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COMPARATIVE STUDIES OF SOME SEMEN PHYSICAL CHARACTERISTICS OF CULTURED AND WILD AFRICAN CATFISH (*Clarias gariepinus*, Burchell, 1822) BROODSTOCK

By

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ABSTRACT
The aim of this study was to compare some semen physical characteristics of both wild and cultured Clarias gareipinus broodstocks in order to know their relative economic advantages to farmers. Nine male broodstocks were selected for each with their weight ranges between 700g to l250g, with total length ranges between 51.50cm to 61.00cm. The fish were sacrificed by spinal transaction, after which the fish were dissected and the gonads were removed. The gonads were examined after weighing, and were evaluated for p1-I, motility, and volume and sperm concentration. Descriptive statistics was used to find their minimum and maximum values. Student t-test was used to analyse the differences of their means. Also, the relationships between semen parameters were tested using the bivariate correlation coefficients of Pearson. There was no significant difference (P>0.05) in the mean semen concentration (x109/ml) of Cultured (2.53±0.69) and Wild (1.92±0.95) broodstocks respectively. Significant differences (P<0. 05) were observed in semen mean progressive motility (%), pH, volume (ml), weight of gonads (g) of Cultured (88.00±6.96%, 7.22±0.26, 8.01±1.13m1, 4.16±1.59g) and Wild (56.30±42.30, 6.89±0.33, 5.80+0.40, 2.01±1.02) broodstocks, respectively. There was significant correlation (P<0.05) between pH and progressive motility, volume and concentration, weight of gonads and volume of the Cultured broodstocks. There was a significant correlation between weight of gonads and concentration of both Cultured and Wild African Catfish. The semen quality of the cultured broodstocks was higher than that of wild broodstocks - and this may be due to differences in their environment and their feeding conditions. It is recommended that further research should be done on evolutionary and genetic performance of wild African catfish.

Keywords: Broodstocks, gonads, spinal, dissect, cultured, genetic, wild African catfish, semen, motility, evolutionary

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INTRODUCTION

Catfishes are an economically important group of fresh and brackish water fish worldwide. Several species have been successfully introduced in aquaculture (Teugels, *1996),* and African catfish, *Clarias gariepinus* is perhaps the most important one, not only in Africa but also in South Asia (e.g., Thailand) and Europe (e.g., Netherlands). The availability of gametes throughout the year is important to ensure a constant supply of fish. In captivity (25°C, 12h light per day), *C gariepinus* gametogenesis is continuous once sexual maturity is reached (Huisman and Richter, 1987). However, whereas female can be stripped of eggs after treatment with carp pituitary extracts (cPE; Hogendoom, 1979) or human Chorionic Gonadotropin (HCG; Eding *et al,* 1982), spermiation and male reproductive behaviour do not take place spontaneously (Van Oordt *et al.*, 1987) even after hormonal therapy. To obtain spermatozoa it is necessary to sacrifice male brood fish (Steyn and Van Vuren, 1987) or surgically removed part of their testes (Bait and Dunham, 1990).

Fingerling production and availability of quality fish feeds have been bottlenecks for development of fish farming in Nigeria for the past 40 years (NSPFS, 2006). Over the past several years, private sector fingerling production has increased from some 3 million per year in 2001 to more than 30 million per annum at present with several large producers delivering more than 300, 000 fingerlings monthly (NSPFS, 2006). There are 24 species of Clarias (Idodo-Umeh, 2003) in Nigeria and only the *Clarias gariepinus* has been singled out as the best fish for culture instead of the *Clarias Lazera* from central Africa which was first cultured intensively by Dutch Scientists working in Bangui, Central African Republic in the late 1970's. The cultivation of many economically important species has been helped greatly by the growing use of artificial fertilization and incubation. The artificial spawning and fertilization of many species to which this technique could not be applied formerly is now possible due to hypophysation. The eggs of the fish obtained in this way are generally incubated artificially to guarantee success. In fish reproduction under controlled conditions, attempts are made to obtain sperm of the highest quality and hence to produce the highest possible numbers of good quality fingerlings (Enuice *et al,* 2010).

Therefore, the use of high quality gametes from captive fish broodstock is of great importance for ensuring production of valuable offspring and increased production in aquaculture (Bromage, 1995). In order to have controlled and successful production in aquaculture systems, it is necessary to have adequate knowledge of the physical characteristics of the semen of either wild or cultured catfish *(Clarias gariepinus,).* The cultured African catfish *Clarias gariepinus* is the most popularly culture fish in Nigeria. Therefore, the study was initiated to compare some semen physical characteristics of both cultured and wild broodstocks in order to know their relative economic advantage to farmers.

AIM AND OBJECTIVES OF THE STUDY

The main objective of this study is to compare some semen physical characteristics of cultured and wild African catfish *(Clarias gariepimis)* broodstocks. The specific objectives are to;

i. Determine the sperm concentration (sperm count) and sperm motility of the cultured and wild catfish.

ii. Determine the pH, and volume of semen of the cultured and wild catfish

iii. Compare the parameters determined for cultured and wild catfish

MATERIALS AND METHODS

EXPERIMENTAL DESIGN

The nine (9) wild male broodstocks (mean weight 977. 8g) of *C/arias gariepinus* were obtained from Shika Dam located at Shika Zaria, Kaduna state. Whereas, the nine (9) cultured male broodstocks (mean weight 1016. 5g) of *Clarias gariepirms* were obtained from Tee Jay fisheries, located at the Ajibesin Ogidi Tiorin, Kwara State, were used for this experiment. The male broodstocks of cultured *C/arias gariepinus* were acclimatized for two weeks in 1000 litres tank after which they were transported to and examined at Artificial Insemination section laboratory of National Animal Production Research Institute (NAPRI) of Ahamadu Bello University Zaria, Kaduna state. The male broodstocks of wild *C/arias gariepinus* were also acclimatized for two weeks before analysis. The choice of males was based on the possession of a well vascularised genital papilla. The spawning season of the fish was considered (August — September, 2010).

SEMEN COLLECTION

The male broodstocks of African catfish *Clarias gariepinus* of both wild and cultured were sacrificed, after which the abdomen were dissected and the testes removed. Blood clots and other tissues were rinsed away using the normal saline solution. The testes were placed in the buffer solution pending the time of semen release in a test tube (Adeyemo *et al*, 2007).

POST COLLECTION EXAMINATION

The collected gonads of *C/arias gariepinus* were evaluated for gonads weight, pH, motility, and volume and sperm concentration. Immediately the gonads were removed, it was weighed with sensitive weighing balance to get the actual weight of the gonads. The pH of semen was measured with a semi-microelectrode pH Meter (SM1 02 pH Meter) as describes by (Saeed *et al,* 2009).

MOTILITY ASSESSMENT

Spermatozoa motility was assessed by placing the slides containing semen on an inverted microscope stage of either 10x or 20x objective lens. Estimation of spermatozoa motility was started immediately after the semen was gently crushed on the slides and the movement was observed till 2mins. Motility were analysed by using descriptive and numerical scales for evaluation of microscopic wave pattern of semen. In this method, the motility was recorded and expressed as the percentage based on the wave pattern movement of sperm cells. Only forward-moving sperm were judge motile, those simply vibrating or turning on their axes were considered immotile (Aas, *et al.,* 1991).

VOLUME DETERMINATION

The gonads were placed in a normal saline (5ml) in a test tube and were left for about 24 hours. After which the volume was measured by calibrated volumetric test tube.

SEMEN CONCENTRATION DETERMINATION

The semen concentration was determined by using haemocytometer counting chamber according to Caille *et* al., (2006). The counter was used to determine the actual number of sperm cells in the gonads.

STATISTICAL ANALYSIS

All parameters were analysed by using descriptive statistics to find there means and standard error. T-test was used to establish differences between them. The Pearson correlation was used to establish the level of relationship between parameters using SPSS (IBM SPSS 2009, Version 19).

RESULTS

The minimum and maximum values of semen physical characteristics of Cultured and Wild African Catfish are presented in Table 1 in which minimum value of 0% motility and maximum value of 92.50% was recorded for wild male broodstock fish. The mean values and standard error of the parameters (sperm concentration, progressive motility, pH, semen volume, gonads weight, fish weight and total length) are shown in Table 2 at which concentration *(*x10^9/ml*)*, weight of fish (g) and total length (cm) are not significant ($P<0.05$). Significant differences ($P<0.05$) were shown in motility **(%),** pH, volume (ml) and gonads weight (g). Correlations between the parameters are shown in Table 3, for both cultured and wild African catfish.

DISCUSSION

The 0% progressive motility recorded for wild African catfish agrees with Alavi *et al.,* (2006) that reported similar finding and assert that motility is induced after the spermatozoa are released into the aqueous during natural reproduction or into the diluents during artificial reproduction. There was a significant difference ($P<0.05$) in the progressive motility of the spermatozoa and this may be as a result of individual male depending on ripeness as it reported by (Akcay *et al*., 2002b) who stated that spermatozoa motility varies in vigour and duration not only among males but also within an individual male depending on ripeness. Most studies on fish also show that duration and motility of semen may vary seasonally (Benau and Terner, 1980; Akcay *et al*, 2004). There was a significant different ($P<0.05$) between mean progressive motility **(%),** mean pH, mean semen volume (ml) and mean gonad weight (g) of the cultured and wild male broodstock. These differences may likely be due to age, feeding condition, water quality, and different environmental conditions and spawning season.

Table 1. Minimum and maximum values for semen physical characteristics of cultured and wild African Catfish *(Clarias gariepinus,).*

	Cultured	African Catfish	Wild African	catfish
Parameters	Mm	Max	Mm	max
Semen Concentration ($x10^9$/ml)	1.64	3.76	1.13	3.90
Progressive motility **(%)**	77.50	97.00	.00	92.50
pH	7.00	7.50	6.00	7.00
Semen Volume (ml)	6.50	9.80	5.30	6.40
Gonadweight(g)	1.60	‘6.3O	1.12	3.76
Weight of fish(g)	800.00	1250.00	740.00	1180.00
Total length (cm)	51.90	61.00	51.50	55.00

Table 2. Mean value for Semen physical characteristics of Cultured and Wild African Catfish *(Clarius gariepinus)* broodstock.

Parameters	Cultured	Wild
Semen Concentration ($x10^9$ / ml)	2.53 ±0.69	1.92 ±0.95
Progressive Motility (%)	88.00±6.96’	$56.30±4230^b$
pH	7.22±026’	$6.89±33^b$
Semen Volume (ml)	8.ol+1.13a	$5.80±0.41^b$
Gonad weight (g)	4.16±1.59a	$2.01±1.02^b$
Weight of fish(g)	$1016.67±154.10^a$	$977.78±150.40^a$
Total length(cm)	$55.10±2.73^b$	$53.6±1.20^a$

Data are expressed as mean
Values having different letters differ significantly in a rpw (p<O.05)

Table 3. Correlation coefficient of semen physical characteristics of Cultured and Wild African catfish ***(Clarias** gariepinus)* (n=9 semen samples).

Parameters	Catfish	Semen concentration ($x10^9$/ml)	Progressive motility (%)	pH	Semen Volume (ml)	Gonad weight (g)
Progressive Motility (%)	Cultured	0.0067				
	Wild	0.512				
pH	Cultured	0.303	0.766**			
	Wild	-0.206	-0.321			
Semen volume (ml)	Cultured	0.726*	-0.033	0.410		
	Wild	0.353	0.065	0.000		
Gonad weight (g)	Cultured	0.717*	0.077	0.519	0.980**	
	Wild	0.607*	0.570	-0.576	0.413	
Weight of fish (g)	Cultured	-0.329	0.154	0.051	-0.051	-0.425
	Wild	-0.151	-0.170	-0.055	0.246	0.244

* Correlation is significant at the 0.05 level (1-tailed)

** Correlation is significant at the 0.01 level (1-tailed)

The pH values for both cultured and wild male broodstock ranged between (7 - 7.5) and (6 — 7) respectively, while the mean pH values for both fish samples are (7.22±0.26 and 6.89±0.33). Similarly, Ingerman *et al.,,* (2002) and Williot *et al*., (2000) reported a range of pH values of(6.0 —7.0) for *Acipenser transmontanus* in Kootenai River, USA. There was no correlation (r = -0.321) between the pH values and progressive motility of wild male broodstock and this agrees with the result reported by Kgerman *et al.,* (2002) and Williot, *et al.,* (2000) for wild Salmonids and *Acipencer baeri* respectively. However, there was a correlation (r = 0.766, P<0.0 1) between the pH and progressive motility of cultured male broodstock, this may be likely due to their feeding controlled environmental conditions and time of spawning.

CONCLUSION

The result of this study has shown that wild male *Clarias gariepinus* broodstocks can also be used for artificial insemination despite the importance of the cultured broodstock in terms of semen quality which is not statistically significant than the wild broodstocks The use of wild male *Clarias gariepinus* in breeding should be encourage as it will minimize the dependence on cultured *Clarias gariepinus* and also to optimize the income of farmers, as the wild male broodstocks is cheaper than the cultured male broodstock. Further research should be done on the evolutionary and genetical ability of wild *Clarias gariepinus* broodstocks. Breeding of male wild broodstocks with the female of cultured should be done in order to know the performance of the fish based on size, weight, length and rate of growth. Further study should also be done in comparing the physical characteristics of female gonads of cultured and wild African Catfish broodstocks.

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