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The larval survival of selected fresh water ornamental fishes (*Carassius auratus* and *Trichopodus trichopterus*)

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Abstract-Ornamental fish breeding is an emerging sector and can be a world scale opportunity area for fish farmers in India, especially in rural population. Larval rearing is one of the most essential criteria for any successful aquaculture. In developing countries fish seed production and larval survival is most unsuccessful due to poor nutrition of these graceful living jewels. Proper statistical analysis estimation has been done which support the management of both the rearing environment and feeding regime in order to assure productive growth and survival rate of larvae of selected ornamental fishes (*Carassius auratus* and *Trichopodus trichopterus*). Information regarding age specific food preferences of fish on different food items is deficient and survivability is also less which needs research trust for augmenting larval survival and it also heavily depends on the supply of suitable feed which should also be cost effective. The experiment was conducted to investigate the effect of alternative formulative feed on larval survival, a control diet (CD), different types of Spirulina diet (S_1, S_2 and S_3) and experimental diets (DEF, DCF, DSF and SPF). The experiment was carried out for 20 days and the larval survival rate was calculated of two selected ornamental fishes (*Carassius auratus* and *Trichopodus trichopterus*). All the five different feeds were readily accepted from the beginning of feeding and was found to be high with SPF whereas low with CD in both the larvae of *Carassius auratus* and *Trichopodus trichopterus*. In the present investigation attempt has been made to formulate cost effective, high quality, high yielding, protein and lipid rich nutritious feed for gaining high survival and growth rate in the larvae of *Carassius auratus* and *Trichopodus trichopterus* in a healthy aquatic environment.

Key words: Ornamental, emerging sector, feeding regime, aquatic environment, formulated feed.

INTRODUCTION

India is the third largest producer of ornamental fish in the world and the fishery sector is a major foreign exchange earner. Ornamental fish keeping is emerging as one of the most popular hobbies across the world next to photography.[1]

With the increase demand for ornamental fishes especially in USA, Europe and Japan and many countries in Asia including India have started capturing and culturing beautifully colored ornamental fishes, the true living jewels. Watching them swimming gracefully in the aquarium is a pure sense of joy and mental pleasure to many enthusiastic. Larval rearing is one of the essential criteria for any successful aquaculture. In developing countries, fish seed production and larval survival is mostly unsuccessful due to poor nutrition. There are a number of factors related to food and feeding which directly affect larval survival. They are the duration of development from the embryo stage to the time of the first feeding responses occur. The preferred food species

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and its abundance and distributions. The behavioral relation between the larva and its prey, the success of feeding responses, the swimming ability of larvae in search of food and the required food ration for growth and metabolic expenditure.

The small mouth gap of the larvae at first hatching makes feeding over the first few days crucial. Fish larvae are the smallest self-supporting vertebrates and in order to increase their chances of survival, they need to complete their morpho-functional systems to escape predictions and to obtain food. Food preferences of fish on different food item is deficient and the survivability is also very less which needs research thrust for augmenting larval survival and it also heavily depends on the supply of suitable life feed.[2]

When yolk sac is exhausted, fish larvae will enter into exogenous feeding and must successfully establish the transition of exogenous nutrition or suffer progressive starvation.[3] The rearing of larvae to the fry stage is most critical in the cycle of fish seed production in hatcheries and its rearing under controlled hatchery condition requires the development of specific culture techniques.[4] In aquaculture survival and production of early-stage larvae is still low.

Growth and survival data are powerful tools for understanding the effects of both live and manufactured diets on first feeding fish larvae.[5] The selection of these live feed organisms is based on many factors such as nutritional requirements of the cultured larvae, the size of mouth gap, development of digestive tract of the cultured larvae, nutritional value, availability of live food and suitability of production. Successful rearing of fish larvae is partially dependent upon the proper availability of lipid, protein, carbohydrate, vitamins and minerals through the diet. Deficiencies of these nutrients result in poor growth, low feed efficiency anemia and high mortality. The factors affecting larval survival can be divided into biotic and abiotic factors.[6] Abiotic factors like water temperature, salinity and light can influence larval survival by directly affecting developmental rates.[7]

Carassius auratus

Trichopodus trichopterus

LITERATURE REVIEW

Ornamental fish farming is becoming a luxurious hobby. Fish feeds contribute to more than one half of the variable operating cost in the aquaculture sector. Many studies on the effects of nutrition on growth in edible fishes have well documented. Paulet (2003)[8] studied the effect of diet and feeding rate on growth, morphological development and behaviors of larval and juvenile god fish, *C.auratus*. Amornsakun1 *et al.* (2004)[9] investigated the period of yolk absorption, the onset of first feeding mouth development and starvation in larval *Siamese gourami*, *T.pectoralis*. Caroline and Okpokwasil (2012)[10] determined the effect of PH on hatching success and larval survival of African cat fish, *C. gariepinus*. Allain *et al.* (2007)[11] reported the influences of environment on the survival of anchovy, *Engraulis encrasicolus* larvae in the Bay of Biscay. Sahoo *et al.* (2006)[12] evaluated the effect of different feeds of animal origin in composition on growth and survival of *Wallago attu* larvae.

MATERIALS & METHODS

Fish Feed Preparation:

To estimate the growth and survival of larvae, five different types of food were formulated for two different species of ornamental of fishes, *C.auratus* and *T.trichopterus* given below:

1. Control Feed- C (Feed 1)
2. Dried Earth worm Feed - DEF (Feed 2)
3. Dried Chironomid Feed - DCE (Feed 3)
4. Dried Spirulina Feed - DSF (Feed 4)
5. Specially Prepared Feed - SPF (Feed 5).

Newly hatched larvae of *C.auratus* and *T. trichopterus* were utilized for the present study. The experiment was conducted with the 5th day of hatched larvae and terminated when more than two-thirds of larvae in a group completed their metamorphosis to juvenile phase. Gentle aeration was supplied in the experimental tanks and increased with the growth of larvae. Daily water

exchange rate of 20% was carried out during the experimental period. During larval rearing, dead larvae were counted daily and the waste was siphoned off every day to avoid any means of stress.

Larvae of *T.trichopterus*

Larvae of *C.auratus*

New hatched larvae were randomly assigned into eight groups with 100 larvae in each group. To investigate the effect of alternative feed on larval survival, a control diet, different types of spirulina diets (S_1, S_2 and S_3) and experimental diets (DEF, DCF, DSF and SPF) were given to the larvae during the experimental period. The experiment was carried out for 20 days and the larval survival of *C.auratus* and *T.trichopterus* was calculated using the following formula:

Larval Survival Rate (%) = Final Larvae Number*100/Initial Larvae Number

Statistical Analysis: One way ANOVA without replication was carried out using Microsoft Excel. During the experiment, the water quality parameters (Temperature: 27-30°C; dissolved oxygen: 4.5-5.5 mg/l; PH: 7.5-8.2; hardness: 120-140 mg/l; nitrite: 0.02-0.05 mg/l and ammonia: 0.060.08 mg/l) were estimated and maintained.

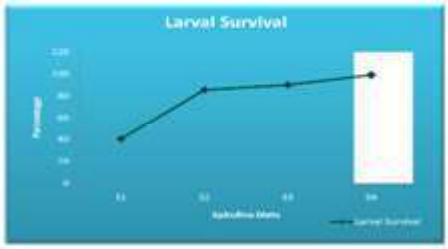
RESULT

The effect of four different feeds on larval survival of selected experimental fishes *C.auratus* and *T.trichopterus* was analysed.

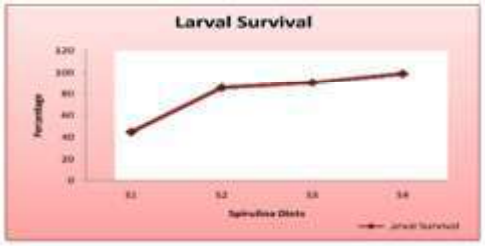
Effect of Spirulina diet on larval survival of selected ornamental fishes:

Experimental diets	Larval survival (%)	
	C.auratus	*T.trichopterus*
C	37.5±1.52	45.8±0.96
S_1	85.5±3.47	85.5±2.34
S_2	89.2±2.93	90.5±3.68
S_3	98.5±3.56	99.6±2.78

The larva of *C.auratus* fed with S_3 diet exhibit the highest survival rate (99± 3.56%) when compared to larvae fed with other diets with lowest (40.5±1.52%) with control diet. Similarly maximum larval survival (99.6±2.78%) was observed in *T.trichopterus* fed with S_3 diet and the lowest (45.8±0.96%) with control diet.



Effect of different levels of Spirulina on larval survival in *C.auratus*



Effect of different levels of Spirulina on larval survival in *T.trichopterus*

One way ANOVA for larval survival of selected ornamental fishes

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	0.96	1	0.96	0.020007	0.894355
Within Groups	191.93	4	47.983		
Total	192.893	5			

P < 0.05 statistically significant

One way ANOVA showed a significant variation ($P<0.05$) existed in survival rate between the larvae of *C.auratus* and *T.trichopterus* fed with different types of experimental feed.

Effect of experimental feed on larval survival of selected ornamental fishes.

All the five different feeds were readily accepted from the beginning of feeding in *C.auratus* and *T.trichopterus*. The larval survival was found to be high (97.32±2.95%) in *C.auratus* fed with SPF whereas the larvae fed with control diet exhibited a low survive rate (40.52±1.35%). In *T.trichopterus* maximum survival rate was observed in larvae fed with SPF diet (98.37±3.46%) followed by DSF (88.91±2.98%), DCF (86.34±3.56%), DEF (85.76±2.87%) and minimum in control diet (45.64± 0.098%).

Effect of experimental feed on larval survival of selected ornamental fishes

Experimental feed	Larval survival (%)	
	C.auratus	*T.trichopterus*
C	40.52±1.35	45.64±0.98
DEF	86.35±3.25	85.76±2.87
DCF	84.59±2.64	86.34±3.56
DSF	82.84±3.17	88.91±2.98
SPF	97.32±2.95	98.37±3.46

± SD from triplicate groups of fish

Effect of different types of experimental feed on larval survival of ornamental fishes

Source of Variation	SS	df	MS	F	P-value
Between Groups	8.5698	1	8.5698	0.223406	0.65316
Within Groups	230.1582	6	38.3597		
Total	238.728	7			

$P < 0.05$ is statistically significant

CONCLUSION

The management of both the rearing environment and feeding regime are the most important aspects of the larval survival. In our present study, five different types of experimental feed were formulated in relation to the mouth size of the larvae. Lipid of earthworm has nutritional and medicinal values, and it is believed that the dissolved substances in its lipid create a good taste to flood which can be useful in aquatics.[13] Spirulina is considered to be with rich source of protein, vitamins, minerals, essential amino acids and fatty acids (gamma linolenic acid) and antioxidant pigments such as carotenoids.[14] In addition, it is effective as an immunomodulator.[15]

Improvement in larval rearing techniques for ornamental fish larvae is considered as an urgent need as there is a demand for ornamental fish seed supply in our country. With the live feed, the larval survival of *C.auratus* and *T.trichopterus* can be improved by enriching with formulated feed. This provides positive impact on economy of fish industry for formulating low-cost feed for the ornamental fishes so that optimum sized fingerlings can be produced to make its culture a variable commercial activity.

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