REPRODUCTIVE AND DEVELOPMENTAL ASPECTS OF JAPANESE ORNAMENTAL CARP

Aurelia Nica[1*], E. Corbu[1], Adina Popescu[1], Daniela Cristina Ibanescu[1], I. Vasilean[1]

[1] *"Dunărea de Jos" University of Galati, Romania*

Abstract

The ornamental form of the carp, Cyprinus carpio L., provides a rich source of investigation for science and commercial possibilities alike. A study was made to investigate the effects of using carp pituitary extract on the spawning performance parameters of koi carp (Cyprinus carpio, L.). Brood carp used in the research- one female (total length 26,5 cm, weight 253 g) and one mascul (total length 28 cm, weight 237 g) - were reared in a pool from september 2015 to april 2019. The brooders were brought in the Aquaculture laboratory of Dunarea de Jos University of Galati and after acclimatization and treatment the fish were kept, separated on sex, in aquariums with a capacity of 150 liters, in a recirculating system. A single injection of 2 mg carp hypophysis was used for induction of the spawning of ornamental carp and this treatment caused successful ovulation. Hatching began 96 hrs after fertilization larvae emerged through the egg membrane, starting from the head. The length of larvae immediately after hatching was 6 mm, the mouth and anus were closed, and the pectoral fin was formed. Post larvae at 14 days after hatching had a total length of 11 mm, separate anal fin and dorsal membranes, and fin ray.

Key words: ornamental carp, spawning, fertilization, hatching, survival

INTRODUCTION

Water magic fascinates mankind for centuries. There are sketches dating from the 1400's. Hr. depicting gardens that are integrated ponds. Almost every culture has fulfilled in its own way the ancient dream of having water in its own garden.

The Chinese used water streams for meditative purposes, in the Islamic civilizations the waterfalls were used to promote relaxation, while in France extravagant springs and fountains represented health and good taste. Even today, ponds still have the same charm as 1000 years ago.

In a world subordinated art work full of stress, peace and relaxation are like a dream. Crowded by the tiring daily, people are thirsty after a corner of tranquility and relaxation. Ornamental carp, *Cyprinus carpio L.*, is king of the pond; he is now enjoying the attention of many fish farmers in the world. Therefore, as an ornamental carp, *Cyprinus carpio L.*, provides a rich source of research to science and business opportunities alike.

MATERIAL AND METHODS

The experiment was carried out in the specialized laboratory of the Department of Food Science, Food Engineering, Biotechnology and Aquaculture at the Faculty of Food Science and Engineering, "Dunarea de Jos" University of Galati. Mature healthy koi carp brooders, one male and one female, 4 age years, were selected by sexual dimorphism for breeding experiments. Female is usually easier to spot, as the belly of a mature female is generally plump, whereas male remains streamlined and more torpedo shaped. Males were typically mature at 2 years of age and females at 3 years of age [3].

The two breeders were brought on April 4, 2019 from the pond at the temperature of 10ºC and were introduced after acclimatization and treatment in a recirculating system at 20ºC. Treatment was done with KMnO4 - 0.1 g / l water for 5 minutes.

*Corresponding author: anica@ugal.ro
The manuscript was received: 19.09.2019
Accepted for publication: 22.10.2019

The fish were introduced separately by gender, aquariums capacity of 170 l and 150 l useful capacity. The female weight was 253 g, length 26.5 cm (figure 1) and the male weight was 237 g, length 28 cm (figure 2). The ration of 3% of the body weight, i.e. 7.59 g / female and 7.11 g / male, was established. Extruded SUPREME 10 (3 mm) granules, which were administered twice daily, were used.

Fig. 1 The female

Fig. 2 The male

Biochemical composition of the feed: crude protein 49%, crude fat 10%, crude fiber 1.5%, ash 7.9%, phosphorus 1.27%, calcium 1.5% and sodium 0.4%.

On June 3, 2019, so almost a month after their introduction, at 1:00 pm, breeders were injected with carp pituitary, 2 mg pituitary + 0.9 physiological / female serum and 2 mg pituitary + 0.6 serum physiological / male, at water temperature of 22ºC (figures 3 and 4). Manipulation of the breeders was done with a damp cloth, without anesthesia.

Locally available dry carp pituitary glands were used as inducing agent who was collected from market in preserved condition in airtight vials.

Fig. 3 Injection breeders

Fig. 4 Injection breeders

At first, the pituitary glands (Pt) were gently removed from the vial with a pair of forceps and dried by using the filter paper for 2-3 minutes and then weighted by an analytical electronic balance.

Weight of PG (mg) = (Wt× Pt) * 1000

where Wt represents total body weight (g) of all the fishes to be injected and Pt, represent the rate in mg PG to be injected/kg body weight.

The weighed PG was transferred to a tissue homogenizer for thoroughly crushing.

The freshly prepared supernatant solution of hormone was then taken slowly in a 1 ml syringe for injection. Brood fish was caught carefully by net and kept in sponge were covered by soft cloth. PG was then injected near the pectoral fin base. The amount of PG solution for each fish was determined according to the body weight of the brood fish.

After the injection, the breeders were introduced into an aquarium with a useful capacity of 130 l, a total capacity of 150 l, with netting on the bottom of the aquarium.

After some time (1 to 3hrs) one mL of water collected from depth to identify and calculate egg fertilization ratio.

Egg samples were identified through a magnifying glass and fertile eggs counted by the help of brush (soft thin). Fertile eggs have a transparent shell with black spot and unfertile eggs are pale in color and black spot also absent. For the determination of the fertilization ratio in eggs following formula were used [5]:

$$\text{Fertilization rate} = \frac{\text{Number of fertilized eggs}}{\text{Total number of eggs}} \times 100$$

To calculate hatching ratio, samples were collected from hatching tank and total number of fertile eggs in the sample and number of hatched larvae were counted through visual observations. Then hatching rate was calculated by following formula:

$$\text{Hatching rate} = \frac{\text{Number of hachlings}}{\text{Total number of fertilized eggs}} \times 100$$

RESULTS AND DISCUSSIONS

On June 4, 2019, at 7 o'clock, so after 18 hours after the injection, it was found that the deposits were deposited, the bottom of the aquariums filled with eggs, eggs on sponges, too (figure 5).

Fig. 5 The eggs

The breeders were removed from the breeding aquarium and reintroduced into the recirculating system. On the day when the deposition of the eggs was found, at 10 o'clock, long-term treatment was performed for the eggs, with malachite green, 5 ml / aquarium (130 l) to prevent the infestation of the eggs with *Saprolegnia fungus*, a harmful factor specific to the embryonic development.

On June 7, 2019, 10 o'clock, so 4 days after depositing (96 hours), at a temperature of 22ºC, that is, a number of 88 degrees days, larvae were observed in the aquarium. The length of the larvae at hatching in the case of our experiment was 6 mm. The hatched larvae remained glued to the substrate and mesh for as long as they fed on the yolk sac.

The fertilization rate of egg found by the recent study was 50.34 and hatching rate for fertilized eggs was obtained at 44.34.

After 2 days after hatching, the upper part of the bladder developed and the larvae began to swim actively in search of food. The developmental stages were divided into embryonic, larval and post larval development. The embryonic stage occurs in the egg shell till to hatching. The larval stage was considered from egg yolk till to exogenous feeding during this larva can move vertically. The stage of post larva starts when they swim horizontally because of egg yolk finished completely and looking for external feed (artificial) in the water [4].

Autonomous feeding and morphological changes characterized the larval stage [2]. The larvae were fed ad libitum with *Artemia salina* Nauplia, 2 meals / day (9 am and 15

pm). From June 15, a feeding table was introduced at 12 noon. Scarlet 0.5-0.8 mm extruded feed was used with the following biochemical composition: 53% crude protein, 13% crude fat, 0.2% crude fiber, 10.5% ash, 1.6% phosphorus, 2.5% calcium, sodium 0.6%, fast A 14 000 IU / kg, fast C 700 mg / kg, fast E 280 mg / kg, fast D3 1648 IU / kg. The feed contains fish meal, wheat flour, lecithin, fish oil, monocalcium phosphate. In choosing the diet for ornamental carp, the following main aspects must be taken into consideration: their nutritional requirements, the strengthening of the immune system, the growth and, last but not least, the intensification of the color. Larvae obtained free movement with the help of swimmers at the age of 10 hours.

Fig. 6 Larvae

Hubbs (1943) defined post-larva as a stage that began immediately after absorption of the vitelline sac that lasts as long as the structure and form are similar to that of the fry. The pectoral wings were differentiated and were in the form of a fallacy behind the operculum; at this point the lateral movement of the larvae has begun. At this stage the bladder with two chambers was seen. After 3 days, the vitelline sac was completely absorbed and the larvae began to actively swim in search of food. After 7 days, the post-larval color was lemon yellow and reached a length of 4.0-4.5 mm. Post-larval to fry metamorphosis occurred after 15 days. Most of the fry were lemon yellow, while some of them had black and orange coloring.

At this stage, the fry length ranged from 7-8 mm and they gradually resembled adults with external features. Koi fry has only one swimmer, which surrounds the back end of the body.

Fig. 7 Larvae

CONCLUSIONS

Results of the current study indicated successful induction of spawning koi carp using carp pituitary extract.

Because koi is an ornamental fish, its value is affected by perceived qualities and breeders aim to improve those qualities through parentage and selection criteria.

During the fry period, repeated fish selection is required, due to the strong manifestation of cannibalism.

ACKNOWLEDGEMENTS

This work was supported by Center for Scientific Research “Romania Center for Modeling of Recirculating Aquaculture Systems” - (MoRAS), from University Dunărea de Jos, of Galați which was established as a result of the implementation of the POSCCE project 622 / 11.03.2014.

REFERENCES

[1] Hubbs, C. L. 1973: Terminology of early stages of fishes. copeia 4: 260.

[2]. Haniffa M. A., Allen Benziger P. S., Jesu Arockiaraj A., Nagarajan M. and Siby P.: Breeding Behaviour and Embryonic Development of Koi Carp (*Cyprinus carpio*). Taiwania, 52(1): 93-99, 2007

[3] Grant W. Tempero , Nicholas Ling , Brendan J. Hicks & Matthew W. Osborne (2006) Age composition, growth, and reproduction of koi carp (*Cyprinus carpio*) in the lower Waikato region,

New Zealand, New Zealand Journal of Marine and Freshwater Research, 40:4, 571-583,DOI: 10.1080/00288330.2006.9517446
[4] Malik A.; Abbas G.; Jabbar A.; Sajjad Shah S.;Ali Muhammad A.: Effect of different salinity level on spawning, fertilization, hatching and survival of common carp, *Cyprinus carpio*
[5] Sajjad Shah S.Ali Muhammad A. Effect of different salinity level on spawning, fertilization, hatching and survival of common carp, *Cyprinus carpio* (Linnaeus, 1758) in semi-artificial environment. eus, 1758) in semi-artificial environment