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REPRODUCTIVE INDICES OF TWO STRAINS OF *Clarias gariepinus*: FROM CAMEROON AND NIGERIA

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ABSTRACT

Evaluation of reproductive characters between of Clarias gariepinus from Cameroon and Nigeria was carried at the Department of Fisheries and Aquaculture Teaching and Research farm Adamawa State University, Mubi Nigeria, to determine the fecundity, milt volume, sperm motility, percentage fertilization and hatchability from four experimental crosses. Water parameters such as PH, temperature and dissolved oxygen were monitor and found to be at optimal level for catfish culture. The results showed that purebred from Cameroon had better fecundity (242,433 eggs) than Nigeria (219,204 eggs). There was a significant difference (p<0.05) in the weight of right and left lobes of testes and in the length of the right and left lobes of the broodstock from the different strains. FNIG x MNIG had the highest percentage fertility (99.63%) followed by FCM x FNIG (99.54%), FCM x MCM (99 53%) and the least in FNIG x MCM (99.50%). FNIG x MNIG had the highest percentage hatchability (87.523%) followed by FCM x FNIG (80.00%), FNIG x MCM (75.86%) and the least was FCM x MCM (75.12%). There was a significant difference (p <0.05%) in the fertility and hatchability between purebreds and hybrids

Key words: Strain, Fertilization, Hatchability, Milt and fecundity Clarias gariepinus

INTRODUCTION

African catfish *Clarias gariepinus*, holds significant economic and ecological importance as a vital species in both natural and aquaculture industries worldwide. (Nguyen *et al.,* 2018) *Clarias gariepinus* is referred to as cornerstone species in aquaculture ventures owing to its adaptability to various environmental conditions, rapid growth and high fecundity. This species, has emerged as a key player in meeting the increasing global demand for fish and fish product (Nguyen *et al.,* 2018). Aquaculture being one of the key agricultural activities, has potential to contribute to food security and poverty reduction by supplementing dwindling scarcity of capture fisheries that are being exploited beyond their maximum sustainable yields (GoM, 2016). Hybridization can be defined as the union of gametes from two different species strains to produce new organisms of desirable characters with the aim of improving the genetic quality of the offspring (hybrid) as compared with those of parental stock. Fish hybridization is one of the genetic techniques which help to remove undesirable traits while retaining only the desirable ones. Fish production through hybridization is an age long practice in Africa (Adah *et al*., 2014). Hybridization has also been successful in evaluating and improving reproductive traits, (Hassan *et al*., 2011).

Intraspecific hybridization is the crossing or mating of fish of the same species and genus but from different locality, region or ecological zones. The motive behind this is to get an improved quality fish seed. The primary goal of intraspecific hybridization is to produce hybrids from species of different genotypes exclusively for production. The species used for crossing should be of pure line so that the generation of hybrids can produce quality and fast growing offspring (Adene *et al*., 2017). This research

aimed at evaluating the fecundity, milt volume, fertility, fertilization hatchability percentage of *Clarias gariepinus* from Cameroon and Nigeria.

MATERIALS AND METHODS

The experiment was carried at the Department of Fisheries and Aquaculture Teaching and Research farm Adamawa State University, Mubi Nigeria. Ten (10) cultured Broodstocks five male and five female Clarias *gariepinus* were obtained reportable fish farm in Bukula from Cameroon Republic and transported to Mubi Adamawa State, Nigeria in 50 litre jerican. Also ten (10) cultured *Clarias gariepinus* were obtained from private fish farm in Mubi, Adamawa State. The maturity of the fish was ascertained as identify by some key identification according to Reed *et al.,* (1967). The selected mature broodstock were separate into male and female based on examination of the genital papillae. The weighed of male and female broodstock was recorded separately using a weighing balance. The broodstock were allowed to acclimatize for ten days in a concrete tank before the commencement of the experiment.

The following mating combinations were used for the crossing:

Male/ female	♀**NCG**	♀**CCG**
♂ **NCG**	NCG x NCG	**NCG x CCG**
♂**CCG**	CCG x WCG	**CCG x CCG**

Key
NCG = Nigeria *Clarias gariepinus*
CCG = Cameroon *Clarias gariepinus*
♂ = Male
♀= Female

Induced Breeding: The broodstock were injected with Ovaprim synthetic hormone based on their body weighed in (g). Synthetic hormone was administer intramuscularly above the lateral line, towards the tail 0.5 ml per kg of female fish and 0.25 ml per kg of male fish. After the administration of the ovaprim synthetic hormone at 10.00 pm, the brooders were kept in separate bowls for 10 hours to observe the latency period of each. Milt was collected by dissecting the male at the abdomen using dissecting kits to obtain the testes. The two lobes of the males were removed and cleaned with tissue paper and then kept in a labeled Petri dish. The length of the lobes was measure using a meter ruler and the weight was also taken using sensitive weighing balance. Female broodstock from both countries were stripped by gentle application of pressure on the abdomen to release the eggs into a clean dry labeled plastic dish.

Evaluation of milt Quality

The quality of the collected b was determined by estimating the milt volume and percentage motility count

Milt Volume

The testes were removed from the males of each strain. The milt were squeezed into a labeled petri dish. The volume of the milt collected were measured using 10mls plastic syringe. (Adeparusie. *et al.*,2010)

Sperm Motility

Motility of the milt was evaluated using light microscope x 100. Sodium chloride was use as activating solution. The milt collected in combination with sodium chloride was place on a glass microscope slide

the duration duration of spermatozoa movement was assessed and recorded using sensitive chronometer**.**

Percentage Motility Count
Milt concentration was determine by counting the number of spermatozoa in the milt. Percentage motility was also examined by placing 1 ml of milt into activating solution and view under light microscope x 400magnification. Immobile sperm cells and whole mobile cells were counted as adopted by Canyurt and Ahan (2008).
MC=WSC-ISC
% MC=MC/WSC x 100

Estimation of Fecundity
The fecundity of the female fishes from both countries were calculated using the formula adopted by Ndeham *et al.* (2018) after measuring the weight of the stripped eggs from the female stocks.
Fecundity = $\frac{weight\ of\ stripped\ egg}{Body\ weight\ of\ fish}\ x\ 100$

Percentage Fertilization
Percentage fertilization were calculated using the formula adopted by Duwal, (2016). After counting the number of fertilized and unfertilized eggs immediately after an hour of fertilization.
Percentage Fertilization = $\frac{Number\ of\ fertilized\ eggs}{Total\ number\ of\ eggs} x\ 100$

Percentage Hatchability
Percentage hatchability was determined by counting all the hatchlings against the incubated fertile eggs. This was determined according to the formula adopted by Onyia *et al.* (2021)
Percentage Hatchability = $\frac{Number\ of\ hatchlings\ in\ each\ tank}{Number\ of\ incubated\ eggs\ in\ each\ tank}\ x\ 100$

Water Quality
Water quality parameters such as pH, temperature and dissolved oxygen (DO) were monitored throughout the period of the experiment by the use of water test kit.
All data collected were analyzed using Simple percentage.

RESULTS AND DISCUSSION
Table 1 shows the body weight, length and reproductive indices of female *Clarias gariepinus* from the Nigeria and Cameroon. The result revealed that female fish from Nigeria had weight of 3000g while Cameroon female had 2750g, Cameroon female had high fecundity rate (242,433), compared to the broodstock obtained from Nigeria (`219,204). There were difference in the weight of the ovary, body length and number of eggs in one gram between Nigeria and Cameroon fishes. The body weight and length, weight and length of testes and milt volume from Nigeria and Cameroon are shown in Table 2.
Table 3 shows the fertilization and hatchability rate of *C. gariepinus* purelines and their hybrids FNIG x MNIG had the highest percentage fertilization and hatchability

Table 1: Reproductive Performance of female *Clarias gariepinus* From Nigeria and Cameroon

Parameters	Female fish from Nigeria (NCG)	Female fish from Cameroon (CCG)
Body weight (g)	3000[a]	2450[b]
Body Length (cm)	68[a]	60[b]
Weight of stripped eggs (g)	347[b]	369[a]
Weight after stripping (g)	265 [a]	238 [b]
Number of eggs in 1g	63 [b]	65 [a]
Nature of eggs ovulated	Matured brown	Matured dark green
Fecundity	219,204[b]	242,433[a]
Egg diameter (mm)	1.15 [b]	1.1 [b]

Means with different superscript are significantly different (P <0.05)

Table 2: Weight, Length and Weight of Lobe of males *Clarias gariepinus* From Nigeria and Cameroon

Parameters	Male *Clarias gariepinus* from Nigeria (NCG)	Male *Clarias gariepinus* from Cameroon (CCG)
Mean body Weight (Kg)	1.75	2.1
Body Length (cm)	62	83
Weight of Testes (g)	109.9	123.6
Length of Testes (cm)	12.7	14.4
Weight of Right Lobe (g)	54.4	65.3
Length of Right Lobe (cm)	6.4	7.3
Weight of Left Lobe (g)	55.5	59.3
Length of Left Lobe (cm)	6.3	7.1
Milt Volume (ml)	3.1	4.6
Sperm motility duration (minutes)	34	36

Means with different superscript are significantly different (P <0.05)

Table 3: Percentage Fertilization and Hatchability of *Clarias gariepinus* cross between Nigeria and Cameroon

Matting Combination	No of eggs treated	No of eggs not fertilize	No eggs fertilize	No of hatched eggs	% fertilization	% hatchability
FNIG x MNIG	126,400	460	125,940	110,230	99.63	87.52
FCM x MCM	131,400	615	130,785	98,246	99.53	75.12
FNIG x MCM	103,800	513	103,287	78,356	99.50	75.86
FCM x FNIG	110,400	498	109,902	87,930	99.54	80.00

Means with different superscript are significantly different (P <0.05)

This study examined the reproductive characters between Nigeria and Cameroon *clarias gariepinus* and found out that Spawning fecundity was higher in Cameroon female (242,433), Nigeria female had (219, 204). The high fecundity recorded in Cameroon female may be due to weight of the egg, differences in environment, food supply and size of the egg. (Mbeng, *et al*., 2023). The results of this research disagree with the findings of (Mbeng, *et al*., 2023)
Cameroon male had higher weight and length (2.15kg, 83cm) followed by Nigeria male (1.75kg, 63cm) Cameroon male had milt volume of (4.6ml) with right lobe length measured (7.3cm) and left lobe measured (7.12cm) when compared with Nigeria male which had milt volume of (3.1ml) with right and left lobes measured (5.4cm and 6.3cm respectively). The differences could be attributed to the length of Cameroon male (14.4cm) compared to Nigeria (2,71cm). Variation in milt quality may be due to sex ratio, stocking density, age size, nutrition, and feeding regime. (Tahoun *et al*, 2008).
The percentage fertilization was highest in Nigeria parent FNIG x MNIG (99.63) while FCM x NIG (99.56) was the highest among the hybrids. The overall result revealed that purebreds had highest percentage fertility than the hybrids. Shah *et al*, (2011) also reported higher fertility in purebreds (95%) and had lower fertility (86% -89%) in hybrids. The highest percentage hatchability of 87.52% was recorded by FNIG x MNIG which is contrary to the results reported by Adene et al. (2017) who hybridized a native African catfish strain in Nigeria with improved "hollandaise" strain, but is similar to the result obtained in an interspecific hybridization by Tiogue et al. (2020). This was followed by the cross between FCM x FNIG with (80.00%) and the least was 75.12% for FCM x MCM. There was a significant difference in percentage hatchability between the pure strains and their reciprocal cross. Although there has been limited research work on this area, but the high percentage hatchability recorded in NIG might be due to generic improvement through selective breeding.

CONCLUSION

The study finding reported that FCM x FNIG had the best percentage and hatchability among the hybrids, though pure line from Cameroon has the highest percentage and hatchability but for sustainable production of seed in aquaculture FCM x FNIG should be use. Therefore, the hybrid could be used further by hatchery managers to raise fingerlings and maximize profit in their business. Furthermore, researchers could explore the genetic traits of this strain to develop improved broodstock at the second filial generation.

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