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Citation	Garcia-Abiado, M.A.R., Paras, H.J.S., & Mair, Graham C. (1993). Correlations of oocyte diameter with some morphometric characters in the Nile tilapia, <i>Oreochromis niloticus</i> L. In: Marte CL, Quinitio GF, Emata AC (Eds.). Proceedings of the Seminar-Workshop on Breeding and Seed Production of Cultured Finfishes in the Philippines. 4-5 May 1993, Tigbauan, Iloilo, Philippines. (pp. 83-88). Iloilo, Philippines: SEAFDEC Aquaculture Department.
Issue Date	1993
URL	http://hdl.handle.net/10862/590

This document is downloaded at: 2013-07-02 08:11:45 CST



Correlations of Oocyte Diameter with Some Morphometric Characters in the Nile Tilapia, *Oreochromis niloticus* L.

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Abstract

A study was conducted to determine the correlation of oocyte diameter with some morphometric characters in a Philippine strain of *Oreochromis niloticus* L. One hundred and thirty-five 7- to 9-month old sexually mature female broodstock (body weight: 71 ± 35 g; standard length: 13.1 ± 2.1 cm) were randomly sampled from a pool of broodstock maintained in 4 m^2 net enclosures suspended in an earthen pond. The following morphometric characters were determined for each fish: body weight, standard length, genital pore dimension, and genital papilla dimension. Intra-ovarian oocyte samples were obtained by inserting a soft silicon rubber tubing into the ovipore of the fish and aspirating the oocytes by mouth. There were no significant correlations between the average oocyte diameter and any of the morphological characters studied. Results justify the adoption of an ovarian biopsy technique for assessing the stage of gonadal maturity in sexually mature tilapia.

Introduction

Selection of quality and mature spawners is a prerequisite for breeding of tilapia. The use of immature spawners may entail additional labor and maintenance costs when spawning does not occur at the expected time and reduces the overall efficiency of fry production.

As in other teleosts, the success of any induced spawning attempt in tilapia lies on the ability to characterize the stage of ovarian maturity in prospective spawners (Garcia 1991). Females which are most likely to be responsive to hormonal administration have oocytes larger than a critical oocyte diameter (Garcia

1989). Babiker and Ibrahim (1979) differentiated six stages of ovarian maturity in Nile tilapia based on the histological appearance of dissected ovaries and oocyte diameter. Previous results showed that selection of broodstock based on critical oocyte diameter significantly increased the frequency of spawning over a three-day period indicating that oocyte diameter is a reliable predictor of sexual maturity (Garcia et al., in press). It is therefore of interest to correlate this predictor with other morphological parameters.

Recently, an ovarian biopsy technique was introduced to facilitate a reliable and systematic assessment of the stage of sexual maturity in tilapia without sacrificing the fish (Garcia et al. in press). This involves the sampling of intra-ovarian oocytes with the use of a soft silastic tubing (2 mm internal diameter) and aspirating the oocytes by mouth. This ovarian biopsy technique may be less stressful than manual extrusion of gametes (stripping) which may cause rupture of oocytes. The number of eggs collected by stripping also cannot be easily controlled and usually exceeds requirements. However, basing maturity from morphometric characters such as body weight, length, and degree of swelling of the genital papilla is still a more popular technique used by fishfarmers and researchers. Srisakultiew and Wee (1988) suggested that swollen belly and protruding genital papilla may be unreliable in as much as belly-swelling in tilapia is not as distinct as in Chinese carps. Thus, there is a need to assess the reliability of these conventional practices in order to qualify and recommend the most efficient method for adoption by fishfarmers.

This study aims to determine any correlation between oocyte diameter and body weight, standard length, and dimensions of genital papilla as a measure of the state of gonadal maturity in tilapia.

Materials and Methods

One hundred and thirty-five sexually-mature breeders (7-9 months old) belonging to a Philippines strain of *Oreochromis niloticus* were randomly sampled from a pool of broodstock maintained in 4 m² net enclosures suspended in earthen ponds at the FAC/CLSU-UCS Genetic Manipulation for Improved Tilapia Project.

For each fish, the following morphometric characters were measured: body weight, standard length, genital pore dimension, and papilla dimension. The dimensions of the genital papilla were obtained by taking the mean of their respective width and length to the nearest 0.1 mm with the aid of a Cambridge-type caliper (see Fig. 1). Oocyte-sampling was done by inserting a soft silicon rubber tubing (about 2 mm internal diameter) into the ovipore of the fish followed by gently aspirating approximately 30 eggs by mouth. The oocytes were fixed in 1% phosphate buffered formalin and measured immediately after sampling. The diameter (mean of the

major and minor axes) of 30 eggs was measured to the nearest 0.01 mm using an ocular micrometer fitted to an Olympus compound microscope at 20x magnification.

The relationship of oocyte diameter with all morphometric characters was determined using the Pearson Product Moment Correlation analysis (Zar 1988).

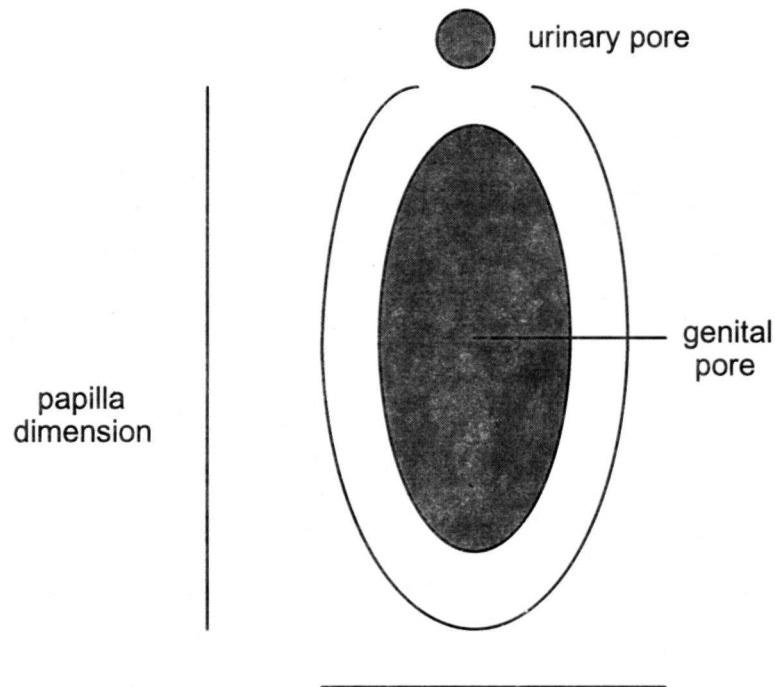


Fig 1. Schematic diagram of the female genital papilla in *Oreochromis niloticus* L. Each dimension represents the average of their respective length and width (not drawn to scale).

Results and Discussion

The mean of each of the morphometric characters measured are presented in Table 1. There were no significant correlations between oocyte diameter and the morphometric characters body weight, standard length, genital pore and papilla dimensions (Table 1). These morphometric characters are thus not sound criteria for characterizing the stage of gonadal maturity in sexually-mature tilapia.

Views on the relationship of egg size with body size of teleosts are conflicting. Babiker and Ibrahim (1979) stated that the development of the gonads in wild-caught *O. niloticus* is closely related to the general size of the body. Fecundity and egg size of rainbow trout broodstock of different strains increase with increasing fish size (Bromage and Cumaranatunga 1989). However, Lowe-McConnel (1955) showed that the size of eggs in fish is species-specific and not related to the body weight of the female. Peters (1983) indicated that there was no relationship between female size and egg size in *Tilapia tholloni*, *T. zilli*, *T. guineensis* (10-80 g) and *Sarotherodon melanotheron* (10-40 g).

Table 1. Mean and standard deviation of some morphometric characters in sexually mature Nile tilapia and correlation with oocyte diameter (N=135). ns = not significant.

Parameters	Mean ±SD	Correlation coefficient (r)
Body weight (g)	71.0± 35.0	-0.14 (ns)
Standard length (cm)	13.1 ± 2.1	-0.09 (ns)
Genital pore dimension (mm)	1.2 ± 0.5	-0.14 (ns)
Genital papilla dimension (mm)	2.4 ± 0.7	-0.01 (ns)
Oocyte diameter (mm)	1.3 ± 0.5	

Under certain conditions, maturation has been observed in 4.2 cm *O. mossambicus* (Arrignon 1969). The diameter and dry weight of the eggs in two-year old haddock, *Melanogrammus aeglefinus* are positively correlated with fish length (Hislop 1988). But not so in the Arcto-Norwegian cod, *Gadus morhua* L. (Solemdal 1970).

In the absence of any distinct morphological differentiation of the genital papilla, the average oocyte diameter varied significantly (<0.01) between individual females at each sampling period (Garcia 1991). Among females reared in either aquaria or small net enclosures, it was commonly observed that size of genital papilla is not indicative of proximity to spawning. Under aquarium conditions, the bulging and widening of the genital papilla is prominent only a few hours prior to spawning, particularly during courtship activity.

In as much as morphological characters are not sound criteria for judging gonadal maturity, the results further justify the validity of an ovarian biopsy

technique for selecting broodstock prior to either hormone-induced or natural spawning. This technique provides a sample that is representative of the maturity stage of the ovaries in tilapia. This has also been found reliable for estimating the ovarian stage of development in the grey mullet (Shehadeh et al. 1973), milkfish (Lee et al. 1986), and sea bass (Garcia 1989).

Thus it is concluded that neither body weight and length nor genital papillae dimensions are useful predictors of the stage of ovarian development and cannot be used quantitatively and reliably to predict spawning in female *O. niloticus*. It is nevertheless possible that non-quantifiable character such as belly swelling, body and papilla coloration as well as behavior could be used together with genital papilla morphology to predict spawning readiness. The use of critical oocyte diameter by ovarian biopsy is still the most reliable method for assessing whether female Nile tilapia is ready to spawn.

Acknowledgments

This paper is a contribution of the FAC/CLSU-UCS Genetic Manipulations for Improved Tilapia Project funded by a grant from the British Overseas Development Administration (R.4803) to G.C. Mair and D.O.F. Skibinski.

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