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A comparative study of hybrid catfish fry in concrete tank fed with fairy Shrimp, *Moina macrocopa, Artemia salina* and commercial feed

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Experiments were conducted to study the culture and use of the fairy shrimp, *B. thailandensis* as live food for hybrid catfish, *Clarias macrocephalus* x *C. gariepinus*. The study aimed to compare the growth performance of hybrid catfish fed with fairy shrimp, *Moina macrocopa*, *Artemia salina*, commercial feed and continually fed with commercial feed until harvestable stage. Results indicated that the hybrid catfish fed with fairy shrimp had shown maximum length, final weight gain, daily weight gain and survival rate. The differences were shown on the final weight, daily weight gain and survival rate of hybrid catfish fed previously with fairy shrimps compared to other feeds. However, the food conversion ratio of hybrid catfish previously fed with fairy shrimp was not significantly ($p > 0.05$) compared to fish fed with *Moina, Artemia* and commercial feed.

Key words: *Clarias macrocephalus* x *C. gariepinus, Branchinella thailandensis, Moina macrocopa*, *Artemia salina*

Introduction

Fairy shrimps have great potential as live food organisms for a variety of aquatic animals. Both larvae and adult fairy shrimps (live or even frozen) can be fed to commercial aquaculture species such as catfish and shrimps and other aquarium species such as flower horn (Boonmak *et al.,* 2007). The cysts of fairy shrimps contain 45-50% protein and 5-6% lipids while adult fairy shrimps have higher protein and carotene contents. Fairy shrimp biomass produced (using livestock waste as a nutrient source) can be used as nursery and maturation feed for ornamental fishes (Munuswamy *et al.,* 1997).

It has also been shown that fairy shrimps contain high levels of many essential amino acids which are important for the growth performance of fresh

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and brackish water fishes and other crustaceans. Through enrichment and bio-encapsulation, fairy shrimps can be an ideal candidate for the provision of valuable nutrients to young larvae of commercial aquaculture species (Munuswamy, 2005). Their high carotenoid content also makes them ideal for color enhancement in ornamental fish culture.

With the high cost of *Artemia* cyst to provide a good source of protein for freshwater and brackish fishes, the government of Thailand restructured a financially viable agendum by conducting research on the production of fairy shrimps (*Branchinella thailandensis* Sanoamuang, Saengphan and Murugan, 2002) which are locally available (Saengphan and Chusing, 2006) in the country.

In view of the foregoing, a study on the culture and use of fairy shrimps as live food for hybrid catfish was conducted to reduce the country's dependence on the imported, costly brine shrimp *Artemia salina*. This study documented the growth performance of hybrid catfishes' fry, fed with fairy shrimp, *M. macrocopa*, *A. salina*, and commercial feed.

Material and methods

The treatments were laid out in Completely Randomized Design and replicated four times as follows: Treatment 1 - 70 hybrid catfishes (*Clarias macrocephalus* x *C. gariepinus)* fed with fairy shrimps, Treatment 2 - 70 hybrid catfishes (*Clarias macrocephalus* x *C. gariepinus)* fed with *M. Macrocopa,* Treatment 3 - 70 hybrid catfishes (*Clarias macrocephalus* x *C. gariepinus)* fed with *A. Salina* and Treatment 4 - 70 hybrid catfishes *(Clarias macrocephalus x C. gariepinus)* fed with commercial feed.

From day 1 to day 7, hybrid catfish in Treatment 1 were fed with fairy shrimp + commercial feed (estimated volume ratio of 70:30) *ad libitum*. Fish in Treatments 2, 3, and 4 were fed *ad libitum* with *Moina* + commercial feed, *Artemia* + commercial feed and commercial feed only, respectively. From day 8 to day 15, hybrid catfish in Treatments 1, 2 and 3 were fed with fairy shrimp + commercial, *Moina* + commercial feed, *Artemia* + commercial feeds, respectively except that the estimated volume ratio with commercial feed was 30:70. Fish in Treatment 4 were fed *ad libitum* with 100% commercial feed. From day 16 to day 45 fish in each treatment were given small pellet-size commercial feeds, and from day 46-105, medium pellet-size commercial feeds were fed to the fish. The variation of size of pellets was considered to enable the hybrid catfish to swallow efficiently the commercial feeds which were given twice a day in 5% of the fish biomass. The nutrient composition of commercial feeds was used in this experiment.

Monitoring Growth Performance

Initial and final weights of hybrid catfish were monitored before and after the experimental period using a weighing scale while initial and final lengths were determined using a ruler. Recorded data supported the data gathered. Forty-three percent of the total fish populations per treatment were collected to determine the various growth parameters such as survival rate, Daily Weight Gain (DWG) and Food Conversion Ratio (FCR) which were computed.

Water Quality

Water quality was monitored regularly. Specifically, monitoring of dissolved oxygen using DO meter, temperature using a thermometer, pH using a pH meter and ammonia using ammonium test kit was done between 06:00–07:00 am. The selected water quality parameters were monitored once a week until the end of the experimental period.

Statistical analysis

All experiments were laid out following the Completely Randomized Design (CRD). Analysis of variance was employed to determine significant differences among the treatment effects while Duncan's Multiple Range Test (DMRT) was employed to determine specific treatment mean differences. All statistical significance was compared at the 5% probability level. All computations and analysis were carried out using the SAS v6.12 statistical software.

Results and discussion

The growth performance and survival of hybrid catfish are presented in Table 1. At the start of the experiment, the hybrid catfish fed with fairy shrimp weighed more and were longer than those fed with *Moina*, commercial feed and *Artemia*, in descending order. A similar trend was also observed after three months of feeding with commercial feed. Survival was higher in hybrid catfish previously fed with fairy shrimp than that of groups fed with *M. macrocopa, A. salina* and commercial feed (Table 1). Data showed that early feeding of hybrid catfish reared in concrete tank with live food influenced their growth performance and survival when subsequently fed with commercial feed for the next three months.

Table 1. Growth performance and survival of hybrid catfish.

Parameter	Treatments			
	1	2	3	4
Total fish stocked	70	70	70	70
Initial length (cm)	1.33	1.33	1.33	1.33
Initial weight (g)	0.43[a]	0.22[a]	0.21[a]	0.22[a]
Final length (cm)	16.32[a]	14.74[ab]	14.48[b]	12.99[b]
Final weight (g)	52.14[a]	43.04[ab]	41.93[ab]	36.62[b]
Daily weight gain (g/day)	0.58[a]	0.48[ab]	0.47[ab]	0.40[b]
Food Conversion Ratio (FCR)	1.15[a]	0.94[a]	1.02[a]	1.02[a]
Percent survival	73.2[a]	66.4[a]	61.43[ab]	45.7[b]

Means within a row connected by the same letter are not significantly different from each other at 5% probability level by DMRT

The mean initial length of fish in all treatments was 1.33 cm while the initial weights of catfish fed with fairy shrimp, *Moina, Artemia* and commercial feed were 0.43, 0.22, 0.22 and 0.21 g., respectively. The comparable weight of catfish fed with fairy shrimp may be accounted to the fact that fairy shrimps have a soft shelled-body that makes them easier swallowed by fingerling hybrid catfish.

After three months of culture in concrete tanks with pure commercial feeds, results showed that the hybrid catfish previously fed with fairy shrimp had the highest final length followed by the hybrid catfish previously fed with *Moina* and *Artemia* with mean lengths of 16.32, 14.74 and 14.48 cm, respectively. Hybrid catfish fed with pure commercial feed obtained the lowest final length of 12.99 cm.Analysis of variance on the final length of catfish revealed highly significant differences ($p < 0.01$) among treatments (Fig. 1 and Fig. 2).

Fig. 1. Concrete tanks used on the rear of hybrid catfish for 3 months

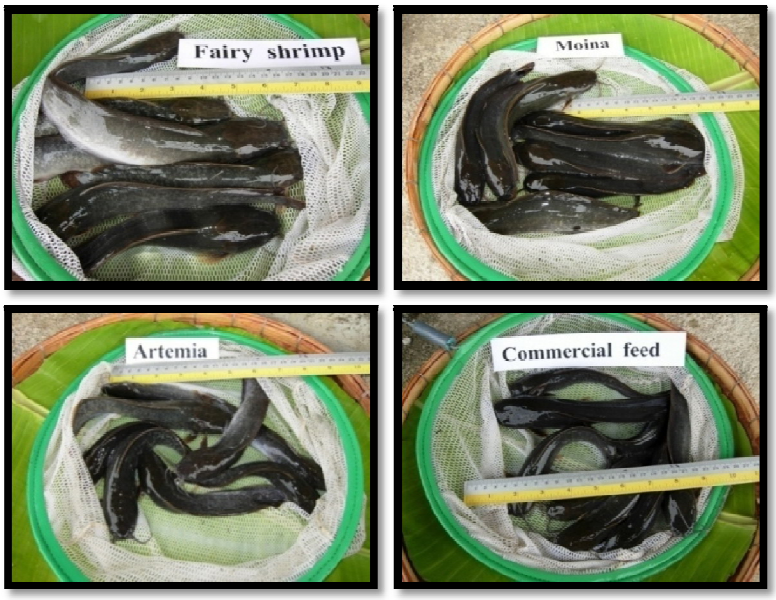

Fig. 2. Three month old hybrid catfish with various fed by commercial feed

The highest final weight was obtained by catfish previously fed with fairy shrimp followed by hybrid catfish previously fed with *Moina* and *Artemia* with mean weight measurements of 52.14, 43.04 and 41.93 g, respectively while hybrid catfish fed with pure commercial feed obtained the lowest final weight of 36.62 g.

The potential use of fairy shrimp in increasing the weight of fish may be due to its composition and nutritional efficacy. The analysis made by Saengphan (2005) showed that the composition of fairy shrimp is 64.94% protein, 5.07% fat, 17.96% carbohydrate, and 8.40% ash. The effective utilization of adult fairy shrimp was studied using ornamental fishes by Velu and Munuswamy (2007) and they found that the biochemical analyses of the whole tissue of the fish fed with fairy shrimps showed efficient utilization as observed in the gain in weight of fish. More so, fish fed on live feed showed a higher weight gain as compared with fish fed with other types of feed. This is further supported by the findings of Bergot and Breque (1983) that showed that excess carbohydrates are assimilated at a higher rate, resulting in a better weight gain.

Analysis of variance on final weight revealed significant differences among treatments ($p < 0.05$). The daily weight gains between fairy shrimps and commercial feed was 0.58 and 0.40 g/day, respectively, showing a significant difference. The remaining treatments, on the other hand, showed no significant mean differences.

In terms of food conversion ratio, fish fed with fairy shrimps is not significantly different from fish fed with *Moina, Artemia* and commercial feed. Data on percent survival showed significant difference between hybrid catfish fed with fairy shrimp and *Moina* as compared against fish fed with pure commercial feed. Catfish fry obtained sufficient benefits from the live food organisms than from commercial feeds. Their nature of being a carnivore organism clarifies high percent survival rate with live feeds than that of commercial feed.

The water quality range in concrete tanks for a 30-day culture of hybrid catfish was within tolerable limits (Table 2). The level of water quality of the study demonstrated a safe, favorable and suitable rearing aqueous environment for hybrid catfish.

Table 2. Water quality parameters of the experiment for hybrid catfish previously treated with different types of feed reared in concrete tanks for 3 months.

Treatments	Temp (°c)	Do (ml/l)	pH	Ammonia (ml/l)
T1	26.50	6.00	7.93	0.00
T2	26.67	6.08	7.86	0.00
T3	26.50	7.15	7.93	0.00
T4	26.60	6.54	7.94	0.00

Conclusion

The study showed that the hybrid catfish fed with fairy shrimp had the highest final length followed by the hybrid catfish fed with *Moina* and *Artemia* with mean lengths of 16.32, 14.74 and 14.48 cm, respectively. Whereas hybrid catfish fed with pure commercial feed obtained the lowest final length of 12.99 cm. Analysis of variance on the final length of catfish revealed highly significant differences among treatments ($p < 0.01$).

For treatments given pure commercial feeds, the highest final weight was obtained by catfish fed with fairy shrimp followed by hybrid catfish fed with *Moina* and *Artemia* with mean weight measurements of 52.14, 43.04 and 41.93 g, respectively while hybrid catfish fed with pure commercial feed obtained the lowest final weight of 36.62 g. The daily weight gain between fairy shrimp and commercial feed was 0.58 and 0.40 g/day, respectively, and showed significant difference. The remaining treatments, on the other hand, showed no significant mean differences of replication.

In terms of food conversion ratio, fish fed with fairy shrimp was not significantly different from fish previously fed with *Moina, Artemia* and

commercial feed. Data on percent survival showed significant difference between the survival rate of hybrid catfish fed previously with fairy shrimp and *Moina* as compared against fish fed with pure commercial feed.

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