

STUDY ON THE MORPHOLOGY AND DIGESTIVE  
SYSTEM DEVELOPMENT IN EARLY LIFE STAGES  
OF KELAH , *Tor tambroides* ( BLEEKER, 1854 )

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**STUDY ON THE MORPHOLOGY AND DIGESTIVE SYSTEM  
DEVELOPMENT IN EARLY LIFE STAGES OF KELAH,  
*Tor tambroides* (BLEEKER, 1854).**

**ENDRYENI MULYADI**

**April 2010**

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**Institute : Institute of Tropical Aquaculture**

A study on external morphology and digestive system development of *Tor tambroides* were conducted at Institute of Tropical Aquaculture of Universiti Malaysia Terengganu from newly hatched larvae until 45 day after hatching (DAH) by morphological measurement and histological technique. This study is to provide information for the best rearing management based on the development and behaviour of this fish. Information on digestive system development can improve the feeding strategy of this species.

Based on external morphology, the early development of *T. tambroides* was divided into: pre-larvae, larvae, post-larvae and juvenile stage. At hatching, *T. tambroides* larvae measured  $9.82 \pm 0.69$  mm (mean Total Length (TL)) and measured  $24.50 \pm$

1.23 mm TL by 45 DAH. The mean growth of larvae was  $0.33 \text{ mm.day}^{-1}$  at  $25^{\circ} \text{C}$  controlled rearing temperature. Like other cyprinids, *T. tambroides* neither have stomach and pyloric caeca and the intestine was divided into anterior and posterior intestine.

The pre-larvae stage started from newly hatched until 8 DAH which measured  $11.96 \pm 0.59 \text{ mm TL}$ . The newly hatched larvae were transparent and covered by thin layer epithelium, unpigmented eyes with mouth and anus that were closed. The yolk volume at hatched was  $11.25 \pm 1.94 \mu\text{L}$ . The intestine appeared as a simple undifferentiated tube. The pectoral fin appeared on the day of hatching and then on 3 DAH the dorsal fin bud appears with no fin ray. On 4 DAH the buccopharynx connected with short oesophagus, which will connect with anterior intestine on 6 DAH and at the same time the mouth started to open and the intestine started to coil. At 8 DAH the goblet cells were formed.

The larvae stage started at 9 DAH when the larvae started fed on *Artemia* nauplii, at the time 1.2% yolk volume still remain, in this stage larvae from 9 – 13 DAH measured  $12.02 \pm 0.59 \text{ mm TL}$  to  $12.48 \pm 0.94 \text{ mm TL}$ , respectively. The pelvic fins appear under the yolk sac and the emarginated shape of the caudal fin was noticed on 9 DAH. The pharyngeal teeth appeared on 11 DAH at the posterior end of pharynx, and on the intestine the mucous cells appeared on 10 DAH and started to function. By 12 DAH the pectoral fin rays started to segmented.

The post-larvae started when the yolk completely absorbed and the larvae were given exogenous feeding only with *Artemia* nauplii until 25 DAH, and started on 26

DAH combine with artificial fed. On 14 DAH to 29 DAH larvae measured  $12.53 \pm 0.70$  mm TL until  $17.60 \pm 1.56$  mm TL. The lipid vacuoles were found in posterior intestine on 15 DAH. The fins are fully formed on 17 DAH but the finfold on the caudal peduncle was still evident. By 23 DAH was noticed the gastric gland on the anterior intestine.

The juvenile stages started from 27 DAH and the *T. tambroides* larvae measured  $17.14 \pm 1.22$  mm TL. The morphology this fish was similar with an adult fish, were all of fins fully developed. The scales started to form on 31 DAH and complete on 37 DAH, with 20 to 22 lateral line scales. Histological observation showed that the number of goblet cells and gastric glands in intestine increase and became complex as a fish grew and based on that, suggested that the *T. tambroides* would be capable of digesting and assimilating compound diet and the digestive tract is fully functional at 39 DAH.

Abstrak thesis yang dikemukakan kepada senat Universiti Malaysia Terengganu  
sebagai memenuhi keperluan untuk ijazah Master Sains

**KAJIAN DIATAS MORFOLOGI DAN PERKEMBANGAN SISTEM  
PENCERNAAN AWAL PADA IKAN KELAH  
*Tor tambroides* (Bleeker, 1854)**

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April 2010

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Satu kajian ke atas morfologi luaran dan perkembangan sistem pencernaan *Tor tambroides* telah dijalankan di Institut Akuakultur Tropika, Universiti Malaysia Terengganu bermula pada hari pertama menetas sehingga ke 45 hari selepas menetas (HSM) melalui pengukuran morfologi dan teknik histologi. Kajian ini bertujuan untuk mendapatkan maklumat terbaik dalam pengurusan ternakan berdasarkan perkembangan dan tingkah laku ikan ini. Maklumat mengenai perkembangan sistem pencernaan boleh diperbaiki melalui startegi pemakanan bagi spesis ini.

Berdasarkan morfologi luaran bagi peringkat yang berbeza ketika perkembangan awal *T. tambroides* adalah dibahagikan kepada: pra larva, larva, pasca larva dan juvenil. Sewaktu penetasan larva *T. tambroides* berukuran  $9.82 \pm 0.69$  mm (panjang penuh (PP)) dan berukuran  $24.50 \pm 1.23$  mm PP bagi 45 HSM. Purata pertumbuhan

bagi larva adalah  $0.33 \text{ mm.day}^{-1}$  pada  $25^{\circ}\text{C}$  suhu kawalan. Seperti cyprinid lain *T. tambroides* tidak mempunyai perut dan sekum pylorus dan usus berbagi kepada anterior dan posterior.

Peringkat pra larva berukuran dari  $9.82 \pm 0.69 \text{ mm PP}$  ketika penetasan dan berukuran  $11.96 \pm 0.59 \text{ mm}$  ketika 8 HSM. Pra larva diseliputi oleh lapisan epithelium nipis, mempunyai badan yang lut sinar dan mempunyai mata yang tidak berpigmen diikuti mulut dan anus yang tertutup. Isi padu yolka pada peringkat ini ialah  $11.25 \pm 1.94 \mu\text{L}$ . Sirip pektoral muncul pada hari selepas penetasan, tunas sirip dorsal muncul pada 3 HSM dengan tiada tulang sirip awal, diikuti dengan tunas sirip anal pada 5 HSM. Saluran pencernaan bagi larva *T. tambroides* terbentuk sebagai saluran yang ringkas selepas penetasan dan pada 4 HSM *buccopharynx* berhubung dengan esofagus pendek yang akan berhubung dengan usus anterior pada 6 HSM dan pada masa yang sama mulut mulai terbuka. Walau bagaimana pun pada peringkat ini, pemakanan eksogen masih belum diberi kerana 20.1% kandungan yolka masih ada dan pada masa yang sama usus anterior mulai melingkar.

Peringkat larva bermula apabila larva mulai menerima pemakanan eksogen melalui makanan hidup (*Artemia nauplii*) pada 9 HSM, tinggalan isi padu yolka pada masa itu adalah 1.2%, peringkat larva dari 9 hingga 13 HSM masing-masing berukuran  $12.02 \pm 0.59 \text{ mm PP}$  to  $12.48 \pm 0.94 \text{ mm PP}$ . Sirip pelvic muncul dibawah kantung yolka dan bentuk sempadan bagi sirip kaudal diperhatikan pada 9 HSM. Pada 12 HSM sirip pectoral mulai membahagi. Gigi farinks terbentuk pada 11 HSM di bahagian belakang farink, dan pada usus sel mucus terbentuk pada 10 HSM dan mulai berfungsi.

Pasca larva bermula ketika yolka habis diserap dan larva hanya diberikan makanan eksogen iaitu artemia nauplii sehingga 25 HSM. Pada 14 HSM sehingga 29 HSM latvae berukuran  $12.53 \pm 0.70$  mm PP sehingga  $17.60 \pm 1.56$  mm PP. Semua sirip terbentuk sepenuhnya pada 17 HSM tetapi usul sirip (finfold) pada pangkal sirip kaudal masih ada. Vakuol lipid telah ditemui dalam usus posterior pada 15 HSM dan pada 23 HSM kelenjar gastric terbentuk.

Peringkat juvenile bermula dari 27 HSM dan larva *T. tambroides* berukuran  $17.14 \pm 1.22$  mm PP. Morfologi bagi ikan ini menyerupai ikan dewasa, dimana semua sirip terbentuk dengan sempurna. Sisik berkembang pada 31 HSM dan sempurna pada 37 HSM, dengan 20 – 22 sisik pada garisan tengah. Dari kajian histology jumlah sel goblet dan kelenjar gastric di usus bertambah dan menjadi kompleks seiring dengan perkembangan ikan berdasarkan dari itu dicadangkan bahawa *T. tambroides* mampu mencerna serta mengasimilasi diet sehati dan saluran pencernaan berfungsi sepenuhnya pada 39 HSM.