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SHORT COMMUNICATION

ARTIFICIAL PROPAGATION OF *CLARIAS GARIEPINUS* (BURCHELL, 1822) IN AQUARIA

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ABSTRACT: Induced spawning of the African catfish (*Clarias gariepinus*) was successfully carried out using natural hormone (homoplastic hormone-pituitary extract from *Clarias gariepinus*). The study which was carried out at Bahir Dar Fisheries and Other Aquatic Life Research Centre lasted 78 days (June to October). Three gravid females and three mature males of *C. gariepinus* (weight range of 305 to 1035 g) were used for the study. In all, three trials were carried out in glass aquaria with 50 litre volume. The spawning fecundity of the three *C. gariepinus* injected with catfish pituitary extract varied from 43,456 to 75,460 with mean fecundity value 54,572. The mean percentage fertilization, hatching rate and survival rate of the eggs were 81.5 ± 2.36, 87.13 ± 0.13 and 87.04 ± 5.98, respectively. This study has shown that *C. gariepinus* can be successfully bred using pituitary of *C. gariepinus* with simple low cost technique using glass aquaria.

Key words/phrases: Aquaria, Catfish, Fecundity, Induced spawning, Survival rate.

INTRODUCTION

There are several techniques used in artificial propagation of catfishes. In induced propagation without hormone treatment, mature breeders are reproduced artificially by simulating the events which will occur during rainy season and these trigger the mating and spawning processes. However, these methods cannot be used for commercial purposes because the success rate is low. The most successful method of artificial reproduction in catfish is by induced breeding through hormone treatment followed by artificial fertilization and incubation of fertilized eggs and the subsequent rearing to fingerlings. The hormone administered can be deoxycorticosteroid acetate (DOCA), human chorionic gonadotropin (HCG) or the pituitary glands of fish and other animals like frogs (Nwokoye *et al*., 2007).

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In recent years, the culture of species of the catfish belonging to the Clariidae family is fast gaining global attention. They are widely cultured owing to their high market price, fast growth rate and ability to withstand adverse pond conditions, especially low oxygen content (Adewolu and Adeoti, 2010).

Ethiopian lakes and rivers have a great potential for the production of *Clarias gariepinus*. But lack of fry, failure to breed in ponds and absence of previous experience on catfish rearing in the country are the chief constraints on breeding the species. Therefore, this study was designed to tackle bottleneck problems of seed production of *C. gariepinus*.

MATERIALS AND METHODS

This study was carried out between June, 2012 and October, 2012 using indoor aquaria facilities of the Bahir Dar Fisheries and Other Aquatic Life Research Centre. Three females and three males *C. gariepinus* (weight range of 305 to 1035 g) were selected. The female broodfish were kept separate from males in different glass aquaria.

Experimental design and artificial spawning

Three hormonal materials pituitary gland of *C. gariepinus* (homoplastic hormones) were used. Three artificial spawning trials were carried out using three mature females and three mature males of *C. gariepinus*. Hormonal materials (extracted pituitary gland) were administered between 18:00 and 19:00 same day. After injection with the pituitary homogenate, female fish were placed into covered glass aquaria which contained fresh and oxygenated water for a length of 14 h at a mean temperature of 28°C.

Stripping and fertilization

At approximately 08:00 the following morning the fish that were ready for spawning were removed from the glass aquaria for stripping of eggs.

The ovulated eggs oozed out on slight pressure by thumb onto the plastic bowl. Three male broodfish were anaesthetized, sacrificed, and their testes removed. Incisions were then made on the sperm sac and milt was collected after pressed in porcelain mortar. Milt was squeezed over the eggs using dry technique methods (Viveen *et al*., 1985). The process from stripping to fertilization took five minutes to accomplish.

Incubation

Incubation of the fertilized eggs was carried out in 90 x 45 x 44 cm^3 (180 l) glass aquaria. It was equipped with aerator and filtered lake water was used from the recirculation system. Rearing temperature was adjusted to 28.0°C using thermostat according to Verreth and Den Bieman (1987). Water temperature was measured daily using Hanna digital thermometre. Water was changed daily to avoid mortality resulting from polluted water.

Reproductive performance parameters

The number of eggs released was determined by the difference between the weight of the female broodstock after spawning and the weight before spawning in grams. The value obtained was then multiplied by 700 (1 g = 700 eggs) (Viveen *et al*., 1985).

Estimation of percentage fertilization, hatchability and survival

A sample of 200 eggs was taken from each of the treatments at random and incubated in aerated aquaria (38 x 29 x 28 cm^3, 25 l water in each). Dead and unviable eggs which have turned whitish were collected after twenty eight (28) h, while counted and percentage fertilization was estimated. The fertilization rate was then calculated by the following equation according to Adebayo (2006).

$$\text{Fertilization Rate} = \frac{\text{Number of fertilized eggs}}{\text{Total number of eggs counted}} \text{ X } 100$$

Percentage hatchability and survival were also calculated at 30 h and the fifth (5^{th}) day after hatching, respectively, using the equation below (Adebayo, 2006). Four days after hatching, post-yolk fry was fed to satiation with incubated *Artemia naupli*.

$$\text{Hatching rate} = \frac{\text{No. of eggs hatched}}{\text{Total No. of eggs in a batch}} \text{ X } 100$$

Survival rate was also calculated using the equation below (Adebayo, 2006):

$$\text{Survival rate} = \frac{\text{No. of hatchlings alive to larval stage}}{\text{Total No. of hatchlings}} \text{ X } 100$$

Growth performance parameters

The growth phase of the study involved the use of 42 14-day old juveniles. Fourteen juveniles were randomly assigned to each of the three replicate glass aquaria. Rearing conditions were similar to the ones used in the reproductive performance phase of the experiment. Each 38 x 29 x 28 cm^3 glass aquaria contained about 25 l lake water with at least 60% water changed daily. Fish in each experimental unit (glass aquaria) were gradually weaned over a five-day period unto pelleted artificial diet (mixture of wheat bran and fish meal). Feeding was done twice a day at *ad lib* at 09:00–17:00 h for a period of 78 days. Feed was dispensed evenly on the water surface of each glass aquaria to allow equal feeding opportunity. Feeding in all glass aquaria was generally completed in about 10–15 min. A total of six fish samples were collected two from each replicates. The wet weight (g) of the fish and total length (mm) were measured every 2 weeks and preserved with 4% formalin. The following growth parameters were determined:

Growth indices:

a) Relative growth rate (RGR) (Busacker *et al.*, 1990):

$$\% \text{ RGR} = \left[\frac{W_2 - W_1}{W_1 \text{ X } T}\right] \text{ X } 100 \text{ (\%/day)}$$

where W_1 = Initial weight at the start of the studied period (g), W_2 = Final weight at the end of the studied period (g), T = Time of the studied period.

b) Specific growth rate calculations (SGR) (Ahmad *et al.*, 2002):

$$\text{SGR} = \frac{\ln W_2 - \ln W_1}{T \text{ X } 100} \text{ (\%/day)}$$

where W_1 and W_2 are the initial and final weight, respectively, and T is the number of days of the feeding period.

c) Weight gain (WTG) = $W_1 - W_o$

where W_1 = Final mean weight (g), W_o = Initial mean weight (g).

d) Percentage Weight Gain (%)

$$\% = \frac{W_i - W_o}{W_o} \text{X } 100(\%)$$

where W_i = final mean body weight (g), W_o = Initial mean body weight (g).

e) Average Daily Growth (ADG)

$$ADG = \frac{W_i - W_o}{T}$$

where W_i is mean final weight, W_o is mean initial weight and T is rearing period.

Length-weight relationship and condition factor (K)

Parameters of the length-weight relationship of identified fish species were estimated using the equation: $W = aL^b$ (Rickter, 1973), where W = Weight of fish (g); L = Length of fish (cm); a = y-intercept or the initial growth coefficient; b = Slope or the growth coefficient.

Condition factor (K) (Schreck and Moyle, 1990):

$$K = \left(\frac{W}{L^3}\right) X\ 100$$

where W is the wet weight in g, L: is the total length in mm.

Statistical analysis

The data were analysed for significant differences ($P<0.05$) by Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS) for windows (v. 20.0). Determined differences were partitioned by the Least Significant Difference (LSD) at P = 0.05. All percentage data were transformed to arcsine values prior to analysis (Zar, 1984).

RESULTS

Reproductive performance

Artificial breeding of *C. gariepinus* was successfully carried out through the use of pituitary extracts of male and female *C. gariepinus* to induce spawning in broodstocks. Three gravid females of *C. gariepinus* injected with natural hormone (homoplastic hormone-pituitary extract from *Clarias gariepinus*) produced an average egg weighing 77.96 g (62.08–107.8 g eggs) and with mean number of eggs (54,572.00 ± 10,451.20). The spawning fecundity of the three *C. gariepinus* injected with catfish pituitary extract varied from 43,456 to 75,460. The mean fecundity was 54,572. The mean percentage fertilization, hatching rate and survival rate of the eggs were 81.5% ± 2.36, 87.13% ± 0.13 and 87.04% ± 5.98, respectively.

Growth parameters

The mean weight gain was 49.43 g and the mean percentage weight gain was 932.64 g whereas the mean relative growth rate was 170.8%. The mean specific growth rate and the mean average daily growth rates were 8.77% and 9.05% per fish, respectively.

The values of the condition factor "K" were estimated for comparative purposes to assess the impact of environmental alterations on fish performance (Clark and Fraser, 1983). Therefore, the fluctuation in "K" may reflect the health condition of the fish as well as their protein and lipid contents (Weatherley and Gill, 1983). In the present study, the condition factor of *C. gariepinus*, reared in glass aquaria (Table 1) showed non-significant difference in "K" values of fish samples throughout the studied period.

Table 1. Condition factor (k) for artificially reared *Clarias gariepinus* fish, collected from Bahir Dar Fisheries Research Centre glass aquaria during June till October (2012).

Months	**(K) of *Clarias gariepinus***
June	1.35 ± 0.043
July	1.08 ± 0.036
August	0.73 ± 0.77
Sep.	0.70 ± 0.98
Oct.	0.77 ± 1.11

NOTE: Data are represented as means of seven samples ± SE

Length-weight relationship: The growth coefficient factor (b-value) of *C. gariepinus* showed a positive allometric growth (b = 3.49) (Fig. 1).

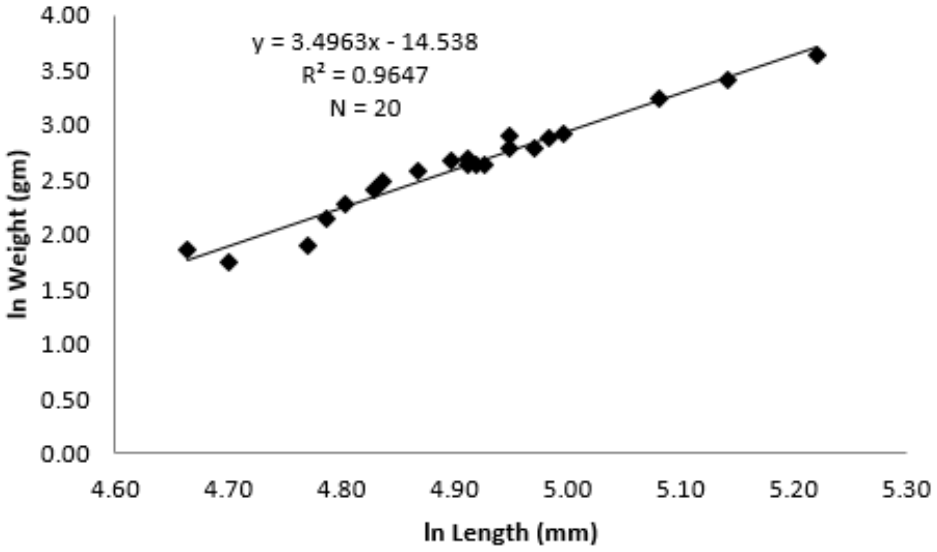

Fig.1. Length-weight relationship of artificially reared *Clarias gariepinus* fish.

DISCUSSION

In this study, spawners injected with natural hormone (homoplastic hormone-pituitary extract from *C. gariepinus*) had significantly higher number of fertilized eggs 43,456 to 75,465. In a similar study using homoplastic hormone to induce breeding in *C. gariepinus*, Sileshi Gadissa and Devi (2013) had fertilized egg output ranging from 49,575 to 96,120. The difference in egg output of Sileshi Gadissa and Devi (2013) when compared to this study even when the same quantity of homoplastic hormone was used may be due to differences in weight of spawners and fertilization techniques (wet over dry fertilization).

Using homoplastic hypophysation of *C. gariepinus* 45.3% hatchability rate was recorded (Sileshi Gadissa and Devi, 2013). The fertility and hatching rate in the present study was higher 81.5 and 87.1%, respectively. This variation might be due to incubation facilities and temperature.

CONCLUSION

This study has shown that *C. gariepinus* can be successfully bred using pituitary of *C. gariepinus*. Fingerlings from *C. gariepinus* induced with pituitary extract of *C. gariepinus* had the best performances in terms of reproductive parameters and growth parameters. Furthermore, it is a simple, low cost technique using glass aquaria at any place, which eliminates problems associated with securing plot of land.

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