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RESEARCH ON LIVE FOOD PRODUCTION FOR FISH

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ABSTRACT

In Romania, although the importance of live food in fish feeding is known, unfortunately, the results obtained so far have not materialized through their application in fish production units, the realization of such crops being a sporadic activity and concentrated almost exclusively at the level of fish research units. The main objective was to identify native species of protozoa, rotifers, copepods, cladoceres and aquatic philopods that are suitable for intensive cultivation, in order to achieve crops for biomass production and the development of cultivation technologies accessible to production units that have as specific production of juveniles from various species of fish. The research did not explicitly aim at inventing new techniques or cultivation facilities, the literature being very rich in this respect and most of them already having, internationally, an industrial character, but the use and adaptation of existing ones to native species and to the technological conditions in Romania. The advantages of creating zooplankton culture systems are numerous, of which the most important can be mentioned: independence from weather conditions, the possibility of scheduling biomass production, depending on technological needs, the possibility to correlate the size of the chicks with that of the live food provided. Internationally, intensive crops of organisms that serve as food for fish larvae and chicks are widely practiced, in recent years developing a branch of aquaculture that deals only with them.

Keywords: *live food, fish, feeding, Romania*

INTRODUCTION

Feeding fish larvae and chicks during the first period of rearing (after switching to active feeding) is a problem that is largely dependent on the entire fish farming activity. If in the case of post-embryonic development in soil ponds there is a technology to stimulate the development of zooplankton (protozoa, rotifers, copepods, cladoceres), which, if successful, can ensure feeding and breeding up to a certain size of chicks, with good survival (Pillay, T.V.R., 2005). In the case of post-embryonic development in closed systems, the production and provision of live food is a relatively difficult problem (Falconer, D.S., Mackay, T.F.C., 1996).

Although there is currently a wide range of special feeds (starter, prestarter type) for the post-embryonic growth period, it is known that the best results are obtained when feeding live zooplankton, which, among other benefits, poses fewer problems with water quality alteration in growing facilities (Oprea, L., Rodica, G., 2000). The advantages of making zooplankton culture systems are numerous, of which the most important can be mentioned:

- ✓ independence from weather conditions
- ✓ the possibility of scheduling biomass production, depending on technological needs
- ✓ the possibility to correlate the size of the chicks with that of the live food provided.

Internationally, intensive crops of organisms that serve as food for fish larvae and chicks are widely practiced, in recent years developing a branch of aquaculture that deals only with them.

In Romania, although the importance of live food in fish feeding is known, unfortunately, the results obtained so far have not materialized through their application in fish production units, the realization of such crops being a sporadic activity and concentrated almost exclusively at the level of fish research units.

The main objective was to identify native species of protozoa, rotifers, copepods, cladoceres and aquatic philopods that are suitable for intensive cultivation, in order to achieve crops for biomass production and the development of cultivation technologies accessible to production units that have as specific production of juveniles from various species of fish (Midlen, A., Redding, T., 1998).

The research did not explicitly aim at inventing new techniques or cultivation facilities, the literature being very rich in this respect and most of them already having, internationally, an industrial character, but the use and adaptation of existing ones to native species. and to the technological conditions in Romania.

The work on the preparation of cultures of zooplankton organisms has been directed in two directions:

- ✓ Obtaining and using *Artemia salina philopodine* wolves to feed *Polyodon spathula* larvae in the first days of active feeding, using resistance eggs produced and packaged by the Dutch company Artemia Systems or Original Great Salt Lake ” U.S.A
- ✓ obtaining and using intensive cladocere crops (*Daphnia longispina* or *Daphnia magna*), outdoors, in concrete basins and in ground basins.

MATERIAL AND METHODS

Artemia salina is one of the best choices in terms of live food, it is very nutritious and suitable for fish that are preparing to lay eggs, fish that have laid eggs and fish that are more demanding of food.

Artemia hawthorns have a high fat content, 23% of their body weight, this huge amount of fat is used for metamorphosis in adults. Once mature, *Artemia* has less fat and much more protein, respectively 63%. The culture of *Artemia* can be prepared by almost anyone because it is not very difficult, you just need to know a few basic questions about the biology of these crustaceans. One of the few disadvantages of *Artemia* is that a crop is rapidly depleted and to feed fish or juveniles more crops are needed, installed on a different day, most often 3-4 crops are used in parallel but can be achieved and more if necessary.

Artemia salina, is the most used species of *Artemia* in our country, it is a small crustacean species, which at maturity reaches a length of only 1,5 cm. It can be found in salt lakes, lakes such as Techirghiol (Romania). At hatching, *Artemia* has a larval stage called nalupi, which are used as food for juvenile fish, especially in the case of species whose chicks are small. *Artemia* hawks are about 0,5 mm long, they are attracted to light but adults avoid light. After about 8 days the *Artemia* nalupes become adults and thus are able to lay eggs and the cycle resumes (Piper, R.G., 1983).

Fig.1. *Artemia* -SERA (crustaceans living in salt water)

Production of *Artemia salina* nauplies

Artemia salina nauplies (Fig. 2) are needed to feed fish larvae in the first three days of active feeding.


Fig. 2 Artemia salina nauplies

Adapted Zug-Weiss incubators (capacity 8 liters) are used to obtain the nauplii, by closing the basal orifice and introducing through the upper part a central aerator, with a role in oxygenating the water and in keeping the *Artemia* eggs in the water mass. 2 g of dried eggs / l of culture medium were used for incubation. The incubation temperature was 27^{o}C, with aeration and permanent lighting (with 40 W fluorescent tube). The incubation period was 27-28 hours.

Depending on the number of chicks hatched in each batch, the number of eggs incubated is staggered so that the ad libitum feeding of the fish larvae for 72 hours can be ensured.

Harvested nauplies are harvested by siphoning them in a fresh solution of NaCl 30 g / l, in which they are kept, with moderate aeration, at room temperature, until they are administered as food (maximum 4 hours).

Prior to administration, the nauplii are filtered through a 25µ mesh nytal cloth and wash with pool water.

A Sartorius-type electric balance was used for weighing, and a Kolkwitz-type chamber was used for counting eggs and nauplies. The nauplies were counted on a binocular magnifier and an MC-5 research microscope (I.O.R.).

To assess the density of the nauplies in the samples, three counts were performed in known volumes (0,5 - 1 ml), the resulting average being extrapolated to the total volume of the medium.

RESULTS AND DISCUSSION

Carrying out intensive cladocere cultures (*Daphnia longispina* and *Daphnia magna*)

For the culture of cladocera species (*Daphnia longispina* and *Daphnia magna*), two stages have been provided:

- ✓ establishment and maintenance of laboratory
- ✓ cultures carrying out intensive crops for biomass production

Laboratory cultures have been initiated since winter (January), being made in 2 plexiglass carafes with a volume of 230 l each.

The water temperature in the culture vessels in the first 2 months was in the range of 10 – 15^{0} C, the cultures being moderately aerated.

As a culture medium, pond water was used, filtered through 25 µ nytal mesh cloth. Two nytal sleeves filled with alfalfa hay were immersed in the culture pots and seeded with resistance eggs (epiphytes).

After 10 days (at an interval of 3-5 days), brewer's yeast was administered, in amounts of 10 mg / l dry matter, on culture medium. The vessels were placed in front of the window, but received additional artificial light, the lighting being done with 20 W fluorescent lamps, for 8 hours / day (from 8^{00} – 16^{00}).

After about a month, the first cladocers appeared, which were further fed with yeast. At the beginning of March, the temperature in the culture vessels was gradually increased to 18–22^{0}C, using electric heaters for this purpose.

At the same time, the artificial lighting period was extended to 12 hours / day. The amount of food administered was increased to 20 mg / day of dry matter per liter of culture medium in 24 hours. After about 25 days, the density in the culture vessels increased to 300 - 500 ex / l (parthenogenetic females in various stages of development). Specimens of *Daphnia sp*. thus obtained, they were used to populate the 2 concrete basins, intended for the cultivation of zooplankton organisms. The culture was initially carried out in the 2 external concrete basins, with a volume of about 32 m³, fed with water from the Ilfov stream (Romania), filtered through a nytal sieve with a = 1,25 mm.

The preparation of the basin went through several technological sequences: flooding, the creation of the culture medium by administering 300 kg of fermented horse manure (in 2 ballasted nytal mattresses), the population of the pools with parthenogenetic females of *Daphnia longispina* and *Daphnia magna*, (fig. 3) at a density of 2 ex / l. Two successive cultures were carried out in each basin, the duration of a culture cycle being 25-30 days.

Fig. 3 Specimens of *Daphnia sp*. from live food culture made in the laboratory

Crop maintenance consisted of the administration of ammonium nitrate and superphosphate, in order to maintain the N-NO3- concentration around 5 mg / l and an N / P ratio of 10: 1.

Feeding was initially done with dry feed yeast (as long as it was marketed), administered daily in quantities of 5 mg / l in the first 7-10 days, 15 mg / l in the last 5-10 days, after which, Bakery yeast 30 mg / l was used daily until the fall of the cladocere culture.

From the 15th day onwards, 0,5-2 kg zooplankton biomass were harvested daily from each pool, quantities that were used to feed the polyiodon and to inoculate other crops, initiated in 2 other land basins, with an area of 0,2 ha. each.

Feeding

The growth of larvae to the shape of adult-like phenotypic characters is done according to a feeding scheme that involves feeding that is based on the administration of live food in the first 7-8 days of growth followed by a mixed feeding based on natural food and feed (Oprea, L., Rodica, G., 2000).

Feeding exclusively with natural food consists in the administration of planktonic and / or benthic organisms. Cladoceres are administered: *Daphnia sp*., *Moina sp*. and *Bosmina sp* .; the philopod Artemia salina; tubifex spigot. Natural food is collected directly from the natural environment or from laboratory crops (De Silva, S.S., Anderson, T. A., 1995).

The natural food combinations practiced are the following:

- ✓ 90% zooplankton and 10% *Tubifex sp*.
- ✓ 50% sweet or saline zooplankton 50% *Tubifex sp.*

Both types of food (plankton and benthos) before administration are subjected to a prophylactic treatment with a 1% solution of methylene blue in the case of the oligocet *Tubifex sp*. and with a solution of 23 mg / l potassium permanganate in the case of sweet zooplankton.

The food ration is determined daily according to the weight of the batch.

The ration administered in 24 hours is calculated as a percentage of 100% of the weight of the batch on that day (Goddard, S., 1996).

Equal fractions of this ration are distributed every 3 hours, both during the day and at night.

Feeding the larvae using live natural food in a mixed diet with feed will involve the application of the following feeding scheme that will allow the phased transition to a feed based exclusively on feed:

- ✓ first 5 days: 85% zooplankton, 5% benthos, 10% feed
- ✓ the following 5 days: 60% zooplankton, 20%, benthos, 25% feed
- ✓ the following 5 days: 50% zooplankton, 5%, benthos, 50% feed
- ✓ the following 5 days: 10% zooplankton, 5%, benthos, 85% feed
- ✓ the next feeding period will be provided only by feed.

With the exclusive switch to feed, the daily ration will be determined according to consumption, the percentage varying between 4-20% of the weight of the lot.

It is recommended to use fodder with a protein content of 35 -45%.

The amount of feed administered, as well as its granulation, will mainly take into account the size of the chicks and the temperature of the technological water.

The percentage of feed in sleeping chicks will be set at 10% of the total weight of the batch / day for specimens with a body mass of 0,5 g, provided that the technological water temperature is 25^0C. This percentage will be reduced with increasing temperature. If the batch has a body mass of 1–3 g / ex. the ration will be set at 2,5 -3,5% of the lot weight. The time interval between meals will be 4-6 hours.

In the conditions in which the lot will become heterogeneous, it will be absolutely necessary to be regrouped by weight categories, situation in which the ration will be adjusted according to biomass, and the granulation of the administered feed will be correlated with the size of the biological material.

The growth increase to be obtained after 45 days, until the outline of the phenotypic characters similar to adults is 3-4 g / ex.

CONCLUSIONS

Artemia salina is one of the best choices in terms of live food, it is very nutritious and suitable for fish that are preparing to lay eggs, fish that have laid eggs and fish that are more demanding of food.

Artemia hawthorns have a high fat content, 23% of their body weight, this huge amount of fat is used for metamorphosis in adults. Once mature, *Artemia* has less fat and much more protein, respectively 63%. The culture of *Artemia* can be prepared by almost anyone because it is not very difficult, you just need to know a few basic questions about the biology of these crustaceans. One of the few disadvantages of *Artemia* is that a crop is rapidly depleted and to feed fish or juveniles more crops are needed, installed on a different day, most often 3-4 crops are used in parallel but can be achieved and more if necessary. *Artemia salina*, is the most used species of *Artemia* in our country.

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