The effect of different live feeds on the growth and survival of comet goldfish *Carrasius auratus auratus* larvae

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**Abstract.** The purpose of this study was to investigate the effect of different live feeds on growth and survival rate of comet goldfish larvae (*Carrasius auratus auratus*) and to find the best live feeds for the growth of comet goldfish larvae (*C. auratus*). This research was conducted at Marine Biology Laboratory, Faculty of Marine and Fisheries of Syiah Kuala University, Banda Aceh. The study was conducted on July 27 to August 24, 2017. This study used Completely Randomized Design (CRD) using 4 treatment levels with 4 replications that were A (*Tubifex* sp.); B (*Moina* sp.); C (*Daphnia* sp.); and D (*Artemia* sp.). The ANOVA test results described that different live feeds effected survival rate, absolute weight gain, absolute length gain, specific growth rate and daily growth rate of comet fish larvae (*Carrasius auratus auratus*) where P<0.05. The results of this study showed that treatment A (*Tubifex* sp.) was the best treatment which resulted in average of survival rate was 97.50 ± 5.00 %, absolute length gain was 2.45 ± 0.30 cm, absolute weight gain was 0.39 ± 0.13 g, specific growth rate was 0.12 ± 0.02 %/day, and daily growth rate was 0.014 ± 0.0003 g/day.

1. **Introduction**

The comet goldfish is one of the freshwater ornamental fish, it is similar to the common goldfish. The comet goldfish can be distinguished from the common goldfish by its long fin, even the comet goldfish fin can reach longer than its body. The comet goldfish also look liked koi, but when this fish grow to adult size, it can be seen clearly that the body of comet goldfish is not too long. The comet goldfish is a hybrid between koi and goldfish [1].

Species and colour diversity of comet goldfish are factors that attracted people. Furthermore, the price of comet goldfish is cheap and comet goldfish can be easily culture. It can be cultured in aquarium and pond by maintaining water flow system.

Success in fish culture depends on hatchery activity for obtaining good seeds based on quality and quantity. One of the stages in hatchery activity can cause failure, abnormality seeds and survival rate less optimal in seeds production of comet goldfish. Fish larvae is critical phase and on this stage has highmortality and low growth rate. It is probably assumed that about 30% of survival rate of comet goldfish larvae are achieved by one broodstock. One of the important things in larvae rearing of comet goldfish is nutrition requirement in feed.

Live feeds are very important to enhance the survival rate and growth of larvae, because it is source of carbohydrate, lipid and protein. Furthermore, live feeds are easily detected and captured due to their swimming movements in water column and it is not polluted water media [2,3]. Some of live feeds that usually used on larvae stages are *Artemia* sp., *Daphnia* sp., *Tubifex* sp., and *Moina* sp. Therefore, the objective of the present study were to investigate the effect of different live feeds on the growth and survival rate and to find the best live feeds for the growth of comet goldfish larvae (*C. auratus*).
2. Materials and Methods

Research was conducted at laboratory of Marine Biology, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh. The larvae of comet goldfish used 7 days old with stocking density 2 fish/liters. The larvae fed by live feeds namely Tubifex sp, Moina sp, Daphnia sp, and Artemia sp. Fish fed by ad-libitum 4 times a day.

This study used completely randomized design (CRD) using 4 treatments with 4 replications, namely treatment A (Tubifex sp.); B (Moina sp.); C (Daphnia sp.); and D (Artemia sp.). Data were collected each 7 days culture periods. Parameters were calculated according to the following equations:

1. Absolute weight gain [4].

\[ W = W_t - W_o \]

Where: \( W \) = Absolute weight gain (g); \( W_t \) = Fish Biomass at final experiment (g); \( W_o \) = Fish Biomass at initial experiment (g)

2. Absolute length gain [4].

\[ L = L_t - L_o \]

Where: \( L \) = Absolute length gain (cm); \( L_t \) = Fish length at final experiment (cm); \( L_o \) = Fish length at initial experiment (cm)

3. Specific Growth Rate [4].

\[ LPS = \frac{\ln W_t - \ln W_o}{t} \times 100\% \]

Where: SGR = Specific growth rate (% per day); \( W_t \) = Fish weight at final experiment (g); \( W_o \) = Fish weight at initial experiment (g); \( t \) = Experiment time (day)

4. Daily growth rate [4].

\[ DGR = (W_t - W_o)(t)^{-1} \]

Where: DGR = Daily growth rate (g/day); \( W_t \) = Fish biomass at final experiment (g); \( W_o \) = Fish Biomass at initial experiment (g); \( t \) = Experiment time (day)

5. Survival rate [5].

\[ SR = \frac{(N_o - N_t)}{N_o} \times 100 \]

Where : \( SR \) = Survival rate (%); \( N_t \) = Total fish death during the study; \( N_o \) = Total fish at initial experiment

3. Results and Discussions

Feeding fish with different live feeds effected on survival rate and growth rate of comet goldfish. Analysis of variance showed that live feeds significantly effected (\( P < 0.05 \)) survival rate, absolute weight gain, absolute length gain, and specific growth rate of comet goldfish larvae. The highest growth rate and survival rate were found in treatment A (Tubifex sp.) (Table 1.), while the lowest was treatment B (Moina sp.). The growth of fish indicated by the increasing of fish weight mean that feeds can meet requirement for fish growth. The highest absolute length gain of comet goldfish was recorded at treatment A (Tubifex sp.). Feeding habit of fish effects fish growth, if the type of feed appropriate for feeding habit, moreover feed can be eaten easily by fish. Fish can choose their food that easily digestible compared to hardly digestible [6].
Table 1. Parameters of comet goldfish larvae

| Treatment | Absolute Weight Gain (g) | Absolute Length Gain (cm) | Specific Growth Rate (%/day) | Daily Growth Rate (g/day) | Survival Rate (%) |
|-----------|--------------------------|---------------------------|-----------------------------|--------------------------|------------------|
| A         | 0.39 ± 0.13^a            | 2.45 ± 0.30^d             | 0.12 ± 0.02^b               | 0.014 ± 0.0003^d         | 97.50 ± 5.00^b   |
| B         | 0.17 ± 0.21^a            | 0.98 ± 0.27^a             | 0.11 ± 0.07^a               | 0.006± 0.000^a           | 80.00 ± 0.00^a   |
| C         | 0.30 ± 0.11^b            | 1.51 ± 0.04^b             | 0.11 ± 0.05^ab              | 0.010 ± 0.0004^b         | 82.50 ± 2.88^a   |
| D         | 0.33 ± 0.07^c            | 1.90 ± 0.04^c             | 0.12 ± 0.01^ab              | 0.012 ± 0.0002^c         | 85.00 ± 5.77^a   |

Different letter of superscript in the same column shows the significant difference.

Another study found the similar result in culture of comet goldfish, study about culture the comet goldfish in recirculating system fed by different types of feed found that Tubifex sp. was the best treatment that exposed the highest absolute weight gain and length gain. It was occurred because seeds of comet goldfish can utilize feed effectively for growth [7]. Tubifex sp. is better than other live feeds because it has bright colour, easy to see, and it has special smell that attracted fish to prey it [6]. The highest survival rate was obtained in fish fed by Tubifex sp., about 97%. While, the lowest found in Moina sp. treatment B (80%). It was assumed that larvae difficult to capture Moina sp. due to the movement activity. Whereas, Tubifex sp. that were chopped were easily consumed by larvae because feeding habit of larvae are finding food in the bottom of water. The other studies presented that Tubifex sp. were a live feed species that move not too active in the bottom of the water. Therefore, Tubifex sp. will be easily captured by fish [2, 6, 7]. While, Moina sp. has the active movement so it were difficult to be prey.

Figure 1. (a) Weight gain, (b) Length gain of comet goldfish larvae
Figure 1 has been shown that weight and length of fish increased rapidly during experiment, particularly in treatment A (Tubifex sp.). The highest weight and length gain was achieved by fish fed with Tubifex sp., followed by artemia sp, daphnia sp, and moina sp. Based on the result of study, treatment A (Tubifex sp) had the highest result on the growth because protein content in Tubifex sp. was higher than other treatments, about 57% [8, 9]. Not only protein, but also lipid effected the fish growth. The requirement of lipid on fish is different, it depends on species. Lipid content of Tubifex sp. is about 13.30% [8]. Tubifex sp is the best choice for the growth of larvae, it has no skeleton bones and its body has segmentation so it can be easily digested [10].

The lowest growth was found in treatment B (Moina sp.). It was occurred because protein content in Moina sp is lower than Tubifex sp. and Artemia sp. The nutrition content in Moina sp were 37.8% of protein, 1.29% of lipid 0% of carbohydrate and 0% of ash [11]. Quality of feed describe that feed meet the nutrient requirement of fish. Not only must the feed contain the proper nutrient but also nutrient must be able to be digested and absorbed in a form that makes them available for providing energy to growth [4]. Moina sp. is one of the plankton which is covered by shell so larvae are difficult to digest it.

### Table 2. Water quality parameters during experiment

| Treatments | Water Quality Parameters |
|------------|--------------------------|
|            | Temperature (°C) | pH       |
| A          | 25-27            | 6.9-7.3  |
| B          | 25-26            | 6.9-7.2  |
| C          | 25-27            | 6.9-7.3  |
| D          | 25-27            | 6.9-7.1  |
| References | 23-29 [12]       | 6.8-8.0 [13] |

Water quality measurements on cultured container were physical and chemical parameters, i.e. pH and temperature. Based on Table 2, it has been shown that temperature ranged from 25 to 27°C and pH ranged from 6.8 to 8.0. This range was in tolerance limit for comet goldfish [12, 13].

### 4. Conclusions

The larvae of comet goldfish fed by different live feeds (Tubifex sp., Moina sp., Daphnia sp. and Artemia sp.) showed the significant effects (P < 0.05) on survival rate, absolute weight gain, absolute length gain, and specific growth rate of comet goldfish larvae. The best life feeds in this study was Tubifex sp.

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