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Advances in Applied Science Research, 2016, 7(2):10-15

Advances in Applied Science Research
Pelagia Research Library

ISSN: 0976-8610
CODEN (USA): AASRFC

Some growth parameters, condition factor and survival rate of *Heterobranchus bidorsalis* fry fed on live food Zooplankton treatments for 16 days

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ABSTRACT

Some growth parameters, condition factor and survival rate of Heterobranchus. bidorsalis fry fed on live food zooplankton treatments for 16 days was investigated. Individual fry (50) of 3 old days were placed in a 10-litre plastic bowls in five treatments of 3 replicates for 16 days. Initial average length (cm) and weight (g) of the fry were recorded. The water in the plastic bowls was aerated continuously and ⅓ of the water was changed with freshwater daily. The following feeds were fed as treatments to the fry to satiation in bowls: Artemia shell free, live Brachionus calyciflorus, Daphnia pulex, M. micrura, and live M. micrura & Brachionus calyciflorus. Temperature, pH, dissolved oxygen, total alkalinity and free carbon dioxide of source of water monitored in each of water quality parameter of the various treatments was not significantly different from each other. Results show that all the treatments favour percentage weigh gain, total body length, percentage survival rate and condition factor of H. bidorsalis fry. However, the result of treatment 'B. calyciflorus & M. micrura mixture' was significantly ($p< 0.05$) the highest in percentage weigh gain, percentage survival rate and condition factor. The total body length of H. bidorsalis fry fed on M. micrura and those fed on B. calyciflorus treatment groups were significantly longer in length than other treatment groups. Mixture of M. micrura & Brachionus calyciflorus live for Heterobranchus. bidorsalis fry is highly recommended.

Key words: *Brachionus calyciflorus*, *Daphnia pulex*, *Moina. micrura*, fry

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INTRODUCTION

Normally, cat fish fry survive and grows in the wild where its preys are readily available but in the hatcheries, where most of the activities are artificial, the survival of fry depends on availability of right food [1]. Fry requires high protein food of 42.0% and 52% for omnivorous and carnivorous fish respectively [2]. *Heterobranchus* species *(H. bidorsalis)* is freshwater cultivable catfish with good taste, colour, size and growth rate [1]. They have high disease resistance and the adults readily accept formulated feeds but the fry accept mainly live food. Presently, most hatcheries dwell on production of fry of *Clarias* species instead of *Heterobranchus* species due to higher mortality rates of the fry [3]. It had been identified that inadequate feeding is the highest single source of mortality of fry and that food must be adequate not only in quality and quantity but also in right size for the fry [1]. Therefore, there is need to investigate the effect of live food freshwater zooplankton on growth rate, condition factor and survival rate of the hatchlings of *Heterobranchus* fry for sustainable production of *Heterobranchus* fish fry for its fingerlings demand. The research into freshwater live food zooplankton to enhance production of *Heterobranchus* fry in our local hatcheries seems inevitable in the drive for food sustainability in human race.

MATERIALS AND METHODS

2.1 Determination of Water quality Parameters used in Laboratory

The water quality parameters were examined using APHA/AWWA/WPCF methods [4]. The temperature of the water used for various treatments was measured using a mercury centigrade dry bulb thermometer. The readings were taken in few centimeters below the surface of the water. The mean of three readings were taken for each group. The pH of water for each treatment was measured using a pH meter model 901. Three readings were taken in each case and their means was recorded. The free dissolved carbon dioxide in water was measured using phenolphthalein method. About 100 ml of water was taken from 25 cm below the water surface into a conical flask and 10 drops of phenolphthalein indicator was added. The sample was then titrated till the color change was observed using N/44 NaOH. The free Carbon-dioxide (ml/L) was recorded as ten times the amount (ml) of N/44 NaOH used for the titration. The Alsterbeg (Azide) method was employed to determine dissolved oxygen. The water samples were collected using 250 ml stopper bottle at 25cm below the water surface. The bottles were corked inside the water to avoid any trapping of air. The water samples were then fixed by adding 2 ml of Manganese Sulphates and 2 ml of Alkaline-iodide (Sodium Azide). The water was restoppered and a careful shaking was done for proper mixing. The samples were allowed to settle for few minutes and then 2 ml of concentrated Sulphuric acid was added. Careful mixing was done by shaking until a solution is formed. About 200 ml of the formed solution was transferred into a conical flask and titrated to pale yellow using 0.025N Sodium Thiosulphate. When 1 ml of 1% starch solution was added, the solution turned blue immediately. Titration was carried out until the blue color first disappears. The volume of the 0.025N Sodium Thiosulphate used in the titration was recorded as the amount of oxygen in the water sample (mgL-1). A sample of water of 100 ml was taken into a conical flask from below the water. About 4 drops of Phenolphthalein indicator was added. The water sample was clear. Two drops of methyl orange indicator were added and titration was carried out until the greenish yellow color turned pink-orange. Ten times the volume (ml) of the 0.02N Sulphuric acid for titration was recorded as the alkalinity of the water (mgL-1) of CaCo3.

2.2 Treatments Layout

Individual fry (50) of 3 old days were placed in a 10-litre plastic bowls in five treatments of 3 replicates for 16 days. Initial average length (cm) and weight (g) of the fry was recorded.

The water in the plastic bowls was aerated continuously and ⅓ of the water was changed with freshwater daily. The following feeds were fed as treatments to the fry to satiation in bowls: *Artemia* shell free, live *Brachionus calyciflorus, Daphnia pulex, M. micrura, and* live *M. micrura & Brachionus calyciflorus.*

2.3 Formulae for determination of Measured Parameters

Percentage weight gain, total body length, the condition factor and percentage survival rate were obtained using the below formulae.

(a) Percentage weight gain of *Heterobranchus bidorsalis* fry within the period of the experiment was calculated according to [5]; [6].

Percentage weight gain (PWG) $=\{ (W_2-W_1) / W_1 \} \times 100$

Where W_2 = final mean body weight and W_1 = initial mean body weight

(b) Increase in Total body length of *Heterobranchus bidorsalis* fry fed from various treatments was measured in millimeter. The fry was placed with water into transparent glass dish to determine the total length with help measuring tape [7]. Increase in total body length in cm = final length – initial length at the start of the experiment

(c) The condition factor of *Heterobranchus bidorsalis* fry was calculated according to [8].

Condition factor (CF) $K = 100w/L^{3.}$ Where w = weight of fish in (g), L = length of fish in (cm)

(d) The percentage of survival of *Heterobranchus bidorsalis* fry within the duration of the experiment was calculated with the formula below [5]; [9].

Percentage survival rate = $\frac{\text{No. of fry that survived}}{\text{Total No. of fry that start the treatment in each bowl}}$ x 100

2.4 Statistical Analysis

The data obtained in this study were analyzed using descriptive statistics, general statistic of variance (Genstat discovery edition 3) statistical package. Statistical difference between various means was tested at 95% confidence level using Duncan Multiple Range Test.

RESULTS

3.1 Water Quality Parameter of Source for Treatments

Results of water quality parameters of the source water for culturing of the fish fry in each treatment for 16 days are shown in table 1. The results of temperature were not significantly different from each other in the all the treatments and the temperature range from 27.43 to 27.44^{O}C. The results of pH of the water (7.45 - 7.47), total alkalinity (15.21mg/L), dissolved oxygen(8.20 - 8.22 mg/L) and Carbon dioxide (4.20 mg/L) were not significantly different from each treatment group.

Table 1: Water Quality Parameters of the Source Water for Culturing of Fish Fry in each Treatment for 16 Days

Parameter	*Zooplankton*				
	M. micrura	*B. calyciflorus &M. micrura*	*B. calyciflorus*	Artemia shell free	*D. pulex*
Temperature (^{o}C)	27.43±0.04	27.43±0.06	27.44±0.02	27.43±0.05	27.43±0.06
pH	7.45±0.02	7.46±0.03	7.47±0.03	7.46±0.03	7.47±0.03
Total alkalinity (mg/L)	15.21±0.03	15.21±0.01	15.21±0.02	15.21±0.03	15.21±0.01
Dissolved oxygen(mg/L)	8.20±0.03	8.21±0.03	8.20±0.03	8.20±0.01	8.22±0.03
Carbon dioxide (mg/L)	4.20±0.01	4.20±0.03	4.20±0.02	4.20±0.03	4.20±0.03

Table 2: Percentage Weigh Gain of *Heterobranchus bidorsalis* Fry Fed on Zooplankton Treatments for 16 Days

Parameters	**Zooplankton**				
	M. micrura	*B. calyciflorus & M. micrura*	*B. calyciflorus*	Shell free *Artemia*	*Daphnia pulex*
Final weight (g)	0.11±0.001	0.14 ±0.002	0.12± 0 .001	0.10± 0.001	0.11±0.003
Initial (g)	0.01	0.01	0.01	0.01	0.01
Weight gain(g)	0.10±0.001	0.13± 0.002	0.11±0.001	0.09±0.001	0.10±0.003
% Weight gain	1010±5.77	1250±15.28	1130±5.77	877±3.33	967±33.33

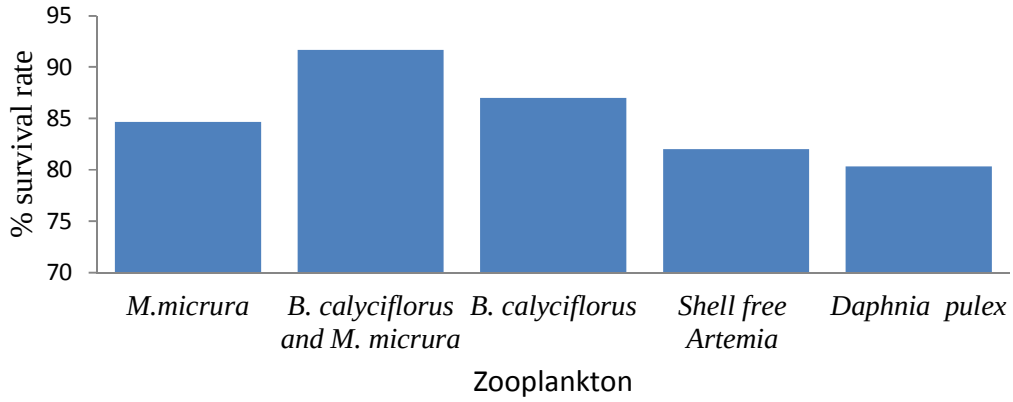

Figure 1: Percentage (%) Survival Rate of *Heterobranchus bidorsalis* Fry Fed on Zooplankton Treatments for 16 Days

Table 2 shows the results of percentage weigh gain of *H. bidorsalis* fry fed on zooplankton treatments for 16 days. Results show that all the treatments favour percentage weigh gain of *H. bidorsalis* fry. However, the treatment of *B. calyciflorus* & *M. micrura* mixture was significantly ($p < 0.05$) the highest followed by *B. calyciflorus*. The least in the percentage weigh gain was found in shell free artemia treatment group. *D. pulex*, *M. micrura*, *B. calyciflorus* & *M. micrura*; and *B. calyciflorus* treatment groups favour high percentage weigh gain of *H. bidorsalis fry* although the percentage weigh gain were significantly different from each other.

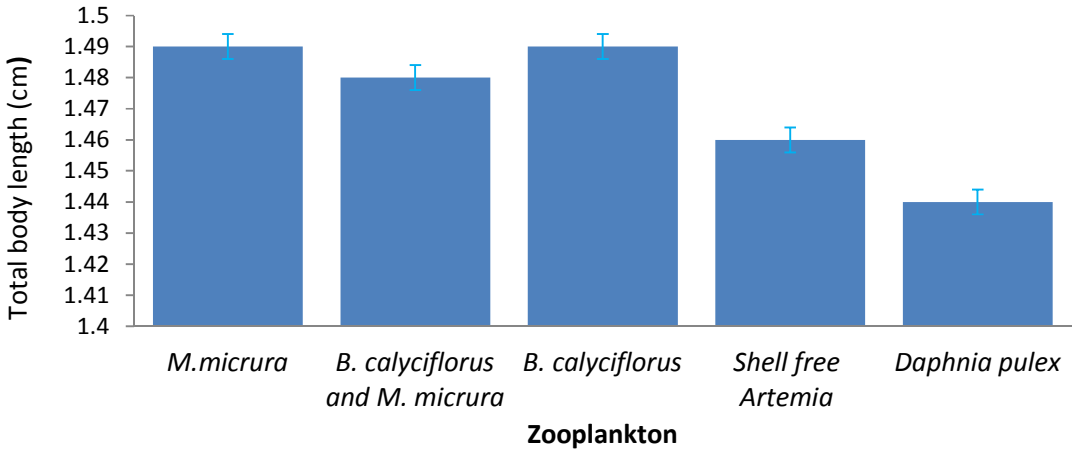

Figure 2: Total Body Length of *Heterobranchus bidorsalis* Fry Fed on Zooplankton Treatments for 16 Days

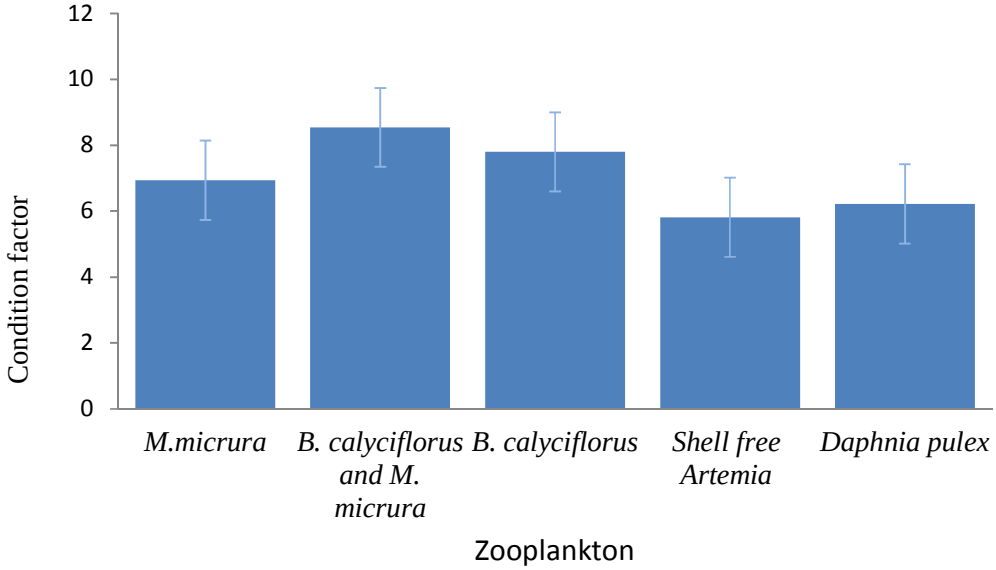

Figure 3: Condition Factor of *Heterobranchus bidorsalis* Fry Fed on Zooplankton Treatments for 16 Days

The results of survival rate of *H. biorsalis* fry in this experiment are shown in figure 1. The highest percentage survival rate of *H. bidorsalis* fry was recorded in *B. calyciflorus* & *M. micrura* treatment and it was significantly higher ($p < 0.05$) than the results from other treatment groups. *D. pulex* maintained the lowest percentage survival rate of *H. bidorsalis* fry. The recorded results of increase in total body length of *H. bidorsalis* are shown in figure 2. The increase in total body length of *H. bidorsalis* fry fed on *M. micrura* and those of *B. calyciflorus* were significantly longer in length than other treatment groups. The least result on increase in total body length was recorded in *Daphnia pulex* treatment group. However, *M. micrura* and *B. calyciflorus* treatment groups increased the fry total body length significantly more than other groups within the 16 days of the experiments.

Results of condition factor of the *H. bidorsalis* fry treated with zooplankton are shown in figure 3 and all the treatments favoured the fry good condition factor. *B. calyciflorus & M. micrura* treatment group recorded the highest condition factor and it is significantly different ($p < 0.05$) from the results of other treatment groups in the experiment. In the case of the condition factors recorded in artemia shell free treatment group, although the condition factor was high but it was still the lowest in all treatment groups.

DISCUSSION

The feeding of fry with any of the selected zooplankton cultured in the experiment positively increase percentage weigh gain of the fry which shows that they are good for live food for the fry. The feeding of fry with any of the zooplankton culture in the experiment positively increase percentage weigh gain of the fry. The *B. calyciflorus* and a mixture of *B. calyciflorus* & *M. micrura* significantly increase weigh gain more than others treatment groups because of the size, slow swimming rate and nutrient availability in the freshwater zooplankton as live feed without significantly increasing water pollution as compared to uneaten supplied artemia shell free in fry tank. Rotifers are one of the smallest metazoans, which served as perfect material for evolution theories and excellent food resources to larva in aquaculture [10]; [11]. The adult of *daphnia* is suspected to be too large and the movement too fast for fry to easily prey on and the stress of catching the prey affected the percentage weighs gain of the fry.

The result of good specific growth rate observed in this investigation was also influenced by the size and slow swimming rate and nutrient availability in the *B. calyciflorus* and *M. micrura*. The live feed zooplankton organisms which were not too large for the mouth part of the fry were caught and easily utilized as they were easily digested by the fry. *B. calyciflorus* as live food for fish was used as ideal starter feed for dwarf gourami *Colisa lalia*, a tropical freshwater ornamental fish species with larvae that are too small to ingest *Artemia* nauplii or *Moina* at its first feeding [12]. Rotifer as starter diet significantly improves the growth and survival of gourami 2-12 days larvae [12].

The increase in total body length of the fry was also improved by the live food organisms and the results proved that *B. calyciflorus* and *M. micrura which* were easier for the fry to prey on were the highest in the treatment groups. This result can be linked to [13]; [14] which showed that *M. micrura* had well distributed amino acid profile. The influence of the increase in total body length of the organisms is linked to the live food utilization for growth of the fry. A similar result was reported on the effect of live food (*Moina micrura*) on total body length of *Clarias gariepinus* [15]. Artemia shell free and *Daphnia pulex* treatment groups were low in increase in total body length probably because size and difficulty in catching of prey which lead to inadequate food supply to the fry [1].

Water quality parameters were within acceptable level and did not significantly influence any changes in treatment groups. With water quality parameter on acceptable level, food influences percentage survival rate of the fry. Easy catch, nutrient content and easy digestibility of the food organisms help to increase the survival rate of the fish fry. *B. calyciflorus* & *M. micrura* treatment group was significantly the best in percentage survival rate because it meets the nutrient requirement, food size and slow swimming rate increase the chance for fry easy catch and as live food they are easily digestible [10].

Condition factor which shows the well being of the fry in a given treatment is positive in all the result but *B. calyciflorus* & *M. micrura* treatment group favoured the rearing of the fry more than other treatment groups in the experiment. *M. micrura* may be considered promising species for feeding fish larvae in large-scale production as they have short life-span, small size, quick embryonic development, and abundant energy store [16]. *Daphnia pulex* treatment group condition factor was low because of the size and the fast swimming ability of the live food organism.

CONCLUSION

A mixture of *B. calyciflorus* & *M. micrura* significantly increase percentage weigh gain, survival rate, incrase in total body length and condition factor of the fry more than others treatment groups. All live food zooplankton improve growth, survival and condition factor of fry but the mixture of *calyciflorus* & *M. micrura* in ratio 1:1 in hatchery enhanced the listed factors more than when they are used in monospecific state for feeding fry. A mixture of *B. calyciflorus* & *M. micrura* in ratio 1:1 is highly recommended to hatchery operators for rearing of *H. bidorsalis* fry.

Acknowledgement
The authors appreciate Department of Forestry, Wildlife and Fisheries, Faculty of Agriculture, Nasarawa State University Keffi, for providing the hatchery for the study.

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