International Journal of Fisheries and Aquatic Research
www.fishjournals.com
ISSN: 2456-7248
Received: 24-09-2021, Accepted: 09-10-2021, Published: 25-10-2021
Volume 6, Issue 2, 2021, Page No. 66-68

Effect of various latency period on fertilization, hatchability and survival of fry of *Clarias gariepinus* in a partial flow through system

Okoro B C[1], Oyeniyi O V[1], Soboyejo I O[1], Nwameka P C[2]
[1] Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria
[2] Department of Fisheries and Aquaculture, Ebonyi State University, Abakaliki, Ebonyi, Nigeria

Abstract
This study on the effect of various latency period on fertilization, hatchability and survival of fry of *Clarias gariepinus* reared in a partial flow through systems reviewed that latency period of 9hours (T1) had 66.67±1.04% fertilization, 44.17±1.59% hatchability and 17.90±0.65% survival; 10 hours (T2) had 58.33±0.75% fertilization, 50.61±0.77% hatchability and 16.77±0.23 survival; 11 hours latency period (T3) had 68.33±1.24% fertilization, 55.96±0.96% hatchability and 18,38±0,53 survival while 12 hours latency period (T4) had 66.50±0.91% fertilization, 83.54±0.22% hatchability and 13.73±0.82% survival after 14 days of rearing, although there was no significant difference(P>0.5) in all the treatment for fertilization, but there was significant difference (P>0.5) between T4 and other treatments in both hatchability and survival. The water quality recorded during this study was within acceptable limits. This study has reviewed that milt can be used when stored in physiological solution for four hours. More investigations on the course of higher hatchability of fry and low survival recorded in T4 (latency period 12 hours) at 27^{0}C are recommended.

Keywords: latency periods, fertilization, hatchability, survival, fry

Introduction
The African catfish, *Clarias gariepinus* (Burchell 1822) [8], is the preferred fish for aquaculture in the West Africa and other part of the African continent. The species is dominant in freshwater environment including lakes, rivers, and dams. According to Adewunmi and Olaleye 2011[3], it can be said that fish is the most heavily traded food commodity in the market, with the continuous declining of natural fish production, it is crucial to improve fish productions from aquaculture as it is one sector that can significantly contribute to the world fish production (Gupta and Acosta, 2001) [9].
Production of catfish in Nigeria account for about 70 percent of the fish production from Aquaculture (Gupta and Acosta, 2001) [9]. The catfish (family Clarridae) is very popular in Nigeria due to its adaptable culture characteristic which has endeared it to many fish farmer. *C. gariepinus* is the most popular fish of culture in Nigeria and most fish farmer undertake its production. This species does not breed in captivity (Adebayo and Fagbenro, 2004) [2] all year round; therefore most farmers depend on fingerling collection from the wild. However, due to the problems associated with wild fish seed such as seasonality in availability, uncertainty of the species of the fish seed collection, disease infection and limited quality of harvested fish seed which calls for the need for seeds production and artificial propagation. One key constraint to its culture is the limited availability of quality fingerlings as seed material (Sahoo *et al*., 2007) [10].
Success of artificial propagation of *C. gariepinus* through induced breeding under controlled environmental condition is mostly dependent on the latency period and humidity/temperature of the environment (Sahoo *et al.,* 2007) [10]. Therefore, the role of latency period in terms of spawning and fertilization of fish egg needs to be systematically evaluated. The objectives of this study were to examine the effect of different latency period on fertilization, hatchability and survival of *C. gariepinus* fry.

Materials and Methods
This research was designed using partial water flow through, a system in the fish hatchery unit of the department of fisheries and aquaculture, Ebonyi State University, Abakaliki, which is located approximately within latitude 6^{0}20'N and longitude 8^{0}06'E in the derived savannah of the south-eastern part of Nigeria.

Procurement of material
A total of nine (9) brood stocks of African catfish (five male and four female) were purchased and transported to the hatchery unit of the Ebonyi State University in small transparent vats, where they were acclimated in concrete tanks before artificially induced breeding was carried out. Both males and females were acclimated in separate concrete tanks of (3x3x2) m for 1 week during which they were fed with imported floating feed at 1% body weight and was stopped 24 hours prior to the breeding exercise (Audu and Ofejekwu, 2010) [5]. De Graaf and Janssen (1996) [6], reported that fertilization and quality of hatchlings are influenced by the quality of broodstocks, as a result the broodstocks were well examined before selection. The hormone (ovaprim) used was procured from Nova mega agro shop in Abakaliki, Ebonyi State. The broodstocks used were between 10-13 months of age with an average weight of 1kg

Hormone administration.
Hormones were administered intramuscularly above the lateral line and below the anterior end of the dorsal fin at a dosage of 0.5ml/kg of fish. All three females were injected between 2:59am to 3:10am at a temperature range 26.6^{0}C - 27^{0}C. All the treated fishes were returned back into their vats and covered tightly. Each of the brood-stock injected were

stripped according to their stipulated latency period, the males were scarified and their bellies dissected vertically and male gonads removed. Blood and other stains were removed from the gonads (testis) and the milt was squeezed out in to saline solution. Saline solution is produced by dissolving 9g of common salt in a litre of water (FAO, 1996). The male and female gametes were mixed and fertilized accordingly and incubated in plastic vat measuring (0.55 X 0.4 X 0.35)m set up as partial flow through system, 1g of eggs were stripped for each replicate according to their time frame, 1g of eggs equals 600 eggs (Agbebi, *et al*., 2013) [4]. The latency period (LP) was 9 hours and was extended by 1hour, 2 hours and 3hours for treatment 2, 3 and 4 respectively. Table 1. below shows the actual latency period (LP), stripping hour (ST), time of milt removal after scarifying the male (TMR), and the difference between the time of milt extraction and use as Milt delayed (MD) in hours. The milt was stored in physiological solution at room temperature.

Table 1: Time of stripping, Milt removal and Fertilization for each treatment

Treatments	LP (hrs)	TS (hrs)	TMR (hrs)	MD (hrs)
T1R1	9	9	9	-
T1R2	9	9	9	-
T1R3	9	9	9	-
T2R1	10	10	9	1
T2R2	10	10	9	1
T2R3	10	10	9	1
T3R1	11	11	9	2
T3R2	11	11	9	2
T3R3	11	11	9	2
T4R1	12	12	9	3
T4R2	12	12	9	3
T4R3	12	12	9	3

Incubation procedures

Immediately after fertilization, each of the replicates was incubated in plastic vats measuring (0.55 X 0.4 X 0.35) m set up as partial flow through system, containing 30 L of water without aeration. Ten hours, after incubation, the observed white and opaque eggs were removed from each vat. This was done by siphoning out the dead/unfertilized eggs which appeared whitish. The percentage fertilization was estimated as:

$$\text{Fertilization (\%)} = \frac{\text{No of fertilized eggs}}{\text{Total no of incubated eggs}} \text{ X } 100$$

(Agbebi *et al*. 2013) [4]

The counting of hatched eggs varied with treatment. The hatched larvae were counted while the un-hatched eggs were discarded. The percentage hatchability was estimated thus below:

$$\text{Hatchability (\%)} = \frac{\text{No of hatching}}{\text{Total No. of fertilized egg}} \times 100$$

(Agbebi *et al.*, 2013) [4]

Hatching was observed within the period of 18hrs – 20hrs of incubation in all treatments.

The percentage survival was estimated thus below:

$$\text{Survival (\%)} = \frac{\text{No. of Fry at the end of study}}{\text{No. of Fry at the beginning of the study}} \times 100$$

(Agbebi *et al.*, 2013) [4]

Physicochemical parameters

The following **physicochemical parameters** were determined; temperature with mercury in glas thermometer, pH with pH meter and Dissolved Oxygen (DO) with D.O meter model 611-R labtech.

Analysis of data

Data were analyzed using one-way analysis of variance in a completely randomized design. Significant means were separated using Duncan Multiple range test.

Result and Discussion

the result from this study as presented in table 2 showed that latency period (LP) of 9hours (T1) had 66.67±1.04% fertilization, 44.17±1.59% hatchability and 17.90±0.65% survival; 10 hours (T2) had 58.33±0.75% fertilization, 50.61±0.77% hatchability and 16.77±0.23 survival; 11 hours latency period (T3) had 68.33±1.24% fertilization, 55.96±0.96% hatchability and 18,38±0,53 survival while 12 hours latency period (T4) had 66.50±0.91% fertilization, 83.54±0.22% hatchability and 13.73±0.82% survival after 14 days of rearing. The number of eggs incubated (NEI) was also shown in the table.

Table 2: Latency period, number of eggs incubated, % fertilization, % Hatchability and % survival of Clarias gariepinus fry reared in partial flow through system at 27^0C.

Treatment	LP (hours)	NEI	% Ferti.	%%Hatch	% Surv.
T1	9	600	66.67±1.04^a	44.17±1.59^a	17.90±0.65^a
T2	10	600	58.33±0.75^a	50.61±0.77^a	16.77±0.23^a
T3	11	600	68.33±1.24^a	55.96±0.96^a	18,38±0,53^a
T4	12	600	66.50±0.91^a	83.54±0.22^b	13.73±0.82^c

Mean value within the same column with the same superscript are not significantly different (P>0.5) According to Agbebi, *et al*. (2013) [4] reported that 68.6% fertilization, 70% hatchability and 68.19% survival when milt was delayed for two hours. This was close to the result recorded in this study where the highest percentage fertilization of 68.33±1.24% and survival of 18,38±0,53 were observed after 14 days of rearing. Abubakar, (2014) [1] who also reported the best hatchability and survival rate at 12 hrs latency period at temperature 27^0C The higher hatchability and survival recorded by Agbebi *et al* (2013) [4] may be due to the culture system used. According to Tan-Fermin *et al*.(1997) [12], latency period of 10hrs is the best for *Clarias gariepinus* at temperature 29.5^0C, according to him, period lower than 10hrs, there will be insufficient action of the hormonal treatment leading to failed ovulation. The result of this work reviewed that milt from *Clarias gariepinus* can be stored in physiological solution at room temperature for three hours after removal from its sac. Agbebi *et al* (2013) [4] reported that milt can survival up to 4 hours at 19^0C. There was no significant difference (P>0.5) in all the treatment for fertilization, but there was significant difference (P>0.5) between T4 and other treatments in both hatchability and survival.

Table 3: Water quality parameters

Parameters	T1	T2	T3	T4
Temp. ^{0}C	27.00±0.01	27.00±0.00	27.00 ±0.00	27.00±0.01
DO	7.50 ±0.00	7.50 ±0.05	7.50 ±0.00	7.50 ±0.03
pH	6.8 ±0.00	6.8 ±0.01	6.8±0.01	6.8 ±0.04

Water quality parameters recorded during the experiment are presented in Table 2. There was no significant difference (P>0.05) in the water quality parameters measured. The water temperature recorded was 27±0.00°C each, dissolved oxygen was 7.50±0.00mg/l and the pH values was 6.8±0.00 across all treatments. The values recorded in this experiment were within the tolerance range of *C. gariepinus* which ranges for physiological function and processes. According to Santosh and Singh (2007) [11], suitable pH for catfish culture is between 6.7 and 8.5 with any value below or above could be stressful to the fish. Environmental factors such as dissolved oxygen, temperature and pH have effects on the development of spawn eggs (Eyo, 1997) [8].

Conclusion

The success of artificial propagation of C. gariepinus through induced breeding under controlled environmental conditions is mostly dependent on the latency period and humidity/temperature, (Agbebi *et al.*, 2013) [4].

This study has reviewed that milt can be used when stored in physiological solution for four hours. The best result was recorded in latency period of 11 hours at 27^0C in term of survival. This could imply that ovulation was completed at 11 hours at 27^0C which could provide the egg with higher immunity at fertilization.

Recommendation

Success in aquaculture depends largely on the quantity of quality seeds that can be produced for culture. In *C. gariepinus*, seed production depends largely on latency period. Ability to establish latency period at different temperature will go a long way in solving our present aquaculture problems. As a result more investigation on the course of higher hatchability of fry and low survival recorded in T4 (latency period 12 hours) at 27^0C is recommended.

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