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Estimation of Growth and Survival of Comet Gold Fish, *Crassius auratus* by Using Artificial and Natural Feeds in Closed Glass Fiber Aquaria

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Abstract The research work was carried out for 60-days with the aim of examine the effects of different feeds on larval development and survival of 3 day-old comet gold fish *Carrasius auratus* larvae in closed fiber glass aquaria to build up nurturing routine for supporting the aquarium business. Six experimental units were consisting three treatments, each comprising of two replications and stocked with 45 larvae. Initial length were 2.21 ± 0.03, 2.23 ± 0.04 and 2.25 ± 0.05 mm respectively in three treatments and weight of larvae was 0.005 ± 0.01 g and the volume of each glass aquaria was 30 × 11 × 8 inch^3. Three different feeds i.e. crushed pellet feed, mixed diet i.e. 50% pellet +50% chopped tubificid worms and live chopped tubificid worms, having different protein levels were administered to compare their suitability as food for nurturing of *C. auratus* larvae. The larvae fed with chopped tubificid worms showed significantly better results in terms of length and weight gain, percent length and weight gain and specific growth rate (SGR %) compared to the rest two treatments. The highest survival rate 64.64 ± 2.46% was shown by the chopped tubificid worms fed larvae which was significantly higher than those of crushed pellet feed and mixed diet respectively. Water quality parameters were monitored throughout the experimental periods. On the basis of larval growth and survival rate, it could be suggested the live chopped tubificid worms is suitable for the nurture of comet gold fish *C. auratus* larvae.

Keywords: *comet gold fish, growth, feeds, aquaria and survival*

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1. Introduction

The ornamental fish sector is a widespread and global component of international trade, fisheries, aquaculture and development. Ornamental fish keeping is becoming popular as an easy and stress relieving hobby. About 7.2 million houses in the USA and 3.2 million in the European Union have an aquarium and the number is increasing day by day throughout the world [1]. Comets are smaller than the common goldfish and only grow to a length of about 6 to 10 inches in an aquarium, but they can reach a length exceeding 12 inches in a large pond. Under optimum conditions, the tails can grow up to 12 inches in length and may live up to 7 to 14 years [2]. Comets goldfish are omnivorous and easy to feed and accept what is offered. They prefer most food sources including flake food and pellets [3]. Cyprinid larvae are known to prefer natural food items such as free living protozoa and rotifers, and larger planktonic organisms like cladocerans and copepods at fry and fingerling stage [4].

For propagation of a fish species knowledge of feeding habit is very essential as it plays a vital role in the growth pattern. Food is the main source energy and plays an important role in determining the population levels, rate of growth and condition of fishes [5]. The proper growth of fish depends on quantity and quality of food having all the essential nutrients [6]. Growth of an organism can be defined as a change in its size (length and weight) over a period of time. The growth rate in fishes is highly variable and depends upon many environmental factors. Quality of food and its availability is one of the important factor influences growth rate of fish [7]. The growth rate of larvae is also influenced by the quality of feed and their acceptability [8]. In aquaculture feed is the single most important item since nearly 60% cost is associated with fish feed [9].

The present study was conducted to find out the proper feed (protein level) for larval growth and survivability of

comet goldfish *(Carassius auratus)* larvae in the congested fiber glass aquaria.

2. Materials and Methods

The experiment was conducted for 60-day long from 20th December, 2010 to 15th February, 2011 in fiber glass aquaria volume (30×11×8 inch^3) in the fish physiology laboratory of Fisheries and Marine Resource Technology Discipline, Khulna University, Bangladesh. In this experiment there were three treatments and each treatment consisted of two replications supplied with three dissimilar feeds i.e. treatment T1 (crushed pellet feed), treatment T2 (mixed diet i.e. 50% pellet + 50% chopped tubificid worms) and treatment T3 (live chopped tubificid worms). Each of the experimental units of 45 larvae was stocked and their average length were 2.21 ± 0.03, 2.23 ± 0.04 and 2.25 ± 0.05 mm respectively in three treatments and their average weight was 0.005 ± 0.001 g respectively. PG dose was used for artificial propagation of the brood fish for production of larvae. Then the larvae were reared in the glass aquaria up to three days and nourished along with boiled eggs for avoiding biasness of outcome. Prior to storing of larvae, each of the fiber glass aquaria was prepared of dirt free up and equipped with all conveniences so that the experimentation runs sound powerfully. About 50% water from each aquarium was partially substituted through hygienic water at every alternate day before feeding. Appropriate aeration was done to supply adequate oxygen into the aquaria by motorized aerator it was nonstop till the conclusion of the research. The feces in each aquarium were removed by siphoning and the dead larvae were removed and reckoned in the morning and in the evening prior to feeding. Proximate composition of feeds were examined following the standard methods given by Association of Official Analytical Chemists [10] in the Fish Nutrition Laboratory of Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna. The larvae stocked under the different treatments were fed with different feeds administered those three times daily at 7:00, 3:30 and 12:300 h. Sampling was made at every 7 days interval. Ten larvae were arbitrarily collected from each aquarium to obtain the length and weight data. The weight (g) was taken in an analytical balance and the length (mm) was measured by placing the fry on a transparent petridish placed on a 1 mm graph-paper. Sampling was done before the application of feed to avoid the biasness of weight due to presence of excessive feed. The following formulae were used to determine the different growth parameters

a) Length gain of larvae was calculated by [11].

$$\text{Length gain (mm)} = \text{Average final length of larvae} - \text{average initial length of larvae.}$$

b) Weight gain of the larvae was calculated by the following formula [11].

$$\text{Weight gain (g)} = \text{Mean final weight} - \text{Mean initial weight}$$

c) Specific growth Rate (%)

According to [12] the specific growth rate of prawn was calculated as, Specific growth rate

$$(SGC) = \frac{LnW_2 - LnW_1}{T_2 - T_1} \times 100$$

Where, W_2 = Final live body weight (g) at time T_2

W_1 = Initial live body weight (g) at time T_1

d) The survival rate was calculated by using the following formula [13]

$$Survival\ Rate(\%) = \frac{Initial\ number\ of\ \ fish - final\ number\ of\ \ fish}{Initial\ number\ of\ \ fish} \times 100$$

e) Feed Conversion Ratio (FCR)

Feed conversion ratio was calculated by using the following formula [14].

$$\text{FCR} = \frac{\text{Mass of food consumed (Dry)}}{\text{Increase in mass of animal}} \times 100$$

2.1. Statistical Analyses

Spread sheet analysis of data was done by using Microsoft Excel, version 5.0, Microsoft Inc. USA. To analyze the data analysis of variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT) [15] was done by using SPSS 16.0 for windows® [16]. Standard (± error) of treatments means were calculated from the residual mean square in the analysis of variance.

Table 1. Proximate composition of feeds used for rearing of *C. auratus* for 60 days (% dry weight)

Feeds	Protein (%)	Lipid (%)	Ash (%)
Pellet feed	29.35	9.45	19.57
Mixed feed	31.06	8.67	13.41
Tubificid worms	31.91	7.23	11.01

Table 2. Growth performance of comet gold fish, *C. auratus* larvae of different treatments after 60 days rearing, (mean ± SE)

Parameters	Treatment T_1 (Crushed Pellet feed)	Treatment T_2 (Mixed diet)	Treatment T_3 (Chopped tubificid worms)
Initial length (mm)	2.23 ± 0.03	2.21 ± 0.04	2.25 ± 0.05
Initial weight (g)	0.005 ± 0.01	0.005 ± 0.01	0.005 ± 0.01
Final length (mm)	22.11 ± 0.53^c	23.8 ± 0.48^b	25.9 ± 0.47^a
Final weight (g)	0.22 ± 0.009^c	0.25 ± 0.010^b	0.32 ± 0.027^a
Length gain (mm)	9.08 ± 1.54^c	9.78 ± 1.87^b	10.4 ± 1.19^a
Weight gain (g)	43.2 ± 0.126^c	48.6 ± 0.037^b	63 ± 0.025^a
Percent length gain	90.8 ± 4.36^c	97.8 ± 5.23^b	100.4 ± 6.03^a
Percent weight gain	432 ± 27.56^c	486 ± 31.32^b	630 ± 33.73^a
Specific growth rate	1.08 ± 0.12^c	1.12 ± 0.65^b	1.33 ± 0.02^a
Survival	51.11 ± 3.10^c	57.77 ± 3.01^b	64.44 ± 2.46^a

Values with different superscripts in a row are significantly different (one way ANOVA followed by Duncan test, $P < 0.05$).

3. Result and Discussion

The 60-day long experiment was performed with a view to observing the effects of different feeds on growth and survival of comet gold fish larvae. Proximate composition of feeds were analyzed and given in Table 1. The initial average length of the larvae were 2.21 ± 0.03, 2.23 ± 0.04 and 2.25 ± 0.05 mm in all treatments respectively and the initial average weight of the larvae were 0.005 ± 0.001 g for all treatments. The final average length of the larvae of treatment T1 (crushing pellet feed), T2 (mixed diet i.e. 50% pellet feed + 50% chopped tubificid worms) and T3 (live chopped tubificid worms) were 22.11 ± 0.53 mm, 23.8 ± 0.48 and 25.9 ± 0.47 mm at the same time as the final average weight were 0.22 ± 0.009 g, 0.25 ± 0.010 g and 0.32 ± 0.027 g respectively (Table 2).

The highest length gain was found to be 10.4 ± 1.19 mm in treatment T3 (fed with chopped tubificid worms) which is significantly ($P < 0.05$) higher than the rest of two treatments (Figure 1). Likewise, the highest gain in weights of the larvae was 63 ± 0.025 g in treatment T3 (fed with live tubificid worms) which is significantly ($P < 0.05$) higher than those of the other two treatments (Figure 2) followed by 48.6 ± 0.037g in treatment T2 (fed with mixed diet) and 43.2 ± 0.126 g in treatment T1 (fed with crushed pellet feed).

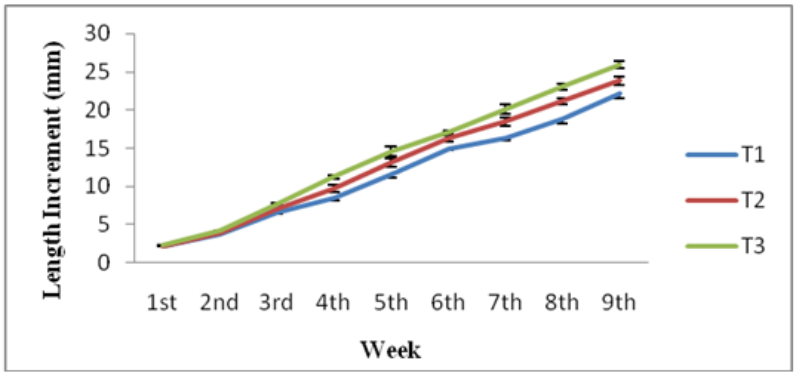

Figure 1. Weekly variation of length increment among three treatments during 60 days experimental period. Vertical bars represented ± standard error

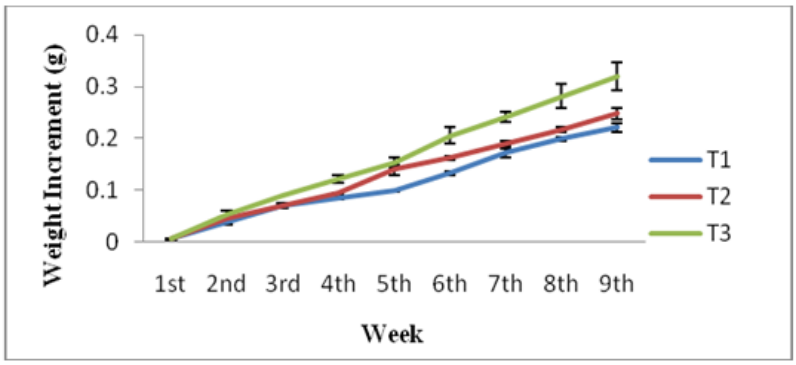

Figure 2. Weekly variation of weight increment among three treatments during 60 days experimental period. Vertical bars represented ± standard error

The highest percent length gain was 100.4 ± 6.03% and percent weight gain was 630 ± 33.73%, respectively as observed in the larvae fed with live tubificid worms (Table 2). After completion of the experiment, the highest specific growth rate was found to be 1.33 ± 0.02% shown by the larvae fed chopped tubificid worms (Table 2) which was significantly ($P<0.05$) higher compared to those in treatment T_1 and T_2 (Figure 3). The survival rates were found to be 64.44 ± 2.46%, 57.7 ± 3.01% and 51.11 ± 2.10%, respectively in T_3, T_2 and T_1 (Figure 4).

According to [17] depicted growth rate of fish increases within the level of dietary protein till the optimum level is reached. [18] Suggest that growth, reproductive potentials, and survival of each species are affected by the nutrient conditions of the culture media. In the present study the experiment was conducted in closed condition in the aquaria that were different than any natural environment. Cyprinid larvae are prefer to natural food items such as free living protozoa and rotifers, and larger planktonic organisms like cladocerans and copepods at fry and fingerling stage [4]. Live-food has been the most useful feed for rearing of fry of *Coregonus lavaretus* [19]. It also plays an important role in the shrimp and salmon industry. Among the different live-foods e.g. rotifers, *Brachionus* spp., *Moina* sp., *Artemia* sp. etc. tubificid worms are very popular and cheap live-food used for feeding larvae of carnivorous and omnivorous fish species [20]. Considerably better growth and survival rates of larvae and fry were observed with tubificid worms over formulated feeds in a number of catfish species such as ornamental koi carp, *Cyprinus carpio* [21], *Channa striatus* [22] *Clarias batrachus* [23]. The results of the present experiment also suggest the suitability of live chopped tubificid worms as the best food of *C. auratus* larvae.

Stocking density is known as one of the important parameters in fish culture, since it directly affects growth and survival, and hence production [24]. [25] Conducted an experiment with the larvae and juveniles of *Clarias gariepinus* and concluded that growth and survival was density dependant and that live food was preferred to formulated feed. In this experiment the stocking density was 45 larvae in each aquarium that was an acceptable density in respect of previous research works. However, the hatchlings fed with formulated feed showed very little

interest according to [26]. The feeding frequency of 3 times/day was adopted during the present experiment to avoid water fouling and ease of feed provision and other managements. Feeding frequency has direct impact on the growth performance and survival of fry and larvae of *Clarias macrocephalus* [27]. They found that a feeding frequency of three times in each day was best for rearing the fry and larvae of *Clarais macrocephalus* which is relevant to the present study.

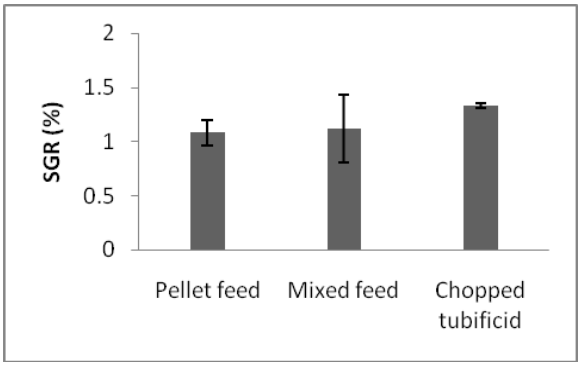

Figure 3. Comparison of specific growth rate (SGR%) of larvae fed with chopped pillet feed, mixed feed and live tubificid worms during 60 days experimental periods. (Vertical bars represented ± standard error. Columns marked with the different letters are significantly different)

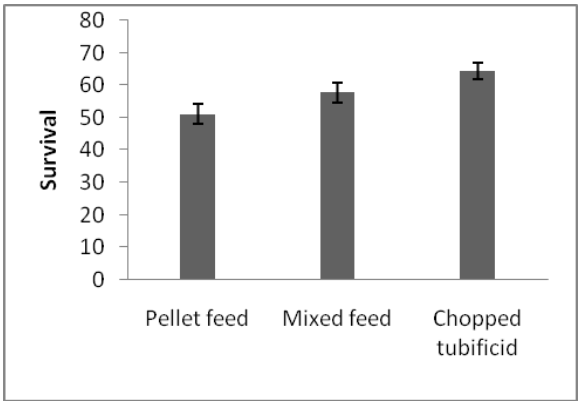

Figure 4. Comparison of survival rate of larvae fed with pellet feed, mixed feed and live tubificid worms during 60 days experimental periods. (Vertical bars represented ± Standard error. Columns marked with the different letters are significantly different)

The available information suggests that the survival rate is very poor in earlier stage of the life cycle. In treatment T_1 the survival rate was lower than that of other two treatments because, pellet feed was used in treatment T_1 which deteriorated the water quality much than other two treatments. This result may be due to poor physiological development of earlier stage of life.

References

[1] Ghosh, A., Mahapatra, B.K and Datta, N.C, "Ornamental Fish Farming-Successful Small Scale Aqua business in India". *Aquaculture Asia*, 8(3). 14-16. 2000.

[2] Jesson, A., "Comet Goldfish. http://ezinearticles.com/?Comet-Goldfish&id=336755". 2006.

[3] Kaiser, H., Endemann, F. and Paulet, T.G, "A comparisonof artificial and natural foods and their combinations in the rearing of goldfish, *Carassius auratus* (L.)". *Aquaculture Research, 34*. 943-950. 2003.

[4] Jhingran, V.G. and Pullin, R.S.V, "A Hatchery Manual for the common, Chinese and Indian Major Carps". *ICLARM Studies and Reviews, 11*. 1-191. 1985.

[5] Begum, M., Alam, M.J., Islam, M.A. and Pal, H.K, "On the food and feeding habit of an estuarine cat fish (*Mystus gulio*, Hamilton) in the south-west coast of Bangladesh". *University Journal of Zoology, Rajshahi University*, 27. 91-94. 2008.

[6] Ghosh, K., Sen, S.K. and Ray, S.K, "Feed utilization efficiency and growth performance of rohu, (*Labeo rohita*, Hamilton-1822), fingerling feed yeast extract supplemental diets". *Acta ichthylogica et piscatorial*, 35(2). 111-117. 2005.

[7] Khanna, S.S, "An introduction to fishes. Central book department". Allahabad, India.1996.

[8] Sahoo, S.K., Giri, S.S., Chandra, S. and Sahu, A.K, "Management in seed rearing Asian catfish *Clarius batrachus*, in hatchery condition". *Aquaculture Asia Magazine*, 15(1). 23-25. 2010.

[9] Hossain, A., Hasan, M., Mollah, M.F.A., "Effects of soyabean and mustard oil cake on the production of fish life food tubificid worms in Bangladesh". *World Journal of fish and marine sciences*, 3(3), 183-189. 2011.

[10] AOAC," Official methods of analysis of the Association of Official Analytical Chemists", 13th edition. Washington, D.C. USA. 1980.

[11] Sandifer, P.A., Smith, J., "Effects of population density on growth and survival of *Macrobrachium rosenbergii* reared in recirculating water management system". *Proceedings of World Mericulture Society*, 6, 43-53. 1975.

[12] Elangovan, A., Shim, K.F., "The influence of replacing fishmeal partially in the diet with soybean meal on growth and body composition of juvenile tin foil barb (*Barbodes altus*)". *Aquaculture*, 189(1-2), 133-144. 2000.

[13] Willis, S.A., Berrrigan, M.E., "Effects of stocking size and density of growth and survival of *Macrobrachium rosenbergii* (de Man) in ponds". *Proceedings of World Mericulture Society*, 8, 251-264. 1977.

[14] Desilva, S.S., Anderson, T.A., "Fish Nutrition in aquaculture". Published by Chapman & Hall, 2-6 Boundary row, London SEI 8HN, 27-30. 1995.

[15] Duncan, D.B., Multiple Range and Multiple F Tests. Biometrics 11, 1-42. 1995.

[16] Steel, R.G.P., Torrie, J.H., "Bioestadystica, Principionsy procedimientos". McGraw-Hall, USA, 622. 1988.

[17] Mondal, K., Kaviraj, A., Mukhopadhay, P.K., Datta, M., Sengupta, C., "Evaluation of fermented fish offal in formulated diet of the Indian major carp, rohu (*Labeo rohita*) Hamilton". *Acta Ichthylogica et piscatorial*, 37(2), 99-105. 2007.

[18] Jana, B.B., Chakraborty, R., "Exogenous introduction of live plankton, a better approach to carp growth than direct-manure systems". *Progressive Fish Culture*, 52, 252-260. 1990.

[19] Mahmoudzadeh, H., Ahmadi, M.R., Shamsei, M., Comparison of rotifer *Brachionus plicatilis* as a choice of live feed in rearing *Coregonus lavaretus* fry. *Aquaculture Nutrition*, 15(2), 129-134. 2009.

[20] Bucher, J., "Food and feeding; culturing Tubifex worm". Tropical Fisheries Hobbyst 25(7), 9-102. 1977.

[21] Mahfuj, M.S., Hossain, M,A., Sarower, M.G., "Effect of different feeds on larval development and survival of ornamental koi carp, *Cyprinus carpio* (Linnaeus, 1758) larvae in laboratory condition". *Journal of Bangladesh Agriculture University*, 10(1), 297-302. 2012.

[22] Sarowar, M.N., Jewel, M.Z.H., Sayeed, M.A., Mollah, M.F.A., "Impacts of different diets on growth and survival of *Channa striatus* fry". *International Journal of Bioresearch*, 1(3), 8-12. 2010.

[23] Mollah, M.F.A., Nurullah, M.," Effects of feeding frequency on the growth and survival of catfish (*Clarias batrachus* L.) larvae". *Bangladesh Journal of Fisheries*, 11(2), 9-14. 1988.

[24] Backiel, T., Lecren, E.D., "Some density relationship for the population parameters. In: S. D. Gerking (editor)". Ecology of Fresh Water Fish Production. Blackwell Scientific Publications, Oxford, 279-302. 1978.

[25] Hecht, T., Appelbaum, S., "Notes on growth of *Clarias gariepinus* during the primary nursing phase". *Aquaculture*, 63, 195-204. 1987.

[26] Sharma, D., Das, J., Dutta, A., "Effect on certain feeds on growth and survival of *Ompok pabda* (Hamilton-Buchanan) hatchlings in captive condition". *International Journal of Scientific Research Publications*, 2(1), 1-5. 2012.

[27] Mollah, M.F.A., Tan, E.S.P., "Effects of feeding frequency on the growth and survival of catfish *Clarias macrocephalus* (Gunther) larvae". *Indian Journal of Fisheries*, 28(1-2), 1-7. 1982.