

## Reproductive performance of selected fresh water ornamental fishes (*C. auratus* and *T. trichopterus*)

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### ABSTRACT

India is the third largest producer of ornamental fish in the world and the fishery sector is a major foreign exchange earner. Ornamental fish breeding is an emerging sector and can be a world - scale opportunity area for fish farmers in India. Nutrition has an important influence on growth and reproductive potential of aquarium fish and various live feed have been used for fish rearing. The short reproductive cycle of aquarium fishes might require continuous availability of right type of broodstock diet. Early larval development depends heavily on yolk nutrients delivered through the brood stock diet. In estimating the reproductive potential of fish, information on sex ratio of fish can be included to determine female spawning biomass. Reproduction in fishes is regulated by both internal mechanisms within the fish and external environmental factors. A proper statistical analysis estimation has been done which supports fish feed must be of good quality to assure high growth rate. The present knowledge on the nutritional requirement of ornamental fishes, cost effective feed, utilization of live feed, formulated feed and specially prepared feed along with the proper maintenance of aquatic environment and also maintenance of good quality and quantity of protein in fish diet have received lesser attention. The experiment was conducted to investigate the effect of alternative formulative feed on reproductive performance (Fecundity, Fertilization Rate, Hatching rate, Gonadosomatic index) of selected fresh water ornamental fishes.

**Key Words** - Ornamental fishes, Fecundity, Fertilization & Hatching rate, Gonadosomatic index

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### INTRODUCTION

Ornamental fish keeping is emerging as one of the most popular hobbies across the world next to photography. Watching these beautiful fishes swimming gracefully in the aquarium is a pure sense of joy and mental pleasure to many enthusiastic. Aquarium keeping in household adds to the aesthetic beauty of a house in many parts of the world. Ornamental fish has become an important part in international trade too. The annual global trade has increased from 4.5 billion dollars (1995) to about 9 billion dollars (2002) which

comprises 85% of freshwater species and the rest are marine species.

Culture and breeding of ornamental fishes can be a promising alternative for many people as well as unemployed youths. It requires little space and less initial investment than most other forms of aquaculture. For ornamental fish farming, only a clear understanding of habits and biology of the fishes is required. Information on reproductive cycles is essential for a better understanding of the biology of any fish population.

An improvement in broodstock nutrition and feeding has been shown to improve not only egg quality and also enhance seed production. (Kithsiri *et al.* 2010) Gonadal maturation depends upon the quantity and quality of food. (Mishra and Singh. 2002). For satisfactory breeding of fish in confined waters, feeding with suitable high energy diets such as protein, vitamins and minerals are required. Ultimately poor broodstock nutrition will lead to the production of inferior quality fry with low survival rate. It is generally accepted that egg and larval quality are partly controlled by broodstock diet. (Farahi *et al.* 2010) Early larval development depends heavily on yolk nutrients delivered through the brood stock diet. Many fishery biologists have worked on the fecundity of different fishes. (Mekkawy and Hassan, 2012).

The operational sex ratio (ratio of fertilizable females to sexually active males at a given time) is a principal factor influencing the intensity of sexual selection. In estimating the reproductive potential of fish, information on sex ratio of fish can be included to determine female spawning biomass.

Reproduction of any species requires successful completion of a number of key steps: (i) brood stock selection (ii) broodstock conditioning (iii) spawning (iv) hatching and (v) larvae and fry survival and growth. Broodstock conditioning is achieved through optimal water quality, ample and appropriate nutrition, habitat and reduction of parasite or pathogen loads.



*Trichopodus trichopterus*



*Carassius auratus*

## LITERATURE REVIEW

Nutritionally well-balanced feeds could be formulated using low-cost ingredients available in the concerned region (Ahilan and Kumaran, 2003). Hardy (1980) developed methods for fish feed formulation in aquaculture with balanced nutrition. Another approach has been developed by Singh and Srivastava (1985) to formulate low-cost diet with appropriate feeding management strategies. Sahzadi *et al.* (2006) described the growth performance and feed conversion ratio of hybrid fingerlings.

Nutrition affects reproductive performance, quality and hatchability of eggs. Limited works were available on the influence of dietary protein on spawning interval and frequency. Owen *et al.* (1989) observed spawning and survival patterns of larval northern anchovy, *Engraulis mordax* in different environments. Lazarus (1990) studied the spawning rate of trenched sardine from vizhinjam, south-west coast of India. Roy (1996) explained the reproductive management of ornamental fish in aquaculture. Degani and Yehuda (1996) studied the effect of various diets on spawning and egg quality in angel fish, *P. scalare*. Izquierdo *et al.* (2001) evaluated effect of broodstock nutrition on reproductive performance of some ornamental fish species.

## MATERIAL AND METHODS

Brood of *C. auratus* and *T. trichopterus* with average wet weight of female ( $3.87 \pm 0.12\text{g}$ ;  $3.72 \pm 0.08\text{g}$ ) and male ( $3.42 \pm 0.07\text{g}$ ;  $3.37 \pm 0.14\text{g}$ ) were selected for the estimation of breeding performance. The male and female sexes can be identified easily with the help of secondary sexual characters. Matured male and female used for the experiment were stocked separately in concrete tanks provided with a water replacement system. They were fed twice a day with 4% of their body weight and conditioned for one week. After proper acclimatization and maintenance, the domesticated brood stock was selected for the breeding experiments.

To determine the effect of different types of formulated feed on breeding performance, the

brood stocks were sorted out in to five groups. They were fed with types of experimental feed such as control feed (C), Dried Earth Worm Feed (DEF), Dried Chironomid Feed (DCE), Dried Spirulina Feed (DSF) and Specially Prepared Feed (SPF). The above experiments were conducted for 120 days in triplicates and the reproductive performance such as fecundity, fertilization rate, hatching rate and GSI were calculated using the standard formula.

Optimum water quality parameters maintained in the experimental tanks such as temperature: 27-28°C; dissolved oxygen: 4.5-5.5mg/l; pH: 7.-8.5; hardness: 120-140mg/l; nitrite: 0.05-0.08mg/l and ammonia: 0.06-0.08 mg/l.

**RESULT**

Breeding performance of *C. auratus* and *T. trichopterus* at variable sex ratios of female and male were studied.

Fish fed with specially prepared feed (SPF) spawned a greater number of eggs followed by DCF, DEF and DSF in both the experimental fishes. The present study revealed that the GSI was higher in fishes fed with SPF as 12.86±0.53 (*C. auratus*) and 13.65±1.42 (*T. trichopterus*) and it was lower in fishes with control diet.

The present study also demonstrated that the use of control feed with inadequate nutrients (without live feed) could lead to poor reproductive performance which in turn to loss in aquaculture production. Therefore, it is concluded that live feed can be utilized as an ingredient in the formulation

of experimental diets to ornamental fishes which enhance breeding performance, so that good quality eggs can be produced.



**Egg of *C. auratus***



**Egg of *T. trichopterus***

**Effect of different sex ratio on fertilization rate (%) of *C. auratus* and *T. trichopterus***

<i>C. auratus</i>		<i>T. trichopterus</i>	
Sex ratio	Fertilization rate (%)	Sex ratio	Fertilization rate (%)
Female: male		Female: male	
1:1	55.25±2.57	1:1	95.34±4.17
1:2	85.64±2.35	1:2	80.52±3.52
1:3	97.47±3.87	1:3	78.37±2.37
1:4	80.19±2.92	1:4	55.93±2.43

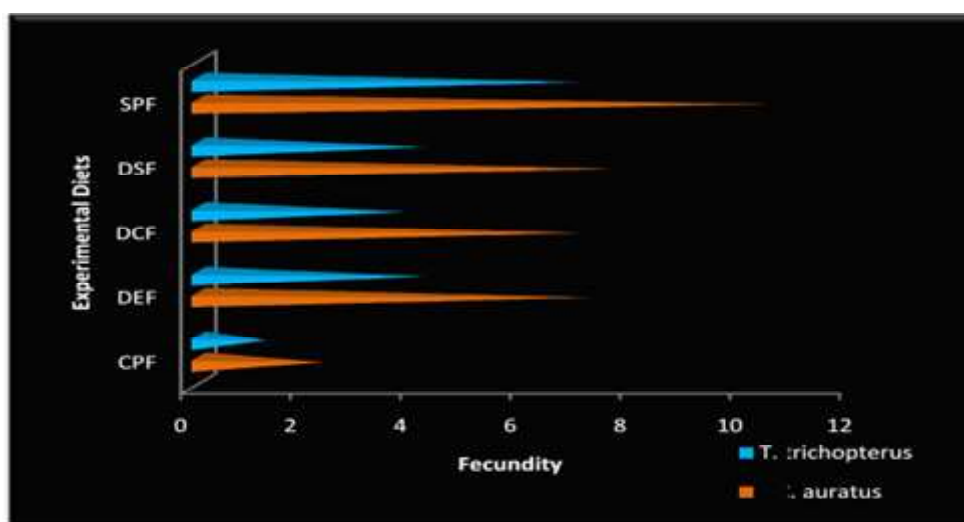
± SD from triplicate groups of fish

**Effect of experimental feed on breeding performance in *C. auratus***

Parameters	Control	DEF	DCF	DSF	SPF	P Value
Fecundity	1.24±0.09	4.12±1.24	3.83±0.78	4.14±0.56	6.98±1.35	P< 0.05
Fertilization Rate (%)	77.75±1.52	95.5±2.56	94.25±2.47	94.44±3.16	97.93±2.86	P< 0.05
Hatching Rate (%)	69.44±1.75	88.26±1.92	91.95±1.78	92.88±2.38	94.85±3.15	P< 0.05
GSI (%)	6.58±0.56	10.22±0.42	9.56±0.79	10.22±0.98	12.86±1.53	P< 0.05

**Effect of experimental feed on breeding performance of *T. trichopterus***

Parameters	Control	DEF	DCF	DSF	SPF	P Value
Fecundity	2.28±0.58	7.14±1.23	6.93±0.94	7.56±0.36	10.32±1.51	P<0.05
Fertilization rate (%)	83.33±1.75	90.47±2.34	89.47±1.98	90.48±2.76	95.83±3.15	P<0.05
Hatching rate (%)	78.33±1.95	88.57±1.69	86.31±2.95	88.57±1.96	91.66±3.13	P<0.05
GSI (%)	8.88±0.56	12.59±0.94	12.81±1.25	12.86±0.79	13.65±1.42	P<0.05



**Effect of experimental feed on fecundity of selected ornamental fishes**

**CONCLUSION**

Reproduction is the basic phenomenon required for the continued existence of living organisms. The reproductive success in fish species is influenced by many factors such as the brood stock, sex ratio, stocking density, age, size, nutrition and feeding regime. Broodstock productivity is the most significant constraint on commercial production of fish. There are several factors such as

environmental conditions, genetic factors and nutrition of feed that influence reproduction in fishes. (Mehrads and Sudagar, 2010) The water quality parameters play a crucial role in fishery to get high yield. (Bhatnagar and Devi, 2013)

The difference in fertilization rate between the different sex ratios of *C.auratus* and *T.trichopterus* observed to be significant. The studies on sex ratio provide information on the proportion of male to

female fish in a population and it also indicates the dominance of sex in a given population. Nutrition affects reproductive performance, egg quality and hatchability of fry. (Bagenal and Braum. 1978) Live feeds were considered as the best feed in ornamental fishes. (Bandyopadhyay *et al.* 2005) The improved gonadal development of selected ornamental fishes with DEF, DCF, DSF and SPF feed in the present study may be due to the nutrients present in the live feed. Therefore, it is concluded that live feed can be utilized as an ingredient in the formulation of experimental diets to ornamental fishes which enhance breeding performance, so that good quality eggs can be produced.

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