Int.J.Curr.Microbiol.App.Sci (2018) *7*(6): 3142-3148

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 06 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.706.369

Influence of Different Feed Additives on the Breeding Performance of Goldfish (*Carassius auratus*)

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Keywords

Gold fish, Feed additives, Breeding

Article Info

Accepted:
24 May 2018
Available Online:
10 June 2018

A B S T R A C T

In the present study was investigated that, the influence of different feed additives *viz.*, fish meal, shrimp head meal and soy flour on the breeding performance of goldfish. These three major ingredients were mixed in the feed at three different concentrations at 20, 30 and 40%. Totally, 15 numbers of goldfishes were stocked in 50 L capacity FRP tank for breeding. Every day the fishes were fed with 5% of the body weight. The experiment was conducted in the adult fishes for duration of 60 days and the sampling was carried out once in fortnight. Among three different concentrations tried, in fish meal containing feed with inclusion level of 30% concentration got best hatching survival rate (98%) With compared to the control fish 87% of survival rate was observed.

Introduction

India is blessed with a rich diversity of freshwater fishes both in the Western Ghats and North Eastern hills. The Western Ghats of India is one of the 34-Biodiversity 'hotspot' areas of the World (Anna Mercy, 2007). Most of the freshwater ornamental fish is sourced from developing countries viz., tropical and sub-tropical regions.

The international trade in ornamental fish in fact, provides employment opportunities for thousands of rural people in developing countries. Over 2500 species of ornamental fishes are involved in the global industry, of which over 60% are of freshwater origin.

Freshwater ornamental fish breeding is an emerging sector and can be a world-scale opportunity area for fish farmers in India. The ornamental fish trade earns foreign exchange, besides serving as a source of employment to rural population. It has a significant role in the economy on country and state level (Ahilan *et al.*, 2010). On the basis of the breeding behavior of ornamental fishes may be categorized in two groups, live bearer and egg layers (Thakur 2004). Among the egg layers one of the most popular ornamental fish for commercial production in ponds as well as in the aquariums is goldfish (*Carassius auratus*). Goldfish lay the eggs easily in captivity condition, uses wide variety of natural foods as well as formulated feeds, can tolerate poor

water quality and grows rapidly at warm temperatures. Many researchers in Iran (Akbary *et al.,* 2010; Bo Zhang, 2010 and Moogouei *et al.,* 2010) have studied the effects of environmental changes on growth, survival and spatial distribution in many species. These studies have also involved in the nutrient requirements of larval stage of ornamental fishes. While it is not easy to quantify the nutritional requirements of larval fish, its believed that the optimal formulations for the first feeding of larvae should simulate the yolk composition and to some extent reflect the nutrient requirement and metabolic capabilities of larval stages of ornamental fishes.

Materials and Methods

The present experiment was conducted for the period 60 days to find out the influence of selected alternative feed additives on the breeding performance of goldfish.

Breeding trial

The gold fishes (Fig 1) were stocked in the FRP tank with the weight of the fishes ranged between 8.00 and 9.54 gram for breeding trial. A total of 10 tanks with 50 litre capacity were used for this experiment. (Three additives with three different concentrations and a control tank).

Before starting the experiment the tanks were washed with lime and dried under the sun light. A total of 15 fishes (containing two replications) were stocked in one FRP tank. The fishes were fed at 5% of the body weight. The experimental tanks were properly aerated. Water exchange was done twice weekly.

Nylon fibrils were provided in the tank for laying of eggs. The parameters like number of eggs laid, hatching time and survival rate were recorded.

Feed additives

Feed additives such as fish meal, shrimp head meal and soy flour (Fig 2) were selected for this study. These ingredients were dried well and powdered. The major ingredients were mixed in the feed at three different concentrations viz., 20, 30 and 40%. The control feed was prepared without adding the major ingredients.

Preparation of feed

Common ingredients such as fish meal, shrimp head meal and soy flour were procured from the local market Thoothukudi (Tamil Nadu) for the preparation of experimental and control feed. The ingredients were dried well and powdered. The major ingredients used for the preparation of feed were fish meal, shrimp head meal and soy flour. These major ingredients were mixed in the feed at three different concentrations viz., 20, 30, and 40%. The control feed was prepared without adding the major ingredients.

All the ingredients and feed additives like (fish meal, shrimp head meal and soy flour) except vitamin and mineral mixture were mixed well as per the ratio and made as a ball. The mixed feed balls were cooked in a pressure cooker for 10-15 minutes. Even distribution of additives was ensured by vigorous kneading during mixing. The cooked paste was cooled and vitamin and mineral mixture were added. Then each feed mixture was pelletized separately by using the manual pelletizer. Each pelletized feed pellets were dried separately under sun and stored in airtight containers.

Proximate composition of formulated test diets

The proximate composition of different test diets such as fish meal included diet (FM),

shrimp head meal included diet (SHM), soy flour included diet (SF) and control diet (C) are given in Table 1. The crude protein content of fish meal included diet is ranging from 19.25 to 39.85. The crude protein content for shrimp head meal and soy flour included diet varied from 20.22 to 39.11 and 18.62 to 39.86.

Results and Discussion

Influence of selected feed additives on the breeding performance of goldfish

Influence of fish meal on the breeding performance of goldfish

The breeding performance of goldfish fed with fish meal is presented in Table 2. Totally, 15 number of goldfishes were stocked in 50 L capacity FRP tank for breeding. The fishes were fed with the same feed which was used for the experiment. The number of eggs laid by the female fishes fed with fish meal diet ranged between 884 -1057. In this group, the eggs took 36 - 39 hour for hatching. The survival rates of the hatchlings were calculated to be 93 – 98%.The fish meal diet with 30% inclusion yielded the best result.

Influence of shrimp head meal on the breeding performance of goldfish

The breeding performance of goldfish fed with shrimp head meal diet is presented in Table 3. The number of eggs laid by the female fishes fed with shrimp head meal diet ranged from 966 to 1167. In this group the eggs took 38 - 41 hour for hatching.

The survival rate of the hatchlings were calculated to be 93 – 95%.The shrimp head meal diet with 20% concentration yielded the best result, though survival of hatchlings was slightly higher in 40% SHM diet.

Influence of soy flour on the breeding performance of goldfish

The breeding performance of goldfish fed with soy flour diet is presented in Table 4. The number of eggs laid by the female fishes fed 64 with soy flour diet ranged between 887 - 1029.

In this group the eggs took 36 - 39 hour for hatching. The survival rate of the hatchlings was calculated to be 90 - 95%.The soya flour diet with 40% inclusion yielded the best result.

Fig.1 Gold Fishes are stocked in the FRP tank

Fig.2 Three different Feed additives with 20%, 30% and 40% concentration

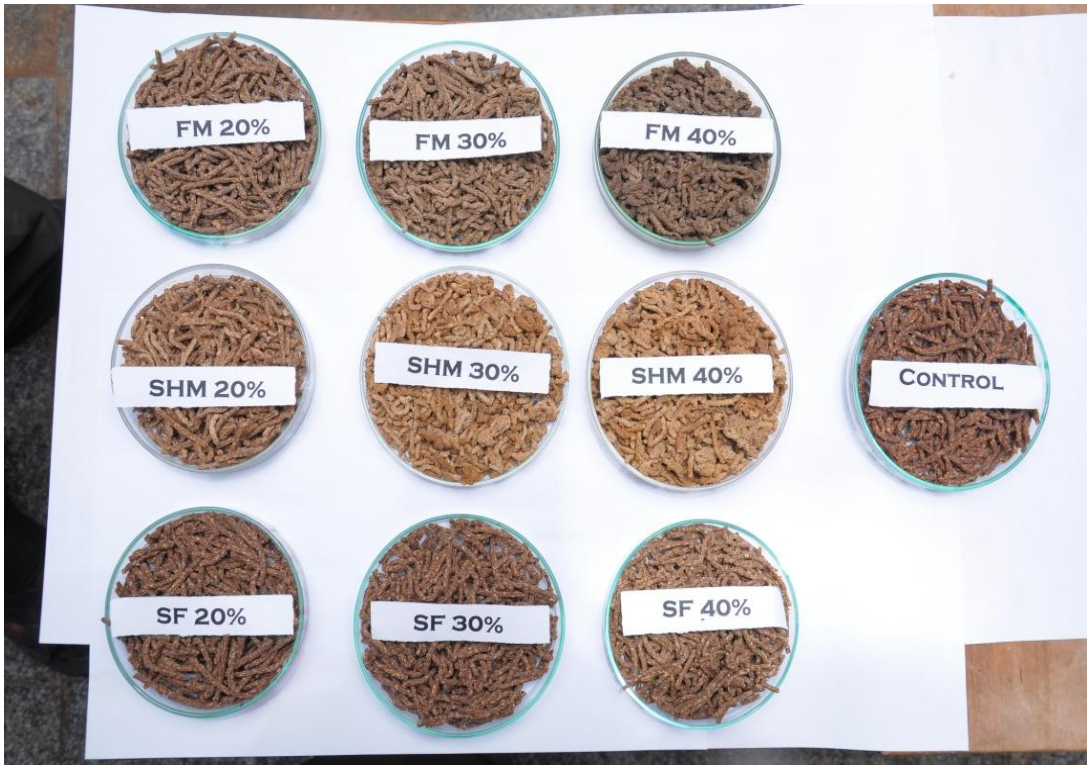

Fig.3 Highest survival rate (%) obtained in different ingredient at different inclusion level

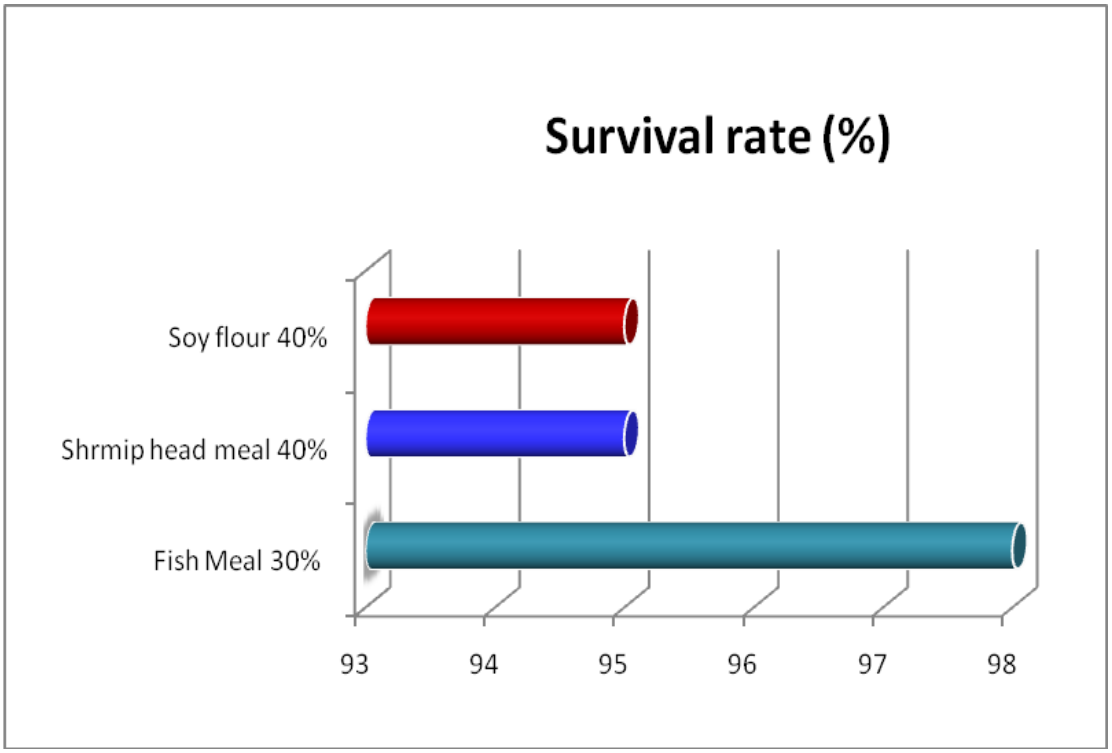

Table.1 Proximate composition of formulated test diets (g/100g) on a dry weight basis

Ingredient Name	Inclusion level (%)	Moisture	Dry Matter (DM)	Crude Protein	Crude Fat	Crude Fibre	Ash	Nitrogen free extract (NFE)
Fish meal	20	8.84	91.16	19.25	8.85	7.76	13.08	42.22
Fish meal	30	8.44	91.56	29.32	6.75	5.03	19.19	31.27
Fish meal	40	7.58	92.42	39.85	3.58	2.57	25.12	21.3
Shrimp head meal	20	8.70	91.3	20.22	4.21	8.44	11.30	47.13
Shrimp head meal	30	9.22	90.78	30.25	4.85	6.13	16.75	32.77
Shrimp head meal	40	10.00	90	39.11	5.15	6.02	17.67	22.05
Soy flour	20	10.06	89.94	18.62	9.25	7.81	6.29	47.97
Soy flour	30	9.64	90.36	29.42	10.5	6.93	5.78	37.73
Soy flour	40	10.09	89.91	39.86	11.25	4.67	4.01	30.12
Control	-	9.97	90.03	19.85	9.25	8.49	6.78	45.66

Table.2 Breeding performance of goldfish fed with fish meal included diet

Sl. No.	Inclusion level (%)	No. of eggs laid	Hatching time (Hour)	No. of hatchlings obtained	Survival rate (%)
1.	20	884	36	843	95
2.	30	1057	39	1038	98
3.	40	986	38	921	93
4.	0	480	43	420	87

Table.3 Breeding performance of goldfish fed with shrimp head meal included diet

Sl. No.	Inclusion level (%)	No. of eggs laid	Hatching time (Hour)	No. of hatchlings obtained	Survival rate (%)
1.	20	1167	38	1089	93
2.	30	966	41	908	93
3.	40	1064	39	1013	95
4.	0	480	43	420	87

Table.4 Breeding performance of goldfish fed with soy flour included diet

Sl. No.	Inclusion level (%)	No. of eggs laid	Hatching time (Hour)	No. of hatchlings obtained	Survival rate (%)
1.	20	986	39	888	90
2.	30	887	36	801	90
3.	40	1029	38	984	95
4.	0	480	43	420	87

This experiment was carried out to find out the influence of selected feed additives on the breeding performance of goldfish. The experimental fishes were fed with feed incorporated with fish meal, shrimp head meal and soy flour at three different concentrations *viz*., 20, 30 and 40%. The fishes were fed with experimental feed twice a day at the rate of 5 percent of body weight. The experiment was conducted for a period of 60 days. The breeding performance of goldfish fed with different concentration of fish meal diet, 30% concentration yielded the best result (No. of eggs 1057) followed by 40% (No. of eggs 986). When compared to control (480) it was twofold higher in 40% concentration. 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 as stated by Salama (1996). James and Sampath (2002) opined that female fish need adequate protein, fat, vitamin and minerals for egg development and spawning. Yolk is composed of phospholipid protein and amalgam of minerals, protein and lipids.

Protein is essentially required for forming of follicles in the embryo. The absence of any of these nutrients can reduce the survival of larvae. The survival rate of larvae is higher in the fishes fed with 30% concentration feed. Chong *et al.,* (2004) reported that a minimum of 30% protein should be included in the diet of Swordtail brood stock for optimum reproductive performance. In our study also the 30% protein feed performed better than the other concentrations and control.

With regard to breeding performance of goldfish fed with different concentration of shrimp head meal diet, 20% concentration yielded the best result (No. of eggs 1167) followed by 40% concentration (No. of eggs 1064). When compared to control it was 3 fold higher in 20% concentration.

With regard to breeding performance of goldfish fed with different concentration of soy flour diet, 40% concentration yielded the best result (No. of eggs 1029) followed by 20% concentration (No. of eggs 986). When compared to control it was 2 fold higher in 40% concentration. The survival rate of larvae is higher in the fishes fed with 40% protein feeds. Escaffre *et al.,* (1997) reported that incorporation of soybean protein concentration upto 40% in the diet did not adversely affect the survival and growth of carp larvae. In conclusion fish meal at 30% performed better in the growth of goldfish and shrimp head meal at 40% yielded best result as per as animal protein sources are concerned. With regard to plant protein source, soy flour at 30% concentration yielded the best result for the better growth of goldfish.

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How to cite this article:

Kannan B., A. Rathipriya, M. Nagoor Meeran and Ahilan B. 2018. Influence of Different Feed Additives on the Breeding Performance of Goldfish (*Carassius auratus*). *Int.J.Curr.Microbiol.App.Sci.* 7(06): 3142-3148. doi: https://doi.org/10.20546/ijcmas.2018.706.369