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Comparative Effect of Fairy Shrimp and Artemia in the Rearing of Blue Gourami, *Trichogaster trichopterus*, Larvae

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Authors' contributions

This work was carried out in collaboration between all authors. Author RD designed and wrote the first draft of the manuscript. Author DS performed and managed the literature searches. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

A feeding experiment was conducted on larvae of blue gourami, *Trichogaster trichopterus* to evaluate the effect of two different live feed on growth and survival rate of the fish. Larval were fed thrice a day with Asian star feed powder and twice a day (morning and evening) with either Artemia or fairy shrimp nauplii as a supplementary feed for 45 days. Tests were run in triplicate and initial and final weights were recorded for all the treatments. Results indicated that the length and weight of fish fed with fairy shrimp nauplii was significantly (P<0.01) higher than those fed with Artemia nauplii. No significant differences (P>0.05) in specific growth rate was found between the two experimental diets. The mean of condition factor also showed higher CF value for fish fed with fairy shrimp. The survival of the fish was not affected by the dietary treatments.

Keywords: Blue gourami; Trichogaster trichopterus; fairy shrimp; ornamental fish culture; Artemia.

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1. INTRODUCTION

In aquaculture, production of fish to market size within a short period is of highest importance [1]. But, the success in the hatchery production of fish fingerlings for stocking in the grow-out production system is largely dependent on the availability of suitable live food organisms for feeding fish larvae, fry and fingerlings. Live feeds also help restore the water quality of the culture system and are more easily accepted by cultured organisms [2]. Dry feed formulations have been tried as substitutes for live food for edible and ornamental fishes [3,4,5]. Common food source for ornamental species are live organisms such as Artemia and Daphnia [6].

The industrial development of freshwater ornamental fish culture has been hampered by the lack of suitable live feeds for feeding the fish at the various production stages [7]. Many freshwater ornamental fish farmers have shifted from Moina to the cleaner Artemia nauplii for feeding their young fish. Due to their convenience as an off-the-shelf feed and requiring only 24 h of incubation from cysts, Artemia nauplii are the most widely used live food organism for the fry production of marine as well as freshwater fish and crustaceans [8]. But major drawback in feeding Artemia nauplii to freshwater fish is that the nauplii die after 30–60 min in freshwater, and must therefore be fed to the fish intermittently every 2–3 h [9]. Furthermore, the high price of Artemia cysts has increased the fish cost, and cheaper alternative diets with comparable nutritional quality are needed to maintain the cost competitiveness of ornamental fish in the global market [7].

Fairy shrimps are freshwater relatives of brine shrimps, which its nauplii closely resemble brine shrimp nauplii and are similar in size and inhabit temporary ponds that lack fish because they are eaten by fish in natural waters [10]. Fairy shrimp have the potential to be used as a feed item for fish such as ornamental fishes that benefit from live food [11] and their cysts and nauplii may be useful in larval culture. In recent years, fairy shrimps and their nauplii have been used as live food for freshwater fish and as test organisms in ecotoxicological tests [12].

This study was focused on the use of fairy shrimp as live food for blue gourami, *Trichogaster trichopterus,* an air breathing fish form an economically important group of ornamental fishes to document the growth performance of this fishes fed with fairy shrimp nauplii as compare to Artemia nauplii.

2. MATERIALS AND METHODS

2.1 Experimental Culture System

Purchased brooders of *Trichogaster trichopterus* were brought to the ornamental fish laboratory and kept under control conditions for two weeks. After the acclimatization, the male was introduced to a small aquarium to build nest and female were introduced to the male shortly after the nest was built. After mating, female was removed and male was kept in the aquarium for the protection of the eggs. Larvae were hatched within 48 h and were kept with the parent till they used the yolk and obtain free swimming. Since the free swimming larvae were too small they were fed with previously prepared green water in the laboratory for two weeks. Larvae were reared in indoor rectangular rearing tanks of 40 x 40 x 40 cm (L:W:H). Tanks were supplied with freshwater without aeration. Temperature and hardness ranged from 28 to 30ºC and 110 ppm, respectively.

2.2 Experimental Design

Larvae of blue gourami, *Trichogaster trichopterus*, produced from the ornamental fish hatchery site of the Persian Gulf University, Iran, were used for the experiment. Since larvae were fed with green water, there was no size variation among them. However, larvae were graded to a uniform size, with a mean total weight and length of 0.0013 g and 0.5 mm, respectively. Sixty larvae were distributed between two treatment and three replicates. Asian star feed were powdered and same amount were fed to all the larvae three times a day. Artemia and fairy shrimp nauplii cysts were obtained from market and hatched under laboratory conditions. Larvae were also provided with freshly hatched Artemia (*Artemia urmiana*) for the first treatment (T1) and fairy shrimp nauplii (*Branchinella thailandensis*) for the second treatment (T2) twice a day. Introduction of nauplii was done after morning and evening feed siphoning so there was around 12 h time for fishes to feed on the nauplii. All the survived fishes per each tank were measured for their total weight and length after 45 days. Mean growth rates (GR) specific growth rate (SGR) and condition factor (CF) were calculated from average increments in size and weight according to the following formula:

GR = (Final weight - Initial weight)/Initial weight

$$SGR = 100 \times \frac{(\ln W2 - \ln W1)}{T}$$

Where;
W1 = initial weights of the larvae
W2 = final weights of the larvae
T = the time in days

$$CF = 100 \times \frac{W}{L_T^{-3}}$$

Where;
W= weight of the fish
L_T = total length.
The number of dead individuals in each treatment was recorded and average survival rate was calculated.
Survival rate = No- Nt / No*100;

Where;
No = initial total number of larvae
Nt = total number of larvae at the end of 45 days of experiment.
All statistical analyses were performed using the SPSS System. Differences in GR, SGR, CF and survival of all treatments were determined through a one-way analysis of variance (ANOVA) and Duncan test to determine significant differences among treatment means.

3. RESULTS AND DISCUSSION

At the end of experiment, the mean values for wet body weight in T1 and T2 were 0.083±0.004 and 0.104±0.005 g, and for total length were 1.04±0.06 and 0.98±0.06 cm, respectively. The studied parameters were growth rate, specific growth rate and condition factor of the fishes. Analysis of variance on growth parameters of fish explains that there is a highly significant differences between the treatments in term of GR (*P*=0/002<0/01) and CF (*P*=0/016<0/05). However, there was statistically no significant difference in the SGR of the two treatments (*P*=0.983<0.01) (Table 1). The data presented in Table 2 shows comparison

of means for the said parameters which well shows the difference between GR and CF of the two treatments.

Table 1. One way ANOVA performance of growth parameters for Blue gourami (*T. trichopterus*) larvae fed on Artemia and fairy shrimp

	Source	Sum square	df	Mean square	f	Sig.
GR	Between group	5435.074	1	5435.074	10.786	0.002
	within group	24187.478	48	503.906		
	Total	29622.552	49			
SGR	Between group	0.001	1	0.001	0.001	0.983
	within group	18.155	48	0.378		
	Total	18.155	49			
CF	Between group	269.352	1	269.352	6.271	0.016
	within group	2061.605	48	42.950		
	Total	2330.957	49			

Table 2. Descriptive statistics for GR, SGR & CF of *T. trichopterus* fed with Artemia and fairy shrimp

	Artemia		Fairy shrimp	
	Mean	**± SD**	**Mean**	**± SD**
GR	82.11	18.594	102.96	25.731
SGR	28.50	0.615	28.51	0.615
CF	9.97	5.474	14.62	7.479

Over the period of experiment, survival exceeded 83.3% for all treatments and did not appear to be affected by live feeds diet. With respect to the calculated chi-square which is smaller than critical chi-square in 0.05 alpha level and degree of freedom it can be concluded that there is no significant difference between the fish survival and treatments (X^2=0.0<3.84, df=1, *P*=1>0.05).

The present investigation assessed the nutritive efficiency of fairy shrimp nauplii, *B. thailandensis* as a potential candidate for replacing Artemia in ornamental fish culture. Based on the present data, it is demonstrated that larvae fed on the fairy shrimp nauplii produced good results in growth (weight gain and length increment), which are higher to those fed with the Artemia nauplii. Having 40% protein content, the brine shrimp is considered as an important criterion as live feed [13]. Adult fairy shrimp (*B. thailandensis*) also has high protein (64.65%), lipid (7.57%), carbohydrates (16.24%) content and has all essential amino and fatty acids [14]. Similar finding was reported when adult fairy shrimp, *S. dichotomus*, and Artemia were fed to *C. auratus* and the biochemical analyses of the whole tissue of the fish fed with fairy shrimps showed efficient utilization as observed in the gain weight of fish [15]. Improved growth and condition factor with increasing dietary protein levels are well documented with other species [16,17,11]. Although fish fed on live feed showed a higher weight gain as compared with fish fed with other types of feeds, but there was no survival difference between the fish fed fairy shrimp or Artemia nauplii.

4. CONCLUSION

This study suggests that the fairy shrimp nauplii is considered to be a suitable live feed for rearing blue gourami larvae due to its ready acceptance, high nutritional value and longer survival time of fairy shrimp nauplii in freshwater. Although fresh-live diet forms have high nutritive value, harvested fairy shrimp can also be frozen, freeze-dried or acid preserved for later use or made into flakes or other forms of formulated feeds like Artemia, and will increase their utility and initiate a new approach in using these fairy shrimps in aquaculture [15]. This can also help the freshwater ornamental fish industry to overcome the high price and survival time of Artemia.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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