



Effect of Synthetic Hormone on Breeding Potential of Gold Fish (*Carassius auratus*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The acquisition of ornamental fish is becoming a prerequisite for luxury. Fish which are ornamental are getting progressively more popular as a way to alleviate stress. Among these, goldfish and koi carp are the most prevalent visually appealing fish that happen to be consistently in demand by fish hobbyists. For millennia, the method of raising these fish has been standardized. One of the most significant advancements in the aquaculture of ornamental fish that are vital to economic prosperity is artificial propagation. Induced breeding is a straightforward approach that guarantees a timely supply of seed spawn for fish culture. The aim of the current study was to use ovaprim™ hormone at various dosages to encourage breeding in gold fish (*Carassius auratus auratus*) kept in captivity. Every breeding pair, including the control, was bred. There were significant (<0.05) variations in the

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success of fertilization and hatching rate at various doses between treatments and the control group. Ovaprim™ at a dose of 0.7ml/kg and 1.4ml/Kg was found to be effective for male and female respectively with 54% fertilization rate, 43 % hatching rate. The positive response to synthetic hormone (ovaprim™) with considerable fertilization and hatching rate makes it possible to conduct the breeding program of this species commercially and the method can be applicable for commercial culture.

Keywords: Ornamental; hormone; breeding; fertilization; hatching.

1. INTRODUCTION

Aquaculture is rearing, breeding, and harvesting of aquatic animals in controlled aquatic environments, like lakes, rivers, ponds, and streams, etc. [1]. Most often, it is done for business and leisure but production of food, restoration of habitat, and protection of threatened species are its three main goals. According to the FAO, about 59.51 million people are engaged in the primary industry of the fish and seafood sector in the world, among which 20.53 million (34.5%) are in aquaculture and 38.98 million (65.5%) are in capture fisheries. The major contribution to the economy is of nutritious and ornamental fishes (FAO, 2022).

India ranks third in the world for fish output, making up 8% of total production and adding 1.1% and more than 6.72% to the gross value added (GVA) and agricultural GVA of the nation, respectively. India has grown its fish and fisheries product exports by 26.73% in terms of quantity between financial year (FN) 2021–22 and FY 2022–23, making it the fourth largest exporter of fish and fisheries products.

Nowadays, fish keeping has become a popular hobby complementing photography, with ornamental fish representing the most popular pets globally. Ornamental fishes, additionally referred to as "Living Jewels," have charmed the hearts of millions of people through their diverse forms and vivid hues [2].

India has plenty of potential for producing ornamental fish because of its considerable species diversity, pleasant coastal climate, and workforce availability. India's decorative fisheries account for roughly one percent of the international ornamental fish trade. In 2020–21, the value of the 54 tonnes of fish that are exported is equivalent to Rupees 13.08 crore. Overall, the quantity and their value in Indian rupees have shot up by 66.55% and 20.59%, correspondingly. Thereby, the fishing sector has an extensive potential uses in our nation, but

some of the most significant hurdles it confronts are a lack of proficiency in the breeding and cultivation of ornamental fish and a lack of encouragement from governmental organizations particularly when it comes to technical, legal, and infrastructure obstacles [3].

The fish industry is growing quickly but one of the main issues with fish farming is the lack of high-quality fish seed [4] Induced breeding has gained widespread recognition as a preferred strategy for the major expansion of aquaculture, with the goal of improving fish quality and quantity [5].

Synthetic ovulation stimulation is becoming more and more common in the fishing industry since it maximises fish output and yields financial gains under strict adherence to other requirements for fish farming [6]. Ovatide and Ovaprim are two common synthetic commercial formulations used in induced breeding [7].

One of the oldest and most well-liked hobbies for enthusiasts of beautiful fish worldwide is caring for goldfish (*Carassius auratus*), the original species of decorative or live jewels [8]. The goldfish, are among the greatest aquarium fish in the world. They are closely related to Indian big carps and are members of the Cyprinidae family [9].

2. MATERIALS AND METHODS

2.1 Overview of the Research Area

The experiment was carried out in the fish nutrition lab of College of Fisheries Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar, and Veterinary Teaching and Clinical Complex, LUVAS, Hisar.

2.3 Collection of Fishes

The healthy fish brooders of gold fish (*Carassius auratus*) were procured from the Kolkata fish market and placed in fibre tanks in the laboratory

so as to enable them to acclimatise. Before being placed in aquariums, they underwent a treatment of 5% potassium permanganate in order to safeguard them from bacteria. Following that, they were transferred into aquaria.

2.4 Brood Fish Conditioning

Fish brooders were separated in the breeding aquarium, and acclimatised for two weeks at a ratio of 2:3 (female to male). The size of the belly and genital papillae allowed males to be distinguished from females. In the breeding aquaria, aquatic plants such as Hydrilla were added, along with a few artificial aquatic plants, to provide protection and places for concealment, as well as for mounting adhesive eggs. Using a hormonal syringe, synthetic hormone ovaprim™ was used for breeding experiment.

2.5 Injecting Hormone

Female brooders with protruding bellies were chosen for gravity. Following that, they received an evening injection of ovaprim hormone. To protect them from infection, the fish were submerged in the KMnO₄ solution prior to injection. The female brood fish were injected intramuscularly in the dorsolateral area of their bodies. The initial dosage of ovaprim™ was adjusted to be 0.5 ml/kg of body weight for females and no dose for males.

2.6 Stripping and Fertilization

At first female was stripped and eggs were collected in a bowl. In the meantime, respective

male was stripped and collected milt was mixed well with previously collected eggs. A clean, sterile feather was thoroughly mixed with physiological saline to improve the fertility outcome. After that, the inseminated eggs were moved into an incubator jar with a constant supply of water. In this way, fertilised eggs hatched.

2.7 Determination of Fertilization Rate and Hatching Rate

Using a soft, thin brush, the fertilised eggs were counted after being examined under a magnifying lens.

The translucent egg shell of the fertilised eggs, accompanied by a black or grey patch inside, allowed for their easy separation from the opaque unfertilized eggs.

The fertilization rate was determined following the formula:

$$\text{Fertilization rate} = \frac{\text{no. of fertilised eggs}}{\text{Total no. of eggs}} \times 100$$

Samples were taken out of the hatching tank to calculate the hatching rate. Visual observations were used to count the total number of fertilised eggs in the sample and the number of hatchlings.

Then hatching rate was determined following the formula:

$$\text{Hatching rate} = \frac{\text{no. of hatchlings}}{\text{Total no. of fertilized eggs}} \times 100$$



Plate 1. Synthetic hormones



Plate 2. Disinfectant treatment using KmNO₄



Plate 3. Injecting hormone

Table 1. Doses of synthetic hormone given to Gold fish

Treatment	Sex (Male/ Female)	Dose: Ovaprim (ml/kg body weight)		
		1st dose	2nd dose	Total dose
Control	Female	0.5	0.5	1
	Male	Not used	0.5	0.5
T1	Female	0.7	0.7	1.4
	Male	Not used	0.7	0.7
T2	Female	1	1	2
	Male	Not used	1	1
T3	Female	1.2	1.2	2.4
	Male	Not used	1.2	1.2

3. RESULTS AND DISCUSSION

The year-round demand for ornamental fish can be satisfied by using the induced breeding approach. The use of synthetic hormones in induced breeding is common and has a strong track record. In the trial, ovaprim™ were administered to *C. auratus auratus* in order to successfully breed the species in captivity. According to the results of this study, the best

dose of ovaprim to induce *C. auratus* in captivity is 0.7 ml/kg body weight for males and 1.4 ml/kg body weight for females. El-Hawarry et al. [10] reported similar results in silver carp produced with several analogues of dopamine antagonists. The current study demonstrates that, in comparison to control, hormone induction enhances fertilisation, and hatching rate. It was discovered that the treatments differed in terms of fecundity, fertilisation, and hatching rate.



Plate 4. Male and female brooders after hormone injection



Plate 5. Goldfish fry

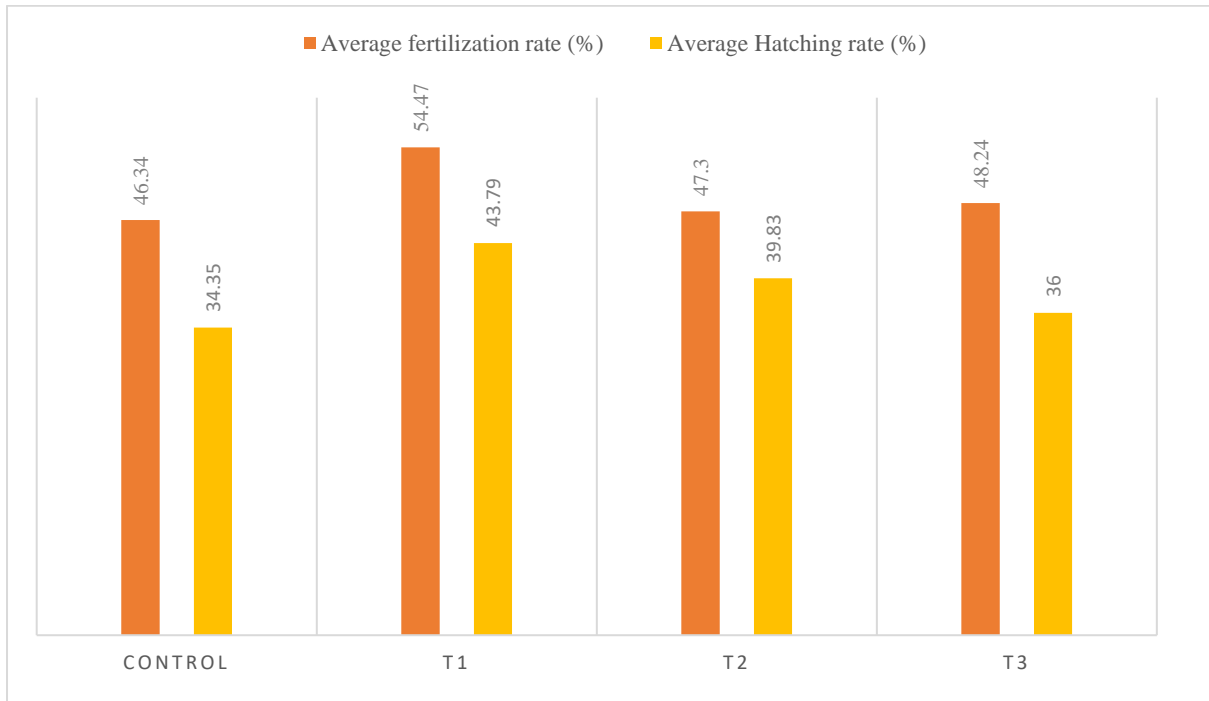


Fig. 1. Average fertilization and hatching rate in Goldfish

Fertilization and hatching rate were observed to be in the range of 46-54% and 34-43%. Yamamoto et al. (2011) reported similar outcomes in goldfish that were stimulated by Ovaprim and HCG.

The present study revealed that using synthetic hormones increased the fertilization and hatching rate in limited period of time thus will be very helpful in meeting high export demands.

4. CONCLUSION

Aquaculture is the growing, breeding, and harvesting of aquatic species in controlled aquatic environments, such as lakes, rivers, ponds, and streams, for the purpose of both plants and animals. Most often, it is done for business and leisure. The most popular fishes nowadays are ornamental fishes known for their coloration and beautiful shape [11]. One of the oldest and most well-liked hobbies for enthusiasts of beautiful fish worldwide is rearing goldfish (*Carassius auratus*), the original species of decorative or live jewels [12]. The goldfish, are among the greatest aquarium fish in the world. They are closely related to Indian big

carps and are members of the Cyprinidae family [7].

Synthetic ovulation stimulation is becoming more and more common in the fishing industry since it maximises fish output and yields financial gains under strict adherence to other requirements for fish farming [13] Ovotide and Ovaprim are two common synthetic commercial formulations used in induced breeding [14].

The use of synthetic hormones in induced breeding showed a significant increase in fertilization rate and hatching rate [15]. According to the results of this study, the best dose of ovaprim/ovotide to induce *C. auratus* in captivity is 0.7 ml/kg body weight for males and 0.5 ml/kg body weight for females [16]. Fertilization and hatching rate were observed to be in the range of 46-54% and 34-43%. Maximum fertilisation recorded is 54% and maximum hatching rate is 43% achieved by T1.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

We hereby declare that no AI technologies and image to text generators have been used during writing and editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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