODUCTION

Characidae is a large family that found in South and North America, especially the Amazon area and comprises about 152 genera and 776 species (Nelson, 1994). Many of the most popular characin species are known as tetras. Serpae tetra (*Hyphessobrycon serpae*) is just one of these tetras and is a popular in the trade of ornamental fish (Frankel, 2004; Uma and Chandran, 2008). Most of ornamental freshwater fishes are captive bred. Larval development stage is the most critical period for fish. Information on larval development of fishes is a fundamental key which enables a closer approach to their culture, biology, taxonomy (Reynalte-Tataje *et al*., 2004). There is a little literature on allometric growth of larval stages of ornamental fishes. Allometric growth during early larval development were observed in different teleost groups (Osse and van den Boogaart, 2004) but allometric growth of serpae tetra have not been observed. In the present study, allometris growth patterns of serpae tetra from hatch to juvenile were described.

MATERIALS AND METHODS

Larvae were obtained from three pairs of serpae tetra kept in a 40 L aquarium. The water parameters were kept at 26±0.5°C, 6-6.5 pH and 100-200 μS conductivity. A 9 light/15 dark photoperiod was maintained by indirect fluorescent lighting. Three pairs adult fish were selected from broodstock tank and were placed into a 15 L spawning tank late in the afternoon. Spawning has been observed the next day around dawn and last from 1-3 h. Fish were transfered to broodstock tank after spawning. Larvae were randomly sampled (n = 5) daily from hatch to 10 and at 1 day interval from 10-30 Days after Hatching (DAH). The specimens were photographed by a video camera (Q imaging, Micropublisher 3.3 RTV, Canada) and and measured using image analysis program (Q Capture Pro, Version 5.1.1.14, Canada). Morphometric characters of larvae were measured from hatch to juvenile: Total Length (TL), Body Depth (BD), Head Length (HL), trunk length, tail length, Eye Diameter (ED), Snout Length (SnL), Pre-anal Myomer length (PrAM), Post-anal Myomer length (PoAM) and Pre-Anal Length (PAL). Larval developmental stages were identified according to Kendall. Allometric growth patterns were calculated as a power function of TL (Fuiman, 1983) with the exponent and intercept obtained from linear regressions on log-transformed data. The allometric equation $Y = aX^b$ of BD, ED, HL, PAL, PrAM, PoAM, SnL, tail length and trunk length on TL was estimated. Where, Y is the dependent variable (measured character), X is the independent variable (TL), a is the intercept and b is the growth coefficient. When isometric growth occurred, b = 1, a positive allometric growth occurred when b >1 and negative when b<1.

RESULTS AND DISCUSSION

Growth of the serpae tetra larvae followed an exponential curve during the larval stages and was represented by the equation $y = 3.0467e^{0.0415x}$ ($R^2 = 0.98$, n = 152) where y is Total Length (TL) mm and x is DAH. Four larval development stages were observed after hatching; yolk sac larvae, preflexion larvae, flexion larvae and postflexion larvae. The yolk sac has been completely consumed at 5 DAH when TL was 3.76±0.11 mm. Notochord has been flexed between 13 and 15 DAH at

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4.80±0.35 mm. All of the meristic characters were completely developed and juvenile stage started at 30 DAH, TL was 10.70±0.27 mm at 30 DAH. In the yolk sac stage, the head, trunk and tail length had negative allometric growth in relation to TL (b = 0.58, b = -0.39, b = 0.4, respectively) (Fig. 1). During the preflexion stage, they still showed negative allometric growth (b = 0.33, b = 0.33, b = 0.24, respectively) (Fig. 1). The head, trunk and tail length were isometry allometric in the flexion stage (b = 0.97, b = 1.02, b = 0.95, respectively) (Fig. 1). In the postflexion stage, growth of trunk length was negatively allometric (b = 0.32) while growth in the head and tail length were positively allometric (b = 1.13, b = 1.22, respectively) (Fig. 1). Allometric growth equations between measured 9 body segments and total length during larval development stage (0-30 DAH) were shown in Fig. 2-4. Growth of trunk in length was negatively from hatch to 30 DAH (a = 0.60, b = 0.58, R^2 = 0.95, n = 152) while the growth coefficients of HL and tail w ere positively allometric (a = 0.11, b = 1.39, R^2 = 0.95, n = 152 and a = 0.43, b = 1.09, R^2 = 0.98, n = 152, respectively) (Fig. 2).

The characters BD and SnL showed positive allometry (a = 1.13, b = 1.30, R^2 = 0.97, n = 152 and a = 0.01, b = 1.50, R^2 = 0.91, n = 152, respectively) while PrAM exhibited negative allo metric growth (a = 0.50, b = 0.68, R^2 = 0.93, n = 152) (Fig. 3). The growth coefficients of PoAM and PAL were negatively allometric (a = 0.53, b = 0.87, R^2 = 0.98, n = 152 and a = 0.60, b = 0.89, R^2 = 0.98, n = 152, respectively) while ED was negatively allometric (a = 0.07, b = 1.07, R^2 = 0.97, n = 152) (Fig. 4). In the present study, the allometric growth patterns in the serpae tetra larvae were studied. The allometric growth

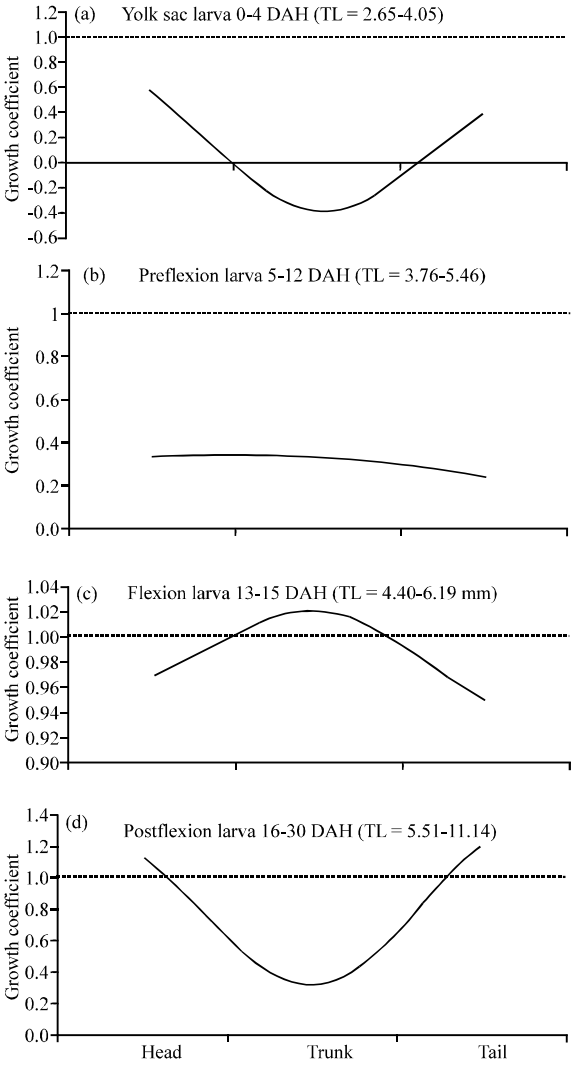

Fig. 1: Growth coefficients of head, trunk and tail length during larval development stage. Each graph represents the growth coefficients during a Total Length (TL) interval

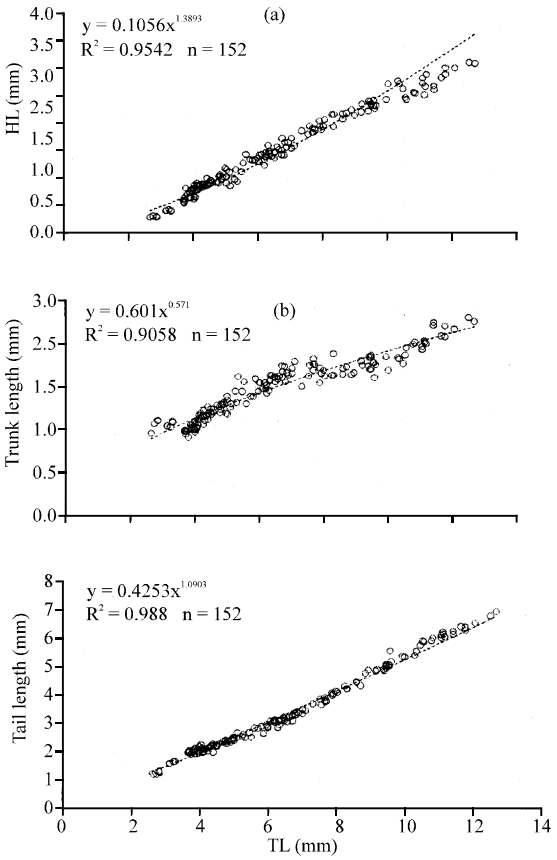

Fig. 2: Allometric growth equations and relationship between three body segments (head, trunk and tail length) and total length in serpae tetra during larval development period (from hatch to 30 DAH)

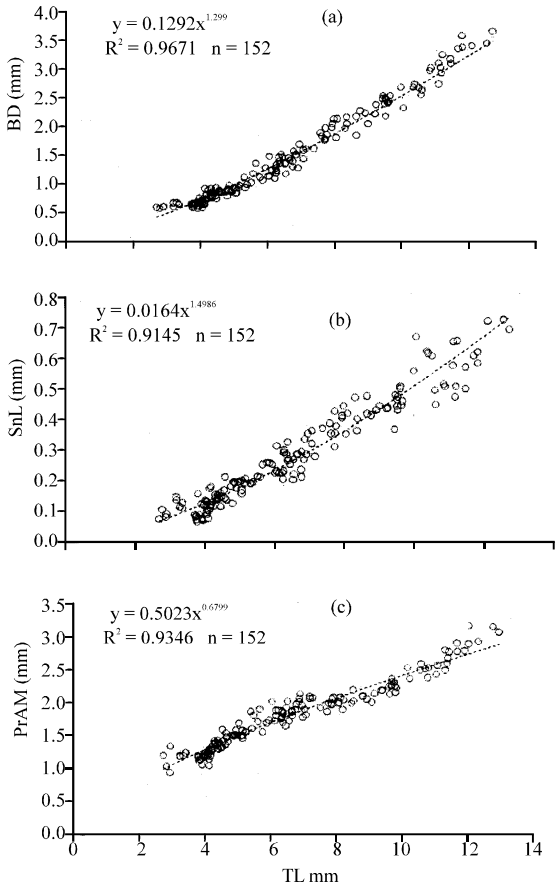

Fig. 3: Allometric growth equations and relationship between three body segments (body depth, snout length and pre-anal myomer length) and total length in serpae tetra during larval development period (from hatch to 30 DAH)

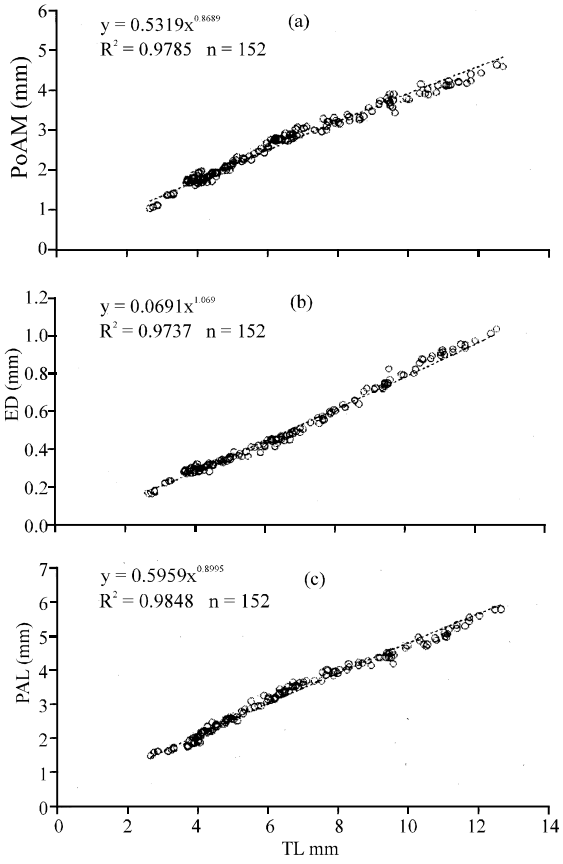

Fig. 4: Allometric growth equations and relationship between three body segments (PAL: Pre-anal Length, PoAM: Post-anal Myomer length; ED: Eye Diameter) and total length in serpae tetra during larval development period (from hatch to 30 DAH)

model is widely used method of analysis for relative growth during early larval development (Osse and van den Boogaart, 2004; Pena and Dumas, 2009). Larval development stage of teleosts was characterized by a high degree of allometric growth patterns (Fuiman 1983; Osse *et al*., 1997; Van Snik *et al*., 1997; Geerinckx *et al*., 2008).

These models can be used to aquaculture and fisheries management by characterizing normal growth patterns (Pena and Dumas, 2009). Allometric growth during larval development of different teleost groups was studied (Osse and van den Boogaart, 2004). But allometric growth patterns of many ornamental fish has not been studied. In this study, it was described the allometric growth patterns of serpae tetra larvae from hatching to day 30. The growth coefficients of head, trunk and tail were significantly different during four larval periods (period I: Yolk sac larva, period II: Preflexion larva, period III: Flexion larva, period IV: Postflexion larva). This results are similar like as other teleosts (Osse and van den Boogaart, 1999; Geerinckx *et al*., 2008; Huysentruyt *et al*., 2009).

CONCLUSION

The growth coefficients of head length, tail length, body depth, eye diameter and snout length were positively allometric while the growth patterns of trunk length, pre-anal myomer length, post-anal myomer length and pre-anal length were negatively allometric during larval development stage (0-30 DAH).

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