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Production Cost of *Heterobranchus longifilis* (Valenciennes, 1840) Fingerlings in the Ponds Fertilized with Poultry Droppings

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Abstract: This study aims to evaluate the production cost of *Heterobranchus longifilis* larvae reared in fertilized fish ponds. Experiment was carried out in two fish ponds. Each fish pond was filled with 200 liters of water and fertilized with dry poultry droppings (dose: 0.6 $g.L^{-1}$) and zooplankton was inoculated with 83±13 individuals/L. Six days after inoculation of zooplankton, larvae of *H. longifilis* of 2 days after post-hatching were directly introduced into ponds with 300 individuals/m^3. These larvae used exclusively zooplankton during the first 7 days. From the 8th day, larvae were fed with Coppens feed until 30 days. At the end, the survival rates were ranged between 58.33% and 56.67%. Final mean weights were brought up to all the ponds and were not significantly different ($p > 0.05$). The production costs ranged between 2.55 FCFA and 2.60 FCFA per fingerling with ratio production cost/weight gain around 0.80 FCFA/g in each pond. Then, this production system of fingerlings in fertilized ponds is very efficient and could be popularized in the rural fish farms.

Key words: Production cost, fingerlings, *Heterobranchus longifilis*, fertilized ponds.

1. Introduction

Catfish is a fatty fish and is of important to human health [1]. In Republic of Benin, *Oreochromis niloticus* and the catfish represented by *Clarias gariepinus* and *Heterobranchus longifilis* are the most consuming and rearing in aquaculture. Unfortunately, contrary to *O. niloticus*, catfishs aquaculture development is limited by unavailability of their fingerlings. The real problem is their larvae rearing which depended on live feed. It was demonstrated by several studies that *Artemia salina* nauplii were an excellent first live feed for these larvae [2]. However, due to escalation in the cost and unavailability of Artemia in our developing countries especially in the rural fish farming [3], some researches of substitutes which will be easily accessible to lesser cost are done. The outcomes of these studies realized in aquarium [3-5] showed the suitability of local zooplankton like rotifers, cladocerean and nauplii of copepods for survival and growth of the catfish larvae. Unfortunately, fishes rearing in aquarium are minuscule and delicate to be produced in rural fish farm [6]. In this context, the larvae of *H. longifilis* rearing in fertilized ponds are tested. The production in fertilized ponds is favorable and least constraint for mass production. In these ponds, live feed are available for the fish and complete the artificial feed. This work aims to evaluate the cost of *H. longifilis* larvae reared in this system.

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2. Material and Methods

2.1 Source of Heterobranchus Longifilis Larvae

Larvae of the African catfish *H. longifilis* were obtained by artificial reproduction of captive broodstock at the Training and Research in Fish Farming, Unit of Hydrobiology and Aquaculture Laboratory, University of Abomey-Calavi, Republic of Benin. One female (body weight 320 g) was hormonally induced to spawn using Ovaprim (0.5 $mL.kg^{-1}$ body weight). The eggs harvested 10 hours after, were fertilized with laitance of a male (body weights 545 g). Those fertile eggs were incubated in hatcheries with flowing water using the procedure of Viveen et al. [7]. Hatching occurred 27 hours after incubation. After hatching, larvae were separated into the different feeding trials with two replicates.

2.2 Experimental Design

Mass production of freshwater zooplankton: Before stocking larvae for rearing, freshwater zooplankton (rotifers, cladocerans and copepods) were mass-produced in two concrete tanks (measures: 1 m × 1 m × 1 m) with manure fertilization method. Each tank was half-filled using 200 liters of water (clean water (4/5) + fishponds water (1/5) filtrates under plankton net of 50 µm for inoculating phytoplankton) and adding chicken droppings (dose = 0.6 $g.L^{-1}$ attached in sack) [8]. Two days after fertilization, zooplankton was inoculated in each tank with 83 ± 15 $individus.L^{-1}$. The water level in tank was follow-up and completed if necessary for keeping the initial level of water.

Stocking of larvae: Larvae were stocked in the tank six days after inoculating of zooplankton to assure a mass production of the live feed. For that, two days after hatching matching with sixth days of zooplankton production, larvae of *H. longifilis* (2 days old) were counted and introduced directly in the tank. The stocking density of the larvae in each tank was 300 $individuals/m^3$ [6]. 200 larvae were sampled and the individual weight was measured; then the average weight of each larva was 2.8 ± 0.1 mg.

During seven days, these larvae were exclusively nourished with freshwater zooplankton *ad libitum* in the tank. Then, after 9 days age, live feed were completed with artificial feed Coppens that components are presented in Table 1. Fish were fed twice daily, morning and evening and water quality monitored. The experimentation lasted 28 days after corresponding to 30 days age. Fish were fed 10% of their body weight daily between 9 to 16 days age, 9% of their body weight daily between 16 to 23 days age and 8% of their body weight daily between 23 to 30 days age [9].

Fingerlings production cost determination: production cost was accessed basing on fixed and variable costs. Fixed costs included tanks and female brooders depreciations. On overhand, variable costs were constituted by brooders and induced hormone ovaprim for larvae getting, poultry dropping for zooplankton production and Coppens for larvae feeding, Cost of used water and labor Cost.

Larvae cost = (female brooders depreciation + Cost of brooders + Cost of Ovaprim quantity used + labor Cost)/number of larvae obtained (1)

Rearing cost = (tanks depreciations + Cost of poultry dropping + Cost of coppens quantity used + Cost of water used)/number of fingerlings obtained (2)

Table 1 Biochemical composition of Coppens.

Composition	Quantity
Crude protein (%)	45
Crude fat (%)	10.4
Crude fibres (%)	1.3
Ash (%)	7.3
Cadnium (%)	0.7
Phosphorus (%)	1.3
Vitamin E (mg/kg)	200
Vitamin C (mg/kg)	300
Size (µm)	200-300

Coppens International (2005).

2.3 Statistical Analysis

The data collected were subjected to statistical analysis using Analysis of Variance (ANOVA). The level for statistical significance was set at 5%. All statistical analyses were performed using Statview software (Version 1992-1998, SAS Institute Inc).

3. Results

3.1 Larvae Obtained

Hatching occurred 27 h after incubation and 6,000 larvae are obtained. Production cost of these larvae is presented in Table 2. One larvae costed 0.69 FCFA (656 FCFA ≈ 1 €).

3.2 Growth Performances of Larvae

Table 3 presents the zootechnical performances of larvae reared for 28 days. The values of parameters were not significantly different. The lowest survival rate was 56.67% observed with larvae in lot 2. Whereas the least value of final weight was obtained with the larvae in lot 1. The specific grow rate ranged between 25.11%/day and 25.17%/day. The nutrient quotient values appeared similar.

The costs of fingerlings produced for 28 days were shown in Table 4. It's concerned the cost of tank fertilization with poultry droppings which were 0.42 FCFA, the feed consumed cost ranged between 30 and 31.1 FCFA, the tank depreciation (value 0.5 FCFA) and the labor costs (value 0.08 FCFA). Then, the costs of larvae rearing during the 28 days were 1.86 FCFA to 1.91 FCFA per individual.

3.3 Ratio Production Cost/Weight Gain

Fig. 1 presents the weight gain, total cost of fingerlings production and the ratio production cost/weight gain.

Table 2 Production cost of *H. longifilis* larvae.

Ingredients/inputs	Cost of inputs	Quantity used	Cost per larvae obtained (FCFA)
Ovaprim (10 mL)	50,000	0.225	0.19
Brooders (male and female) (2)	3,000	2	0.50
Total	-	-	0.69

Number of larvae obtained: 6,000 individuals.

Table 3 Growth performances of *H. longifilis* larvae.

Parameters	Lot 1	Lot 2
Initial weight (mg)	2.8 ± 0.1	2.8 ± 0.1
Final weight (mg)	$3,190.63 \pm 13^{a}$	$3,266.15 \pm 10^{a}$
Survival (%)	58.33	56.67
SGR (%/day)	25.11^{a}	25.17^{a}
Feed distributed (g)	24.0	24.9
Nutrient quotient	0.28	0.27

Table 4 Cost of fingerlings produced.

Parameters	Lot 1	Lot 2
Fertilized cost (poultry droppings) (FCFA)	0.42	0.42
Cost of 1 kg of feed (FCFA)	1200	1200
Feed distributed (g)	24.0	24.9
Cost of feed consumed (FCFA)	30.0	31.1
Cost of feed consumed per individual (FCFA)	0.86	0.91
Fixed costs (depreciation of tanks)[1]	0.5	0.5
Labor costs[2] per individual	0.08	0.08
Total cost per individual (FCFA)	1.86	1.91

[1]Price of tanks confection are 50,000 FCFA. Used live of tank: 10 years. Mean production per year: 10,000 fingerlings.

[2] Labor costs: 1,000 FCFA per day. Duration of work: 15 minutes per day.

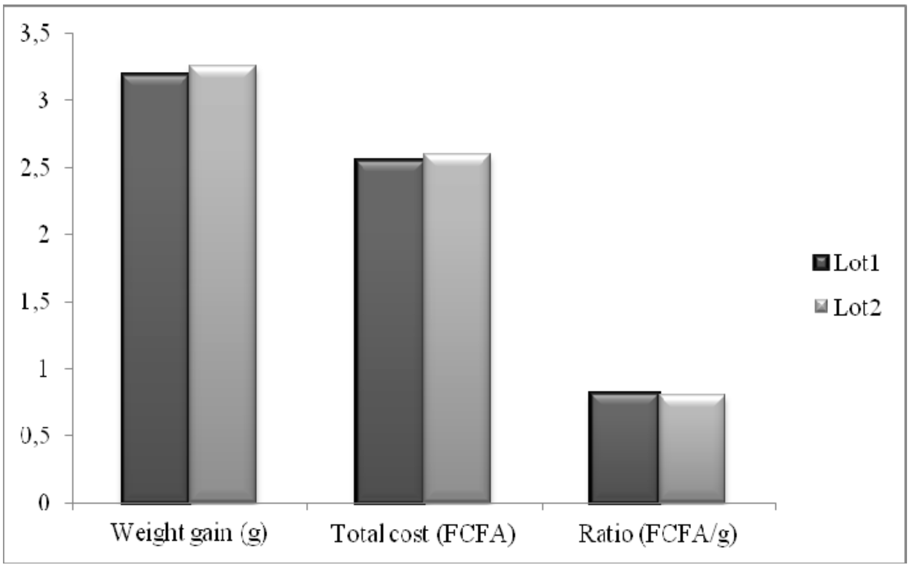

Fig. 1 Weight gain, production cost and ratio cost/weight gain of fingerlings.

The weight gains were 3.19 g and 3.26 g respectively in lot 1 and lot 2. The total cost of production is the sum of larvae obtained cost and larvae rearing cost. These costs were 2.55 FCFA and 2.60 FCFA for fingerlings obtained respectively in lot 1 and lot 2. The ratios were approximately the same in each lot.

4. Discussion

At the end of this study, the survival rates of the *H. longifilis* larvae were 56.67% and 58.33%. These values are relatively low comparatively with 73.0% obtained by Coulibaly et al. [10] who reared the fingerlings of *H. longifilis* (mean weight: 0.8 ± 0.1 g) in the gushed cages in Ayémé barrage at Ivory Cost with the density of 100 individuals/m^3 during 90 days. This difference could be due to the stocking density applied by these authors on one hand and the initial mean weight of these larvae on the other hand. Also, the small survival rate registered in this study was the result of cannibalism [11, 12] exercise by jumpers fishing 16th days, evidence making by their abundance. In fact, with certain species of catfish like *Clarias gariepinus*, the mortality due to it behavior is linked to the size difference in the population [13, 14]. Generally, the risk of cannibalism is important as the size variability is high [15]. In the present study, the size variability is estimated by weight deviation coefficient. Then, the weight deviation coefficients obtained are low (Deviation coefficient of lot 1: 23.56 ± 0.17%; Deviation coefficient of lot 2: 20.72 ± 0.22%) and not be significantly different ($p > 0.05$). During the 28 days of rearing, the larvae mean weight increase considerably and go from 2.8 ± 0.1 to 3,190.63 ± 13 mg in lot 1 and 3,266.15 ± 10 mg in lot 2. These values of final mean weight of fingerlings in the lots are not significantly different ($p > 0.05$). The specific rates of the fingerlings of *H. longifilis* obtained in present conditions are much higher than 14.29 ± 0.22 and 17.2 ± 0.5 obtained by Agadjihouèdé et al. [3] with same species reared in aquariums and nourish respectively with zooplankton and nauplii of *Artemia salina* during 10 day. The mean reason of this difference is the small size of aquarium which is not favorable to mass production.

A lesser amount of cost of larvae (0.69 FCFA per larvae) results to the fecundity of this species. In fact, *H. longifilis* like some catfishes is highly prolific. Its fruitfulness reaches often 28,000 eggs/kg [12]. Then, one reproduction could provide 10,000-20,000 larvae per kilogram. In this study, 6,000 larvae were obtained after reproduction. The total cost of fingerlings production are also less comparing with 5.97 FCFA per fingerlings of 3 mg mean weight obtained by Hounsou [16] with *Clarias gariepinus* reared in aquarium with live food such as larvae of same species, *Rotifers* and artificial feed. The fundamental reason of this difference is the dearness of *Artemia* in developing countries. In Benin, *Artemia* are imported from Nigeria Republic or from developed countries like Belgium and, then are expensive (70,000 FCFA/kg). This escalation of the cost of *Artemia* in our developing countries especially in the rural fish farm [3] lift the fish production cost. In the present study, the feed costs of one larva were 0.86 FCFA and 0.91 FCFA for respectively total costs 2.55 FCFA and 2.60 FCFA. They represent 33.7%-35% of production cost and confirm the effectiveness of fertilization system on catfish larvae production [6]. In this production system, the zooplankton bodies produce themselves massively and are available to the larvae every times. Indeed, these zooplankton bodies constitute a natural feed of catfish larvae which is adapted at this early stage [17, 18]. Generally, the feed cost represents 50%-60% of production cost in the system based on artificial feed [19]. The ratio production cost/weight gain value (around 0.80 FCFA/g) nether to 1 FCFA/g demonstrates that the production system experimented in this study is very efficient.

5. Conclusion

The present study showed that the *H. longifilis* larvae reared in the ponds fertilized with poultry dropping grow quickly and the production costs are lower. Then this system could improve the profitability of fingerlings production especially in our rural fish farm.

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