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Optimization of Cyprinids Larvae Rearing Technology in Earth Ponds Filled by Brackish Water through the Application of Soya Milk in Uzbekistan

M.A.Yuldashov[1], B.G.Kamilov[1], Kim, S.I.[2], N.R.Tosheva[1], F.J.Utemuratova[1]

[1] - Tashkent State Agrarian University, Uzbekistan
[2] – ScientificResearch Institute of Fishery, Uzbekistan

Summary: At 5.06-27.06. 2020, post embryonal larvae (0.004 g) of common carp (Cyprinus carpio), grass carp (Ctenopharyngodon idella), silver carp (Hypophthalmichthys molitrix) and bighead carp (Hypophthalmichthys nobilis) were reared in monoculturein earthen ponds (1-3 ha each) filled with brackish water. Soybean milk was made from bean that had been soaked for 7 - 9 hours in water and grinded with some water; in common, about 10 kg of milk was produced from 1 kg of soybean; 15 kg/ha of soybean was applied during experiment. The water temperature was higher than 22°C, pH varied within 6.9-8.1, water salinity was 2.6 - 3.5 $^{o}/_{oo}$, dissolved oxygen varied within 3.5-5.9 mg/l during the day. To the June the 27th silver carp fry reached 1.0 - 2.1 (on average 1.49) g, bighead carp 1.1 - 2.0 (1.61) g, common carp – 1.0 – 2.5 (1.43), grass carp – 1.3 – 2.7 (1.81) g. Food conversion rate of soya milk was 3.72, 9.82, 1.58, 2.84, respectively. Fry survival rate was 41 - 45 %.

Key words: *common carp, silver carp, grass carp, bighead carp, soya milk, brackish water, aquaculture, Uzbekistan.*

INTRODUCTION

Cultured cyprinidfish species namely common carp (*Cyprinuscarpio*), grass carp (*Ctenopharyngodonidella*), silver carp (*Hypophthalmichthysmolitrix*) and bighead carp(*Hypophthalmichthys nobilis*) are the most important aquaculture species as in the world (FAO, 2018), so in Uzbekistan (Kamilov et al., 2003). Usually, larvae (post embryonal) rearing in ponds is conducted in fresh water, that is strong limitation for arid countries, where water resources are deficient. Technology adoption to brackish water is very promising; for example, in Uzbekistan, more than 50 % of total water resources are kept in drainage channels network (with brackish water). Another promising way to improve aquaculture is to find alternative fish feeds. In aquaculture, determinative share in running cost is expended on feeding the cultured fish. Protein is the most expensive component in fish feeds. Main peculiarity of different cyprinids species larvae is that feeding habits and habitat preferences are the same; they feed small size plankton organisms. So, the same technology of rearing for different species is used. Soy is promising source of fish feed by the high content of omega-3 fatty acids, high protein and unsaturated fat content (Aquaculture in China…, 1989). The goal of this study was to adopt cyprinid larvae rearing technology to brackish water with the administration of soy milk on growth performance of cyprinids larvae.

MATERIALS AND METHODS

An experiment was conducted from 5 June to 27 June (2020) in fish farm “Navruzkutbarrakasi” located on the bank of Central Drainage Collector in Syrdarya region, Uzbekistan. Larvae rearing of silver carp, common carp, grass carp and bighead carp was performed in monoculture in the four earthen ponds having an area of 1 – 3 ha, and an average depth of 1.20 m.

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Water quality parameters were studied daily by using portable thermooximeterYSI Pro.
Six days before stocking the pond with larvae, quicklime (300 kg/ha) and dung (5 t/ha) was spread throughout dry pond bed and fine filter was set on inlet sluice in each pond. Three days before stocking, pond filling up with water was begun; in stocking day water depth in lower part of pond was 10-20 cm, upper part was still dry. Larvae hatching occurred 3.06.2020; 3-day-old larvae of each species were stocked using routine method (Sbornik …, 1986).

Soybean milk was made from bean that had been soaked for 7 - 9 hours in water (water temperature 25-30^{o}C) and then grind with some water; in common, about 10 kg of milk was produced from 1 kg of soybean. Soy milkwas spread evenly into the ponds since 2 days before larvae stocking during the whole experiment. In average, 15 kg of soybean was applied to a 1 ha pond area.
Fish were weighed to the nearest to 0.01 g every week. Growth performance andfeed utilization parameters were determined as follows:

- Weight gain (g) = W2 – W1, where W1 (g) – the initialaverage (for each pond) body weight, W2 (g) – the average(for each pond) final fish weight;
- Relative growth rate (g/day) = weight gain / t, where t –period in days;
- Specific growth rate (SGR) (% per day) = [(lnW2 – lnW1)/ t] * 100, where ln – natural log;
- Feed conversion ratio (FCR) = feed intake (g) / wet bodyweight gain (g);

Data were analyzed by one-way analysis of variance(ANOVA) with “R” statistical software. Statisticalsignificance was determined at 5% ($P<0.05$).

RESULTS

In the first week, the water was concentrated near the outlet sluice, it warmed up well which made it possible to effectively use soy milkon relatively small area. On June the 10th, pond bed was filled by water; on June the 25th, water depth reached 1.5 m near outlet sluice (the deepest part of pond) and 70-80 sm near inlet one.

Hydrochemical regime of ponds. The water in the pond warmed up well: on June the 10th at 8-00, the water temperature in all ponds was 15.8 ° C, at 16-00 - 25.6 ° C, at 20-00 - 17 ° C; On Junethe 25th, the temperature was noticeably higher during the day: 25.2 ° C, 26.8 ° C, 31.5 ° C, respectively. During the experiment, pH varied from 6.9 to 8.1. During the day, the temperature increased by the second half of the day (Fig. 2), and the pH increased at night (Fig. 3). Both indicators were within the normal range. The salinity of water in the pond varied 2.6 - 3.5$^{o}/_{oo}$, i.e. was brackish. The content of dissolved oxygen throughout the month varied from 3.5 to 5.9 mg/l during the day.

Fish behavior and growth. Starting from the second week, when applying soy milk, it was seen that large flocks of silver carpand bighead carp threw themselves into the forming white clouds of milk in the water and actively swam in it. Common carp and grass carp were active when adding milk, they did not create flocks, but approached the places where milk was introduced. The fish were fed individually. Later, it was noticeable that the common carp kept (especially from the second half of June) in the places where milk was introduced.

The control catch, carried out on the June the 9th, showed that silver carp larvae reached 120 -140 (on average 129) mg, bighead carp – 120 – 150 (140) mg, common carp 120 – 150 (139) mg, grass carp – 131 – 200 (161) mg.

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The control catch, carried out on the June the 27th, showed that silver carp fry reached 1.0 - 2.1 (on average 1.49) g of the total weight of fish, bighead carp 1.1 - 2.0 (1.61) g, common carp – 1.0 – 2.5 (1.43), grass carp – 1.3 – 2.7 (1.81) g.

Fry survival rateof silver carp was 45 %, bighead carp – 42 %, common carp – 49 %,grasscarp – 43 %.

Growth performance. Average of initial weights, final weights, weight gains andother growth performance parameters of cyprinids larvae are shown in Table 1, so as growth performance and soy milk utilization parameters.

Table 1. Growth response and feed efficiency of cyprinid larvae with application of soya milk

Parameters	Silver carp	Bighead carp	Common carp	Grass carp
Initial individual weight, g	0.004	0.004	0.005	0.004
Final individual weight, g	1.49	1.61	1.43	1.81
Individual weight gain, g	1.486	1.606	1.425	1.806
Individual relative growth rate, g/day	67.55	73.0	64.77	82.09
Individual specific growth rate, % per day	26.91	27.26	25,71	27.79
Initial total biomass, kg	6,4	2,0	5,0	2
Final total biomass, kg	894	338,1	700,7	389,2
Total biomass gain, kg	887,6	336,1	695,7	387,2
Biomass relative growth rate, kg/day	40,35	15,28	31,62	17,6
Biomass specific growth rate, % per day	0,22	0,23	0,22	0,23
FCR of soy milk	3,72	9,82	1,58	2,84

It can be seen that indicators of different species individual growthwere close to each other, i.e. the larvae of different species studied grew on average the same.Indicators of pondswith different species differed in size; that is due to the fact that a different number of larvae were planted in the ponds so as soy milk, lime and mineral fertilizers were applied per unit area of the pond.In those ponds in which more larvae were planted, the final biomass, biomass increment, and relative biomass increment were higher, while food conversion rate (FCR) was significantly lower.

DISCUSSION

Cultured cyprinids are among the 4 most productive fish species in the world (FAO, 2018). They feed organisms of natural food base in pond and occupy the initial rungs of the food chains in the ecosystem.

In the temperate climate of Uzbekistan, the egg incubation carried out in May - June, the rearing of larvae to fry - in June, i.e. at the beginning of the optimal temperature conditions for the growth of these fish (more than 20-22 ° C). Such a favorable period lasts only 3.5 months, and then the water temperature cools (16-20 ° C), the growth of suumerlings slows down. From late October to early November, wintering conditions begin with a complete stop of fish growth. Thus, in order to use the short growing season and realize the growth potential of the species, the fish farming

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strategy is based on ensuring the aggressive growth of plankton biomass through the application of fertilizers.

In the conditions of the country, the accepted norms are as follows: stocking density 1-2 million pcs/ha, larvae grow up to 30-50 mg in 20 days, survival rate 40-50% (Sbornik…, 1986).In Uzbekistan, since the 1980s, the following version of this technology has been used: in June, larvae of different species in monoculture are grown to fry weighing 0.3-1 g (Kamilov et al., 2003).In July, nursery ponds are totally harvested, and fish of different species are stocked in polyculture (silver carp, common carp, grass carp and bighead carp); until the end of the growing season, summerlings are grown to 25 g on average.

Chinese aquaculturists have payed attention to soybeans as protein-rich culture.

The beans are soaked in water for 6-7 hours (Aquaculture ..., 2018), with the addition of water, they pass through the equipment for grinding with the addition of water (7.5 - 10 kg of water per 0.5 kg of beans), the resulting soy milk is sprayed in a pond with larva.In China, soy milk is made from soybean that has been soaked in water and then grind with some water. The optimum soaking time is 6-7 h at a water temperature of 25-30°C. When grinding, it is proper to add some water so that 7.5-10 kg of milk can be produced from 0.5 kg of soybean.

In Uzbekistan, there is no experience as of soymilk using in pond aquaculture, so of rearing larvae in brackish water.

Our experiment has shown that:
(a) it is possible to successfully grow cyprinids larvae to fry on brackish water of drainage channels network (salinity up to 3.5 $^{o}/_{oo}$) using a set of measures to stimulate the natural food base (plankton) development;
(b) soy milk may be a very promising alternative of feeding carp larvae in earthen ponds.

The results obtained in experiment are in good agreement with the norms of pond polyculture for the south zone of temperate climate:

- survival rate of fry was 41-45%;
- fish growth was high; the individuals had fast growth (fry reached more than 4 g in compare with recently norms 0.3-1 g).

As we can conclude, a portion of the soybean milk is consumed by the fry; most of it serves as a fertilizer. Soybean milk gives a more stable water fertility than green manure.

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Fig. 1.Fillingafrypondforgrowing cyprinids larvae in monoculture, Syrdarya region, Uzbekistan, 2020

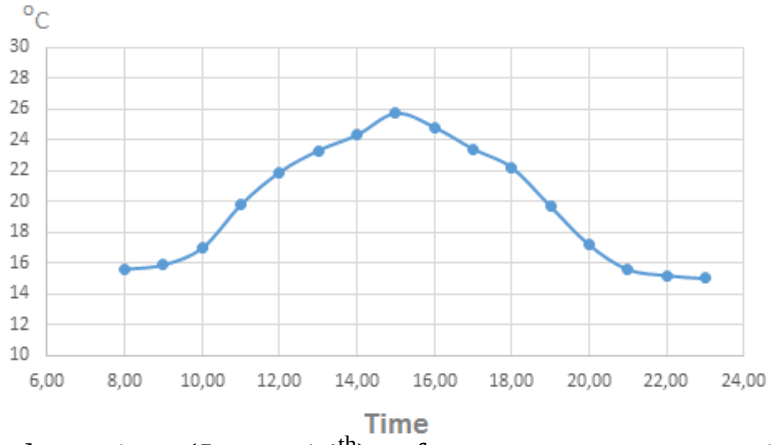

Fig. 2. Daily dynamics (June, 14th) of water temperature in pond No. 2, CentralGolodnostepdrainagecollector, Syrdaryaregion, Uzbekistan

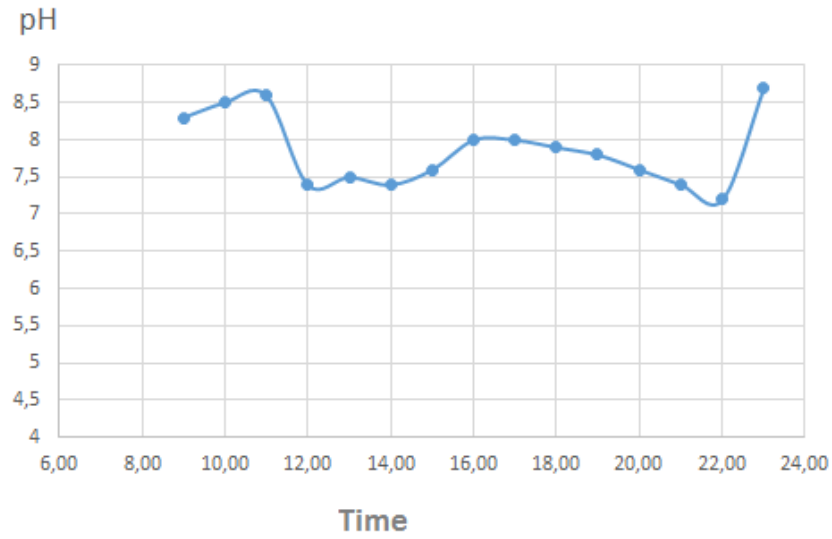

Fig. 3. Daily dynamics of hydrogen potential (June, 14th) in pond No. 2,CentralGolodnostepdrainagecollector, Syrdaryaregion, Uzbekistan