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Production of Organic Fingerlings of African catfish (*Clarias gariepinus*)

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ABSTRACT

Organic fingerlings of *C. gariepinus* were produced using pituitary gland of fish to induce ovulation. Fry obtained were then raised to fingerlings using rotifers, a natural live food (Zooplankton) produced from aquaculture waste effluent. Final mean weight and survival of organically produced fingerlings were significantly lower ($P<0.05$) 0.35±0.14 g and 18.3±57.07% compared with those produced inorganically 0.70±0.0 g and 41.3±5.66% respectively. At the end of the first week of feeding it was observed that organically raised fry performed better than those raised on *Artemia.* This trend however changed between the second and third week with fry fed artemia performing better than those fed rotifers. This might be as a result of insufficient natural food for the organically raised fry which eventually led to cannibalism, reduced growth and lower survival. Over 95% of natural food fed to fry was *B. calyciflorus anuraeiformis, B. c. calyciflorus* and *B. c. amphiceros* produced from aquaculture effluent.

Keywords: organic fingerlings, African Cat fish, pituitary gland, ovulation.

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INTRODUCTION

Fish farming is the fastest growing food production sector in the world with an annual growth in excess of 10% over the last two decades (Yong Yang *et al*, 2006). Fish is also one of the most important protein sources in the diets of Nigerians contributing on the average 20-25% per capital animal protein intake and could be as high as 80% in river-rine communities (FAO, 2000). The projected population and fish demand/supply from 1997 to 2025 were estimated by FAO (2000) with domestic fish production by year 2007 as 0.77 million tonnes. Adamu (2007) gave the actual total domestic fish production in 2005 as 579,500 tonnes, while production from aquaculture was 56,300 tonnes in the same year.

However, the annual potential production from aquaculture is estimated at about 2.50 million metric tonnes. This shows that there is a wide gap between the potential and actual production of fish.

Fish farming can contribute significantly to national food security; alleviate malnutrition and poverty through provision of quality protein, income and employment opportunities particularly among the rural communities where opportunities for economic activities are limited. However, significant market access barriers continue to poise serious threat to aquaculture products as a result of environmental concern related to aquaculture production such as food safety, contamination water pollution, and environmental degradation. This has lead to the advocacy for organically produced fish.

Preference for fish species for organic production according to Naturland (2002) should be native species. This is to reduce the risk of escape of fish into open water which can lead to ecological damage. In Nigeria there are several species of fish that have been identified as culturable. However, the most widely cultured species are catfish (Clarias gariepinus, Heterobranchus longifilis, and H. bidorsalis) and tilapia (Oreochromis niloticus and Sarotherodon galilaeus) (Omitoyin, 2007).

One of the major requirements for the success of organic fish farming activities is the availability of fish seed all year round. This however, requires special skills, availability of quality organic broodstock and necessary food to achieve optimum production. Another major issue in organic fish farming is feed. Presently major fish feed used in the aquaculture industry in Nigeria are either made from locally sourced livestock feed ingredients or their initial culture stage (fingerlings to juveniles) depends heavily on imported fish feed from Europe, America and Asia with doubtful organic compliance (Omitoyin and Ipinjolu, 2008). There is therefore, the need to develop natural fish food that can be used to raise the hatchlings of organically produce fish to fingerlings stage.

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The major objective of this study is to produce organic fingerlings of *C. gariepinus* while, the specific objectives are to:

1. Use pituitary gland of fish to induce ovulation in *Clarias gariepinus* broodstock
2. Raise the hatchlings produced to fingerlings stage by feeding them with cultured zooplankton.

MATERIALS AND METHODS

Experimental site

This experiment was conducted using the indoor hatchery facilities and the outdoor nursery tanks in the Department of Wildlife and Fisheries Management fish farm, University of Ibadan.

Experimental Design and set-up

The experiment was a Randomised complete bock design with two treatments and two replicates. In treatment one, broodstocks of *C. gariepinus* were injected with pituitary gland of fish to induce ovulation for collection of eggs before fertilization. In treatment two, *C. gariepinus* broodstocks were injected with ovaprim hormone to induce ovulation for collection of eggs before fertilization. Hatchlings produced from treatment one was then fed with cultured zooplankton (rotifer) while those produced from treatment two were fed with artemia for four weeks to fingerlings stage.

Experimental Procedures

Four pairs of *C. gariepinus* with average weight of 500g each were procured from MOFEBOD farms Moniya, Ibadan, Nigeria where they had been maintained at a low stocking density and fed on mosquito larvae and insects for over one year and transported very early in the morning (7:00 am) to the Department of Wildlife and Fisheries Management fish farm, University of Ibadan, Ibadan, Nigeria. The broodstocks were acclimatised for 24 hours before induction of ovulation in separate holding tanks to avoid bruising themselves.

The female fish were randomly assigned to treatments with two broodstocks per treatment. Fish in treatment one, were injected with pituitary gland extract of *C. gariepinus* of equal size of fish to be injected. The pituitary glands were grinded and mixed with saline solution before injecting the fish at 5.00 pm. Fish in treatment two were injected with ovaprim hormone at 5.02 pm. Fish in each treatment were kept in separate tanks with minimal water until 9.00 am when their eggs were ready for collection and fertilization. One male fish was sacrificed and the two testes removed, milt from each lobe of testis was then used to fertilize egg

collected from each treatment separately in dry bowls. The fertilized eggs from each treatment were then incubated in different incubation trough in the indoor hatchery under the same condition. Hatching of the incubated eggs in both treatments were completed 36hrs after incubation. The un-hatched eggs and shell were removed from the incubation trough by siphoning and fry in each treatment were left in the troughs without feeding for three days to allow them to completely absorb their yokes.

Raising of Hatchlings to Fingerlings

Hatchlings from each treatment were randomly selected and stocked at the rate of 50fry/m^2 in 2.5 x 1.5 x 0.6m outdoor rectangular concrete nursery tanks in replicates. Hatchlings in treatment one (produced from females induced with pituitary gland extract) were fed with the rotifer *Brachionus calyciflorus* produced from pond effluent water. While hatchlings in treatment two (produced from females induced with ovaprim) were fed with *Artemia*. Fry in each treatment were fed three times daily at 8.00 am, 12.00 noon and 4.00 pm for four weeks.

Water quality Management

Water used for raising the fry was from a spring on the farm. The temperature, pH, alkalinity, ammonia, nitrite and dissolved oxygen content of the water were measured using Hatch Water Analysis test kit Model FF1A Cat. No. 2430-02.

Growth Monitoring

The initial and final weight (mg) of fish in each treatment were taken using metler weighing balance while the initial and weekly length changes and final total length of fish (mm) were determined using graduated transparent measuring ruler. Survival rate was calculated by subtracting the number of fish harvested from the number stocked.

Zooplankton Culture and Identification

The natural food used for this study was cultured using aquaculture effluent water stored in a concrete tank for a period of four weeks. Plankton samples were separated by sedimentation after addition of 4% formalin solution (Boyd, 1979; APHA, 1996) to water samples collected with aid plastic containers. Rotifers were identified with aid Jeje and Fernando, (1986) and Jeje (1988).

Data Analysis

Data obtained were subjected to statistical analysis using Student t-test and Analysis of Variance (ANOVA) (Steel *et al*, 1997).

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RESULTS AND DISCUSSION

Final mean weight, survival rate and length changes of organically produced fry raised to fingerlings are presented in tables 1, 2 and figure 1 respectively. There was significant difference ($P<0.05$) between fry raised organically and the control fry fed artemia having higher survival rate of 41.3±5.66% compared to 18.3±57.07% for fry fed with zooplankton.

Similarly, the control fry fed with artemia has a higher final weight gain of 0.70±0.0 g which was significantly different ($P<0.05$) from 0.35±0.14 g for fry raised organically with zooplankton. Results from this study further shows that it is possible to produce organic fingerlings which can be used as breeding stock for organic fish farming. It was observed that there was size variation in organically produced fingerlings which might be as a result of inadequate availability of zooplankton to meet the quantity of food required by the fish. Regular sorting either weekly or biweekly once shooters are noticed and serial culture of zooplankton to ensure availability when needed may be a practical solution to this problem. The use of organically produced diet to argument zooplankton feeding may also reduce cannibalism and ensure higher survival as observed in this study.

Table 1: Mean weight (g) of *Clarias gariepinus* fry raised to fingerlings using Zooplankton and Artemia

Treatments	Mean Weight(g)
Zooplankton	0.35 ± 0.14^{b}
Artemia	0.70 ± 0.0^{a}

Mean with the same superscript along the column are not significantly different from each other ($p>0.05$).

Table 2: Percentage survival of *Clarias gariepinus* raised to fingerlings using Zooplankton and Artemia

Treatments	Mean Survival (%)
Zooplankton	18.3 ± 57.07^{b}
Artemia	41.3 ± 5.66^{a}

Mean with the same superscript along the column are not significantly different From each other ($p>0.05$).

Table 3: Physico-chemical parameters of the water used for raising *Clarias gariepinus* fry

Parameters	Average values ((±SD)
Temperature (°C)	27.5 ±0.10
Hydrogen ion concentration (pH)	7.06 ±0.02
Dissolved oxygen (mg/L)	6.0 ±0.05
Ammonia (mg/L)	0.03 ±0.01
Nitrite (mg/L)	0.02 ±0.01
Alkalinity (mg/L)	85.59 ±0.02

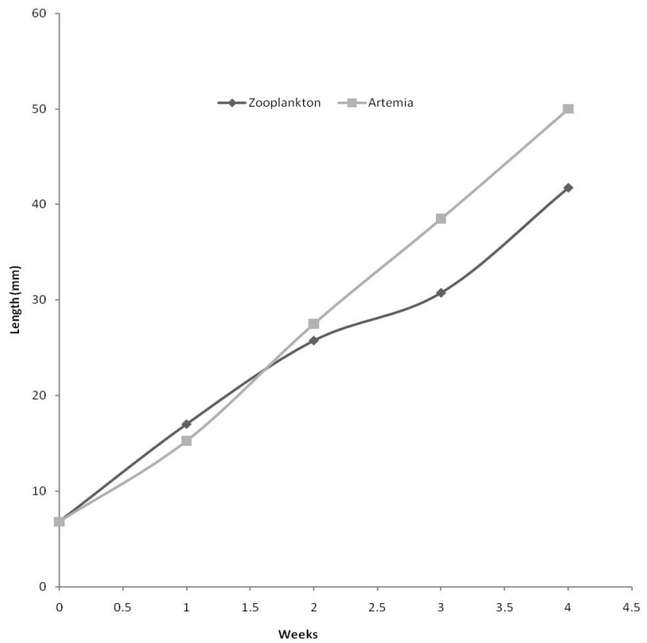

Fig. 1: Length Changes in Fry of *C. gariepinus* fed with Zooplankton and Artemia

Production of organic fingerlings will also need additional facilities for continuous production of zooplankton (rotifers) which the fish depend on as food.

At the end of the first week of feeding it was observed that organically raised fry performed better in terms of length than those raised on *Artemia* (Fig.1). Hogendorn and Vismas (1980) observed that survival and growth of *Clarias gariepinus* fry was much better when fed on natural food either alone or combined with artificial feed. Live food proves to be more acceptable than artificial feed because live food organisms have a triggering effect by their continuous movement allowing an enhanced perception by the feeding fry (Fermin and Bolivar 1996).This trend however, changed between the second and third week with fry fed *Artemia* (control) performing better than those fed rotifer. This might be as a result of insufficient zooplankton to feed the fry hence; there may be the need to combine zooplankton with organically produced feed for fry of *C. gariepinus* to ensure steady growth and higher survival. Fermin and Bolivar (1996) and Omitoyin (2010) also observed that co-feeding of larvae with live and inert improves growth of *Clarias gariepinus* larvae.

To attain the right fingerling size, organically produced fingerlings will have to be raised between 4-6 weeks instead of four weeks used in this study. This study also shows that pure culture of rotifer is achievable with the use of aquaculture effluent. Over 95% of natural food fed the fry were *B. calyciflorus anuraeiformis, B. c. calyciflorus* and *B. c. amphiceros* (Plates 1 and 2). This can significantly reduce cost of production of fingerlings since the artemia used to raised the controlled fingerlings are imported, expensive, not accessible and affordable to rural farmers.

The results of the physico-chemical parameters of the water used to raise the fry are presented in Table 2. The quality of the water was within the optimum range for African catfish as reported by Viveen *et al.*, (1985) and Omitoyin (2007).

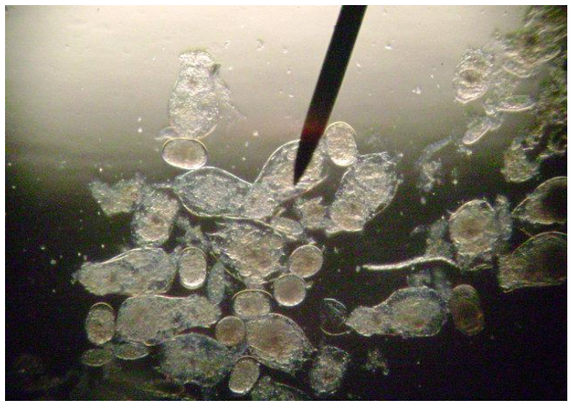

Plate 1: Concentrated cultured rotifer from aquaculture wastewater

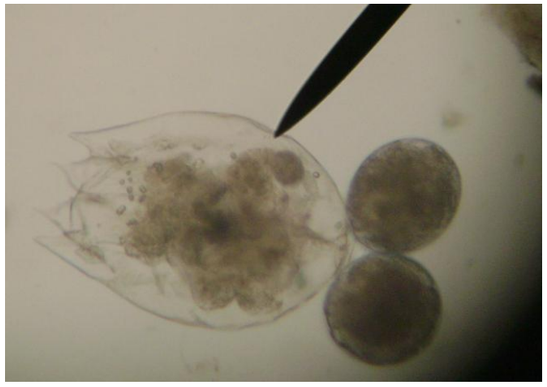

Plate 2: Brachionus calyciflorus from produced from aquaculture wastewater

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