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Effects flower powders of rose *Rosa damascena* and sunflower *Helianthus annuus* on coloration of Gold Fish (*Carassius auratus*)

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Abstract

Efficiency of natural products on the colour enhancement of the gold fish *Carassius auratus* has been studied. Rose (*Rosa damascene*) flower powder mixed feed enhanced the attractive red colour in the gold fish *C. auratus*. However, it affected the normal growth of the fishes. Sunflower *Helianthus annuus* mixed food enhanced their yellow colour without affecting normal growth. Results indicated that the mixture of rose flower powder and sunflower powder may be used with the normal food to enhance and maintain the coloration of the gold fish kept in aquaria.

Keywords : gold fish (*Carassius auratus*), carotenoids, colour enhancement, natural products, rose *Rosa damascena*, sunflower *Helianthus annuus*

INTRODUCTION

Ornamental fishes are grown in aquaria for beauty and hobby. Ancient Egyptians kept large glass tanks of cold water fishes for decoration. Tropical fishes come in all different colours in the wild and are of great attraction to human beings. The pituitary gland of fishes secretes hormones that direct the production and storage of pigments throughout the life of fish, particularly when maturity is reached as pigment production and storage often increase at the onset of maturity (Evans *et al*., 2004). Carotenoid pigments which are red and orange and xanthophylls that are yellow may be laid over each other, or combined with proteins, to create the diverse range of colours in fish. Cells containing yellow pigments overlying those containing blue pigments can produce green hues. However, fishes are incapable of producing certain pigments such as carotenoids (red) and xanthophylls (yellow) pigments and as such depend on natural sources of pigments that are available in their diets (Selong, 2005). Indeed diets containning natural pigments were found to enhance colours of fish. For example, corn gluten meal and dried egg that contain xanthophylls (Yellow pigments) when added to the diet were found to enhance yellow colouration (Anon, 2005), the blue green algae *Spirulina,* a rich source of phycocyanin, in the diet to enhance yellow colouration (Shahidi *et al.,* 1998; Anon, 2005), C*hlorella vulgaris* to enhance the carotenoid concentration in gold fish (Gouveia and Rema, 2005), blue green algae to enhance blue colouration (Endler 1991) and the ground petals of marigold flowers have been used as a source of xanthophylls for fish colouration (Anon, 2005).

Gold fish (*Carassius auratus*) is a popular, fascinating, ornate coloured ornamental fish. How so ever, it is difficult to maintain and optimize their colouration in the controlled medium (aquarium). Effects of addition of flower powders of *rose Rosa damascena* and sunflower *Helianthus annuus* on colour enhancement of *C. auratus* have been described in this paper.

METHODS

The present study was conducted from November 2007 to April 2008 at Nehru Memorial College, Puthanampatti, Tiruchirappalli District, Tamil Nadu State, southern India. Gold fish fry were purchased from Star Aquarium at Trichirappalli and were transported in plastic bags that are partially filled with water, inflated with oxygen and sealed. The fry were separated into four groups, acclimatized for five days, and stocked in troughs.

Experimental design

Totally 20 gold fish fry were selected and randomly placed in 4 experimental groups, *viz.,* Group-I, Group-II, Group-III and Group-IV, of 5 fries each. All groups were maintained in troughs of 25 cm depth and 40 cm diameter at room temperature and with similar water quality.

Group-I: This group was considered to be the "control". In this group, the gold fish fry were fed with normal feed (wheat flour, egg albumin and vascularized *Spirulina* feed in the ratio of 2:1; 0.5) and with a feeding ration of 7 % of its body weight.

Group-II: In this group, the gold fish fry were fed with Feed-A which contained flower powder of *R. domascena*. Feed-A was prepared by mixing wheat flour, egg albumin, *Spirulina* and powdered flower, in the ratio of 2: 1: 0.5: 0.5 and a feeding ration of 7 % of the body weight was followed.

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Group-III: In this group, the gold fish fry were fed with Feed-B which contained ground flower of *H. annuus*. Feed-B was prepared by mixing wheat flour, egg albumin, Spirulina and flower powder in the ratio of 2:1:0.5:0.5 and with a feeding ration of 7% of body weight.

Group-IV: In this group, the gold fish fry were fed with Feed-C which was a mixture with flower powders of both the plants (*R. domascena* and *H. annuus*) along with normal feed i.e., wheat flour, egg albumin, Spirulina feed and flower powders in the ratio of 2:1:0.5:0.5 and with a feeding ration of 7% of body weight of fish stocks.

Management

(a) Pre-stocking Management: The troughs were cleaned with detergent powder and the bottom of troughs and sidewalls were scrubbed by using detergent powder, and then rinsed thoroughly with water to remove soapsuds and loosened contaminants. Then they were disinfected with 100 ppm of chlorine for one hour and the trough bottom and sidewalls were scrubbed once again. Finally, they were rinsed several times with clean fresh water and allowed to dry under sun light. Thereafter, the troughs were filled with tap water for experiments.

(b) Stocking Management of Gold Fish: The four experimental groups of Gold fish fry were stocked in separate troughs and kept in similar environmental conditions.

(c) Post-stocking Management: Each trial was conducted for three weeks duration. The fish fry were fed twice a day at 9.30 am and 4.30 pm, everyday. The excreta were removed from the trough through a siphon every morning. Thereafter, troughs were filled with required amounts of fresh water and then the fry were fed with fresh feeds.

Measurement of Coloration

At the end of the experiments, the colour intensity of gold fish were assessed visually by comparing body colour of control (Group-I) and treatment groups (Group-II, Group-III and Group-IV).

Growth study

Growth of gold fish fry was studied by measuring morphometric variables. All morphometric variables of fishes were measured at weekly intervals throughout the study period with the help of measuring scale with 1.0 mm accuracy. For morphometric measurements fry were caught by simple hand netting and kept in containers with three liters capacity. Then broken pieces of ice were added to chill down the water to 10^0C for sedation of fishes. The use of chilled water brings in practical benefits by way of controlling chances of injury and reducing the time required for handling.

Morphometric measurements: A measuring board with measuring scale, divider and electronic weighing balance were used for measurements. The Morphometric variables measured in the sedated fish were total length (cm), standard length (body length) (cm), body depth (cm) and body mass (g).

(i) Total length: Total length represents the maximum elongation of the body from end to end. It is the distance between anterior most part of the body (snout) and the posterior most tip of the caudal fin. It was measured by using the measuring board.

(ii) Standard length: Standard length represents the distance from the anterior most part of the body (snout) to the base of the caudal fin. Standard length was also measured by using the measuring board.

(iii)Body depth: Body depth represents the distance from the dorsal to the ventral surface of the deepest point. It was measured by using divider and centimeter scale.

(iv) Body mass: The sedated fish was placed on a digital electronic balance and weighed. Before measuring, a butter paper (to maintain the wetness of the body) was placed on the balance and zero was set.

(v) Percent Growth Rate (PGR)

Growth rate was calculated as percentage.

$$PGR = \frac{X_2 - X_1}{T} \times 100$$

Where X_1 is the initial value of individual parameter, X_2 in the final value and, T is the duration in days (Medawar, 1945).

RESULTS AND DISCUSSION

Skin pigmentation is caused by dots (colour cells called chromatophores) the intensity of which is determined by how densely the dots are packed and how intensely each dot are coloured (Beeching, 1995). Coloration is controlled by endocrine and nervous system; however dietary sources containing pigments also play an important role in determining colour in fishes (Anon, 2006). The distribution of chromatophores is genetically determined, while the pigments themselves are designed from the diet (Bjerkeng, *et al.* 1992; Fujii, 1993). There are recognized natural sources with carotenoids suitable for colour enhancement and are also known for their variety of carotenoids. For example Mari gold petals have more than 20 different Carotenoids with a concentration of about 9000 mg/kg (Annon, 2005).

In the present study, *R. damascena* and *H. annuus* flowers were used to test their colour enhancement potentials on the ornamental gold fish *C. auratus*. Results showed that *R. damascena* flower powder mixed feed enhanced

Table 1. Percent growth rate (Mean ± *S.D.*) of different experimental groups of gold fish (*Carassius auratus*) when fed with flower powder mixed feeds. Two way ANOVA[b] investigates the effects of experiment type and week on the growth parameters

S.No	Parameters	Experiment type[a]	Week I	Week II	Week III
1	Standard length (cm)	Group-I	1.14±1.56	1.43±1.43	1.43±1.43
		Group- II	0	0.86±0.78	0
		Group-III	0.29±0.64	0.29±0.64	0.86±1.28
		Group-IV	0.29±0.64	0.29±0.64	1.14±1.20
	Two –way ANOVA	Sources of variation		*F*	*P*
		Experiment type		3.12	0.035
		Week		1.70	0.194
		Experiment type * Week		1.15	0.347
2	Total length (cm)	Group-I	1.14±1.56	3.71±2.60	1.43±1.73
		Group- II	0.29±0.64	0.86±78	1.43±2.02
		Group-III	1.14±1.86	1.43±1.43	2.29±1.92
		Group-IV	0.86±0.78	2.0±1.92	2.0±1.63
	Two –way ANOVA	Sources of variation		*F*	*P*
		Experiment type		1.41	0.250
		Week		0.09	0.912
		Experiment type * Week		0.87	0.525
3	Caudal length (cm)	Group-I	0	2.29±1.63	0.86±0.78
		Group- II	0.29±0.64	0	1.43±2.02
		Group-III	0.57±0.78	1.14±0.64	1.14±0.64
		Group-IV	0.57±0.78	2.57±1.20	1.14±1.20
	Two –way ANOVA	Sources of variation		*F*	*P*
		Experiment type		0.90	0.449
		Week		4.64	0.014
		Experiment type * Week		0.50	0.803
4	Body depth (cm)	Group-I	0.29±0.64	4.29±2.67	2.29±1.63
		Group- II	0.86±1.92	0.29±0.64	1.43±2.47
		Group-III	0	0.86±1.92	0.29±0.64
		Group-IV	0	2.0±1.92	2.57±1.86
	Two –way ANOVA	Sources of variation		*F*	*P*
		Experiment type		4.51	0.007
		Week		6.89	0.002
		Experiment type * Week		1.82	0.115
5	Body weight (g)	Group-I	0	1.71±1.56	1.71±1.20
		Group- II	0	0.57±0.78	0.86±0.78
		Group-III	0	0.29±0.64	0.57±1.28
		Group-IV	0	0	1.43±1.43
	Two –way ANOVA	Sources of variation		*F*	*P*
		Experiment type		2.47	0.073
		Week		9.70	0.000
		Experiment type * Week		1.20	0.324

[a]Group-I (Control); Group- II (Rose flower powder mixed feed); Group-III (Sunflower powder mixed feed); Group-IV (both rose and sunflower powder mixed feed)
[b]Significant *P* values are indicated by bold letters

Plate 1. Colour variation in different groups fishes with reference to various feed formulations

Group 1 (Control)

Gropu 2 (Fed with Rose flower powder mixed feed)

Gropu 3 (Fed with Sunflower powder mixed feed)

Gropu 4 (Fed with both flower powders mixed feed)

red colour on the gold fish (Plate 1). It may be due to the presence of pigments carotene and anthocyanin in the rose flower (Satio and Regier, 1971; Wikipedia, 2008a). The *H. annuus* flower powder mixed feed improved yellow colour (Plate 1). The presence of yellow pigments, xanthophylls (xanthoxin and taraxanthin) and lutein in sunflower (Wikipedia, 2008b) might have provided yellowish hue to the experimental gold fish. The mixture of both the flowers (*R .damascena* and *H. annuus*) improved both red and yellow colouration on the experimental gold fish (Plate 1).

Growth Rate : The intensity of colour could also be affected by overall body condition (which could be directly influenced by the rest of the diet) and stress and thus in the present study the growth and body condition when fed with different diets were also assessed. The growth rate of gold fish is highly variable and their final size depends on the condition in which they are kept. The main factors which control the growth rate of gold fish are feeding and temperature. Gold fish grow faster if they were fed a higher protein feed or fed more often given an adequate food supply (Cejas *et al.,* 2003). Results of the present study revealed that the rose flower powder mixed feed highly enhanced the red colour of gold fish; however, the growth rate was poor as inferred from the lower morphometric features when compared to the other feed (Table 1). The sunflower powder mixed feed enhanced the yellow colour and also markedly increased the growth rate of gold fish (Table 1). It may due to the presence of rich protein in the sun flower (Cejas *et al*., 2003; Wikipedia, 2008b). Although feed with both sunflower and rose powder enhanced the red and yellow colours in the same fish, it decreased the growth rate (Table 1). So, it is inferred that the sunflower feed enhanced the colour without altering the normal body growth rate whereas the rose flower powder mixed feed even though enhanced the body colour, it affected the normal growth.

CONCLUSIONS

R. damascena flower powder mixed diet enhanced the red coloration of gold fish; however the growth rate was poor.

H. annuus flower powder mixed diet enhanced the yellow coloration of gold fish without affecting their normal growth.

Similarly, the mixture of both flower powders (*R. damascena* and *H. annuus*) enhanced the red and yellow colour; but the growth rate was poor.

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