

Sperm Analysis of *Barbodes binotatus* (Valenciennes, 1842) (Cypriniformes: Cyprinidae) : Morphology, Morphometry and Semen Quality Evaluation

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ABSTRACT

Sperm morphology, morphometry and qualitative/quantitative parameters can be an indicator of sperm quality which is used for sperm assessment. Based on observations, Spotted barb (*Barbodes binotatus*) sperm had an oval head shape and a long tail, with an average head length $1,26 \pm 0,24 \mu\text{m}$ and the length of the tail $30,92 \pm 1,98 \mu\text{m}$. Spotted barb semen volume is 0,01 ml, pH 6, milky white colour, fishy smell, thick consistency, concentration $6,365 \times 10^9$ and mass motility +++.

Key words : Morphology, Morphometry, Sperm Quality, Spotted Barb

Introduction

Spotted Barb *Barbodes binotatus* (Valenciennes, 1842) is a species of cyprinid native to the Southeast Asia and the Western Indonesia (Borneo, Sumatra and Java) (Kottelat, 2013; Roberts, 1993; Kottelat *et al.*, 1993; Roberts, 1989). This species commonly found in medium to large rivers, canals, brooks, stagnant water bodies and below waterfalls in isolated mountain streams (Rainboth, 1996; Roberts, 1989; Taki, 1978). As a benthopelagic species, Spotted Barb inhabits in middle to bottom depths waters where the zooplankton, insect larvae and some vascular plants can be found is (Baensch and Riehl, 1985). In the society, Spotted Barb used as a consumption and ornamental fish.

In this paper, we report the morphological and morphometric evaluation of spotted barb sperm that

can be used as an indicator of sperm quality (Tuset *et al.*, 2008). Fish sperm quality assesment is usefull for improving fertilization processes and optimizing production (Kowalski and Cejko, 2019) by knowing the size and the shape of the spermatozoa head as a prerequisite for entering the spermatozoa through the micropyle (Islam and Akhter, 2012). However, the morphological and morphometric of spotted barb sperm has not been studied yet and it's potential to research.

Materials and Methods

We collected ten (10) live mature male of Spotted Barb with a total length $8,6 \pm 0,30 \text{ cm}$ and total weight $7,6 \pm 0,79 \text{ g}$ from Technical Implementation Unit, Fish and Environmental Health Laboratory Umbulan, Pasuruan, East Java, Indonesia, on 02

February 2021. The live specimens were transported by polyethylene bags with oxygen (Piper *et al.*, 1982; Valen *et al.*, 2020) and examined at the Instrument Laboratory, Airlangga University, Banyuwangi Campus, East Java, Indonesia.

Broodstock rearing and collection of sperm was carried out based on Rashid *et al.*, (2018). Morphological and morphometric observations using a trinocular microscope (Nikon Eclipse E200-LED) (1000x magnification) connected to the monitor by OptiLab image raster software. The spermatozoa concentration is calculated based on Syawal *et al.*, (2015) and use 400x magnification. Observation of the volume, pH and color of spermatozoa was carried out by observation. Motility (mass motility) of spermatozoa refers to Susilawati (2013).

Results

Based on observations, the specific morphological, morphometry and semen quality characters of Spotted barb (*Barbodes binotatus*) spermatozoa are as follows: an oval head shape and a long tail / flagellum (Figure 1); average head length $1.26 \pm 0.24 \mu\text{m}$; the length of the tail / flagellum $30.92 \pm 1.98 \mu\text{m}$; semen volume is 0,01 ml; pH 7; semen colour is milky white; fishy smell; thick consistency; concentration of semen 6.365×10^9 and mass motility +++.

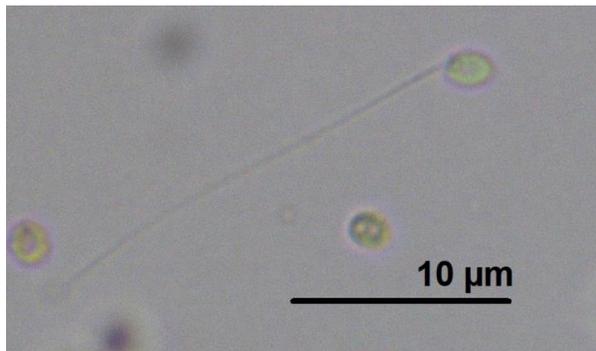


Fig. 1. Spermatozoa of Spotted Barb (*Barbodes binotatus*)

Discussion

The dimensions of fish spermatozoa are generally smaller and have no an acrosome (except for spermatozoa from *Osteichthyes* and all species of *Chondrichthyes*) (Boryshpolets *et al.*, 2018). Size and shape of spermatozoa head is a prerequisite for the entering of spermatozoa the micropyle. The center consists of the centriole and mitochondria, is con-

nected to the head and contributes to the force of the flagellum movement (motility) (Islam and Akhter, 2012).

The flagellum in the sperm tail consists of the motile apparatus necessary for the movement and penetration of the sperm into the egg at fertilization. Each species of fish has a flagellum length different and contains axonema. The length of the flagellum in cyprinid species varies from 36 to 60 μm (Islam and Akhter, 2012).

Observation of spermatozoa morphology is one of the qualities of spermatozoa that is important to do because it is to determine normal and abnormal spermatozoa such as head shape, mid section and tail abnormalities of spermatozoa (Nengsih *et al.*, 2019). The sperm concentration is the number of cells per mL (known as sperm density) by diluting the sperm sample to a known concentration in the extender. Spermatozoa density is expressed in $10^9 / \text{ml}$ (Bozkurt *et al.*, 2011). High sperm concentration causes reduced motility of spermatozoa and competition between spermatozoa making it difficult for sperm to find and penetrate the micropyle. This results in low fertilization rate (Rachimi *et al.*, 2016).

Motility is the motility of spermatozoa which allows sperm to actively reach and penetrate the egg. The duration of movement of sperm is short and lasts only from 30 seconds to several minutes (Islam and Akhter, 2012). Fish spermatozoa motility can be said to be good if it has a motility percentage of at least 60% (Tabares *et al.*, 2007). The percentage of spermatozoa motility suitable for use in the fertilization process with eggs above 40% (Wahyuni *et al.*, 2018).

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