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Research Article

Study on Growth of Silver Carp (Hypophthalmichthys Molitrix) fed by Diatoma Microalgae in Pond

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Abstract

The common method of fertilizing to increase live food (microalgae) in Hypophthalmichthys molitrix ponds has disadvantages, including the fact that fertilizers increase the population of microalgae of all types (toxic and non-toxic) without human control and thus can cause growth. Unwanted to become harmful algae. This study was carried out at the same time with the beginning of the summer season and breeding of silver carp, with the aim of enriching the microalgae composition of warm-water fish breeding ponds located in Mazandaran province. Growth rate was calculated according to the treatments. 100 young of 90g Silver Carp were stored in each pond. Experiments were performed in circular concrete ponds with a diameter of 6 meters and a water height of 1 meter. Different microalgae compositions (1: 70% chlorella, 30% diatoma, 2: 70% diatoma, 30% chlorella and 3: control of natural algae composition of the area) were fed during the experiment. In this study, the growth rate of Silver Carp in different densities of Diatoma and Chlorella algae was evaluated in combination with different percentages in the pond environment and at the end of the experiment, survival percentage, fish growth rate, specific growth rate and average daily growth were calculated. Ponds whose fish were water-enriched with Diatoma microalgae with a density of 70% had higher growth (survival rate, fish growth rate, specific growth rate and average daily growth). Also, according to this study, since one of the condition for having a healthy farmed fish is to have a healthy and proper nutrition, so it is necessary to increase the share of edible microalgae Diatoma in the breeding environment of these fish to produce more and higher quality of these fish

Key Words: silver carp; hypophthalmichthys molitrix; diatoma; growth; nutrition

Introduction

Since one of the conditions for having large and healthy farmed fish is to have a healthy and proper nutrition, the preparation and breeding of live food is very important. Different species of microalgae have different amounts of absorption and some of them are harmful to fish.

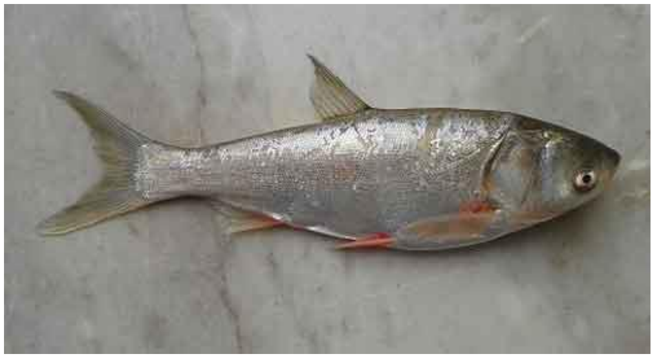

Figure 1. Silver Carp (*Hypophtalmichthys molitrix*)

Despite the high importance of microalgae as primary producers in water resources, their overgrowth causes problems in water quality properties such as color, odor, taste, dissolved oxygen and turbidity of water. Therefore, control of algal biomass is one of the main main management goals in any water source. The use of silver carp due to its microalgae is one of the method of biological control of algal biomass and water quality management (Ghelichi et al., 2016), (Farhangi et al., 2011).

The effect of fertilizer types on the emergence of microalgae species in fish farming ponds have been investigated. According to the results of this researcher, the use of organic fertilizers increases the population of bacteria and benthos, while the use of chemical fertilizers increases the abundance of microalgae (Mohammadyarani et al., 2003).

The contents of the gastrointestinal tract of silver carp were examined for abundance and digestion of food particles. According to the researchers, the diet of this fish includes detritus, protozoa, other algae and green algae in order of importance But very little information is available about the effect of feeding several species of algae with different percentages of frequency. One pond varies from pond to pond in the same place with similar ecological conditions. One of the goals of the present project is to increase the growth rate of Silver Carp by using a combination of microscopic live algae. In recent years, different fertilization methods have been used to increase live food, which has disadvantages, including the fact that fertilizers, especially chemical fertilizers, have a direct negative effect on aquatic animals. The use of methods that dominate the density of edible microalgae in the breeding environment can have beneficial nutritional effects along with a significant increase in quantity and quality in the fish produced. Phytophagous fish are considered for their rapid growth, breedabikity with other fish, good food and also because of their short food chain and as a result have less energy loss. Since this fish makes up about 60% of the composition of warm-water fish ponds, the study of this fish is of particular importance. The main producers, especially in the oceans and deep waters, are phytoplankton. Phytoplankton undoubtedly play a vital role for aquatic ecosystems, because they make up the bulk of the zooplankton diet (Webergen, 2002).

Phytoplankton are single-celled plants that grow and multiply in sunlight with the help of sunlight and dissolved minerals and organics in the water column, and are themselves consumed by filter vegetarians. In any aquatic ecocystem, phytoplankton are important and valuable reserves in terms of organic matter production and being at the bottom of the energy pyramid, and other organisms are directly and indirectly dependent on phytoplankton while interdependent in the food chain. Therefore, their knowledge in any water source, including hydrothermal fish breeding ponds, the production of which is based on phytoplankton nutrition, is of particular importance done.

Tahami et al., (2002) studied the contents of the silver carp digestive tract in terms of abundance and digestion of food particles. According to the results of these researchers, the main food of this fish is phytoplankton of the diatom group, especially Cyclotella.

Tahami et al., (2002) Cyanobacteria, Chlorophyta, Bacillariophyta, Euglenophyta and Pyrrophyta microalgae groups observed in the contents of the intestine of juvenile fish (*Hypophthalmichtys molitrix*). Tahami et al., (2002) classified microalgae as easy to digest and difficult to digest based on changes in the composition of microalgae at the beginning and end of the intestine of silver carp, and this classification may not be absolutely acceptable in all cases.

Zahmatkesh Koumele (1995) has also stated in his research that according to the observation of most microalgae at the beginning and end of the digestive tract of silver carp, it seems that fish to provide their protein, fat and essential amino acids Feed on various microalgae. Therefore, it is necessary to carefully study the essential fatty acids and amino acides required in the growth and breeding of silver carp and by special cultivation of microalgae to prepare a suitable diet in feeding silver carp.

A study examining the eating habits and feeding habits of phytophagous silver carp, as well as the morphological and anatomical changes of phytophagous silver carp during the rearing period, the major diet of Norse juveniles and toe juveniles, has shown that silver carp the enzyme needed for digestion is fiber, chitin, pectin, etc.... and so phytophagous juveniles for digestion of many phytoplankton belonging to the category of green-blue, green, oglens that have a chitin wall or have difficulty or are not able to digest them at all, and the higher the density of plant plankton in the body. The intensity of refining decreases and, unlike plankton eaten by fish, it is not fully digested and excreted in the feces, which is due to the different cell wall compositions of plant plankton and the digestive enzymes of Silver Carp (Nazari, 1996).

The type of food and its size are important for filter fish, and the production of Silver Carp depends entirely on the quality, quantity, availability of desirable food, and environmental conditions and aithogh algae are the staple food of silver carp, zooplankton, bacteria, benthic organisms, and detritus are other food sources that are inadvertently eaten by fish. Also, according to the Dong study, silver carp do not have selective food properties and microalgae groups are fed with the same ratio and intensity of density in the aquatic environment (Dong & Li, 1996).

- Ecological condition of the project area:

This project is located in the Caspian Sea Ecology Research Institute located in the north of the country, Sari city and adjacent to the Caspian Sea with geographical coordinates of 53 degrees and 6 minutes east longitude and 36 degrees and 48 minutes north latitude; It was done 25 km north of Sari. Data analysis was performed in the laboratories of the Caspian Sea Ecology Research Institute with ISO 17025 standard and under the supervision of experts in this field.

Research Method:

Preparation of primary stock of Diatoma sp.

Some freshwater diatom microalgae were prepared from the old route of the Tajan River near the Caspian Ecological Research Institute. Water samples from this pond were transferred to the laboratory and during several days (10 days) several genera of diatoms (Bacillariophyta) were isolated from other phytoplankton and cultured in different containers using general diatom medium (TMRL + NaSiO3). The isolated diatomaceous species included Cyclotella, Nitzschia, Navicula, Cymbella, Gomphonema and Diatoma, which were grown in different containers at 25° C, continuous exposure and aeration. Cultures were examined under a microscope on different days, and after 8 days, Diatoma and Cyclotella genera first survived and grew. Continued cultivation of only the genus Diatoma sp. It had a logarithmic growth and showed the ability of mass cultivation compared to other genera. But the genus Cyclotella was also present in the culture with very low **density.**

Stocks	Per 1000 ml
$NaNO_3$	50.0 g
$Na\ H_2PO_4$	5.0 g
$FeCl_3.6H_2O$	1.0 g
Na_2SiO_3	3.0 g

Table 1. Compounds of culture medium used for culture of Diatoma sp.

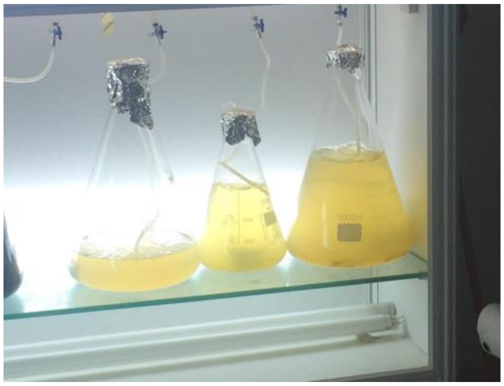

Figure 2. Purification and culture of Diatoma algae

Diatoma sp. first cultured in 250 ml Erlenmeyer for 14 days and then transferred to 500 ml, 1, 2 and 5 liter Erlenmeyer flasks.During the initial cultivation, the culture conditions included 25 ° C, 3000 lux exposure, and continuous exposure and aeration, but during mass cultivation, the exposure period was changed to 16 hours of light and 8 hours of darkness. After the initial culture of algae and transfer to larger containers in a group culture, after preparing 30 liters of the microalgae, the transfer to a 300 liter bath in the laboratory (with a gradual increase in culture volume) was done in the form of intermediate culture.

- Preparing and introducing fish and injecting algae into fish breeding ponds

In this project, we tried to use the anesthetic extract of clove, which has minimal side effects and has sedative and pain relieving properties, which is also used to anesthetize and calm all kinds of fish in countries such as Indonesia, Australia and the United States and Clove with a concentration of 150 mg/l was used. The experiment was performed with the dominance of Diatoma genus and 90 g silver carp for 8 weeks in 3 circular concrete ponds with a diameter of 6 meters and a water intake height of 1 meter in 2 experimental treatments. After transferring 90g silver carp to the Caspian Ecological Research Institute, 200 silver carp were transferred to the studied ponds and the water of the breeding environment was from the Tajan River in Farahabad, Sari, with a geographical location of "50 68 68 North and " 41 '. 6 ˚53 East was providrd.

- Algae feed on fish

In this study, the algae mixture was used to feed the fish, to which 70% of Diatoma and 30% of Chlorella microalgae were added to the natural water of the river.

- Testing in concrete ponds:

At the beginning of the experiment, 30 silver carp were randomly sampled from each pond and biometrically, and then after 8 weeks, 30 silver carp were randomly sampled from each pond (length, height and weight) using the following methods: Growth rate and survival rate of silver carp were calculated

Survival percentage (SR) = ((number of fish harvested per pond)/ (number of fish introduced per pond)) ×100

The growth rate of fish in the studied treatments will be obtained as follows:

Fish growth rate = productive fish biomass- primary fish biomass average daily

growth:ADG= (BW2-BW1)/ (T2-T1)

T2-T1: Number of breeding days

BW_2-BW_1: Average weight of fish fry per gram)

Statistical Method

After adjusting the data, the obtained data were recorded in Excell and SPSS programs under Windows program and the mean and standard deviation of the samples were calculated and compared. Percentage of survival and growth parameters in experimental treatments as a quantity measured by F test (one-way analysis of variance table) was measured at 5% (Farabi et al., 2016).

Results

The genus Diatoma observed is Diatoma, Cyclotella, Cymbella, Nitzschia, Navicula, Melosira, Chaetoceros and Gyrosi umber of fish and survival percentage (SR) of fish in control pond was 94.5% but there was no mortality in pond 2 and had a survival rate of 100%.

Although the Biomass of the fry at the beginning of the project was the same in both ponds, at the end of the experiment the growth rate of the fry in the studied ponds was different and the growth of the fish in pond 2 was higher. Also, the highest average daily growth (ADG) of silver carp belonged to Pond No. 2.

Discussion

In recent years, different fertilization methods have been used to increase live food, which has disadvantages, including the fact that fertilizers, especially chemical fertilizers, have a direct negative effect on aquatic animals. Proper use of microalgae can have significant beneficial effects on the growth rate and quality of silver carp meat, including the fact that fertilizers increase the population of microalgae of all types (Toxic and non-toxic) without human control and therefore can They also cause unwanted growth of harmful algae (Barari and Nikzadsorki, 2016). The cost of using chemical fertilizers and algae is the same in fish farms, but algae can accelerate fish growth due to their easy digestion, protein and unsaturated fatty acids.

Fish are also naturally immersed in the food environment and, therefore, have easy access to the food they need on an industrial scale and the mass cultivation of algae used in this study, by defining a synthetic culture medium based on very low amounts of chemical fertilizers. Algae can be mass-grown and kept in a logarithmic growth phase. So that phytophagous fish feed on the produced edible algae and achieve maximum growth in less time efficiency, so it is expected that after using the addition of 70% of Diatoma microalgae and 30% of Chlorella microalgae to the natural water population The River has more weight gain, which will be profitable for the breeder. Therefore, the breeder will achieve more profit by using less chemical fertilizers, achieving higher weights of silver carp, saving extra costs due to losses due to the bloom caused by toxic microalgae, as well as having healthy and disease-resistant fish and the acquired technical knowledge can be introduced to other hydroponic fish farms. Whith the results obtained in this project, the pond containing the maximum population of diatoms (pond number 2) had the highest growth rate (survival rate, fish growth rate, specific growth rate and average daily growth) which is consistent with the information provided by Tahami et al. In 2012, in the study of Tahami *et al.*, in 2012, the contents of silver carp intestine were qualitatively and quantitatively analyzed in natural water to determine eating habits and selection. Food should be specified in the feeding behavior of this carp.

Studies have shown that most of the plankton in the intestine of silver carp is Diatoma, which can be explained by the fact that this genus, in addition to having nutrients suitable for digestion and absorption in the intestine of silver carp, due to their appropriate size in the size range in 5-25 micrometers, is more easily filtered by phytophagous fish and as a result more populations of this group of plankton are fed to phytophagous silver carp ($P \leq 0.05$) which were also clearly mentioned by Smith (1989), Li and Dong (1996) and Xie (1999) that silver carp is able to collect food particles smaller than the distance between the gill purifiers (DGR) of their gills. In addition to the information obtained from the Phytophage juvenile feeding project, studies by Li and Dong (1996) suggest that silver carp can feed on the genus Diatoma, especially Cyclotella (3.2 µm in diameter). Growth is one of the important components of aquatic growth and indicates the rate of conversion of food used to protein had more ($P \leq 0.05$).

Conclusion

According to the present study, the importance of hydrobiological studies and their role in hydroponic fish farming, and limited studies on the diversity and abundance of phytoplankton in hydroponic fish farms and the impact of each of them on fish growth, can be identified by identifying the species that They have a more suitable conversion factor and by changing the fertilization regime by enriching the pool water with palatable plankton and reducing fertilization, it started producing in hydroponic fish farms with minimal water changes.

And this can lead to increased production per unit area while reducing water pollution and because phytoplankton of the cyanophyte phylum (Blue-Green) are able to compress other phytoplankton families in terms of density due to nitrogen fixation. They also ofter prefer warm waters and are fed into nutrient-rich waters using the method of adding cultured algae such as diatoms, possibly blooming blue-green algae, resulting in the risk of death of phytophagous fish in warm seasons is reducrd. Also, Diatoms can be a good choice for enriching phytophagous fish ponds because their siliceous shells require less energy to divide than the cellulose membranes of other unicellular phytoplankton.

As a results, the quantity and quality of planktonic community abundance in a pond is of great importance for the successful management of aquaculture operations, which can vary from place to place, and from pond to pond in the same place with similar ecological conditions (Hossain et al., 2007).

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