THE AFFECT OF DENSITY ON BESTER (*H.HUSO* × *A. RUTHENUS*) LARVAE REARED IN A SUPERINTENSIVE SYSTEM

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Abstract

The experiment was come off in a flow-through super intensive system, sturgeon larvae being reared in spun glass troughs. Experiment duration was 20 days. Biological material, bester larvae was gained by artificial breeding of breeders, beluga female (H. huso ***Brandt, 1869****) and sterlet males (A. ruthenus,* ***Linné, 1758****) respectively, catch from natural environment. The experiment was going off with three variants and three replications each, rearing densities were as follow: in variant I – 300 ex/tank, in variant II – 400 ex/tank, and in variant III – 500 ex/tank. In all three experimental variants, the feeding of larvae was achieved in the same way, namely the same number of daily intakes, delivery in the same time for all variants and it was used the same type of meal, namely Daphnia species, Tubifex species and fodder. At the end of experiment, the results were: in variant I, the survival rate was 70 %, and final average body mass of larvae 3 g/ex, in variant II, survival rate was 66 %, and final average body mass 2.3 g/ex, and in variant III, survival rate was 48 %, and final average body mass 1.4 g/ex.*

Key words: flow-through system, troughs, sturgeons, larvae.

INTRODUCTION

Production of sturgeons from aquaculture presents a special importance for those countries wherein the natural stocks are declined or were disappeared. Currently, some sturgeon species are being considered interesting candidates to produce them in full cycle [9].

The first trials in sturgeon farming were carried out almost simultaneously in mid 19th century in Russia, Germany and North America to compensate for declines in the harvest for wild sturgeon [10].

As a result of the investigations in sturgeon propagation, the commercial production of bester, started in the 1960s in the former URSS (Burtzev, 1999), this being the first hybrid produced in large quantities in a controlled environment. Currently, bester contributes with 20 % in sturgeon meat production and 5 % in caviar production from Russia [1].

Remarkable results have been gained with worm water bester production. When the water temperature is kept between 18 and 22 ^{0}C, the fish reach 1 – 2 kg body weight by the end of the second year, and 2 – 4 kg in three years (Steffens et al. 1990).

On sturgeon aquaculture, larval rearing is probably the most difficult part of the hatchery process. Fry survival depends on having a proper culture system and a complete nutritional program [2].

The present study was undertaken to determine the growth rate, survival rate and behavior of bester larvae reared in a superintensive flow-through system, at three different stoking densities.

MATERIAL AND METHOD

The experiment was come of inside of private sturgeon rearing farm S.C. Beluga Farm Group from Calarasi County. The rearing system is flow-through and is emplaced into an enclosure as hall type. Sturgeon larvae were reared in spun glass troughs with a capacity of 0.167 m^3.

Feed water for the system come from Mostistea dam whence is gravitationally bring into the rearing enclosure. Water is pump into two mechanical filters with send under pressure which present a system for self cleaning of filtration surface. From filters, water ascends into a pendent tank which is fitted with an air engine for aerating the water and with oxygen battles for emergency cases. Water supply of troughs for larvae rearing is making gravitationally from the pendent tank.

Tanks (troughs) for larvae rearing have a rectangular form, fitted with bolters disposed at both ends, perpendicular to bottom of troughs in order to maintain the larvae in the middle part of the tank so that larvae can't escape or be annoy by the water flow.

Water supply of troughs goes through pipes fitted with stop valves, disposed at one abut of the trough. Discharge of water from troughs is going through across the supplying pipe through another pipe that penetrates vertically the bottom of trough and also determines the level of water inside of trough according to the level that is ascended.

During the experimental period, the water supply debit in troughs was between 0.2 – 3 l/minute, and temperature of water oscillated from 14 to 16 ^{0}C. During the experiment were monitoring the main quality parameters of technological water, namely: pH, dissolved oxygen, total ammonia nitrogen, nitrite, nitrate and hardness.

Table 1
Mean value of physico-chemical parameters of water in experimental variants

Parameters	Variant I	Variant II	Variant III
pH	7,42	7,48	7,54
Dissolved oxygen (mg/l)	6,2	5,65	5,12
Ammonia nitrogen (mg/l)	0,019	0,024	0,031
Nitrite (mg/l)	0,235	0,284	0, 345
Nitrate (mg/l)	9,9	10,54	11,37
Hardness (dGH)	10,95	11,25	11,84

The value of physico-chemical parameters of water were situating inside of normal limits for rearing of sturgeon larvae.

Dissolved oxygen was monitoring by means of WTW oxymeter, pH with WTW pHmeter, and water temperature with a thermometer. The other forenamed parameters for water quality had been monitoring by means of the FF-1 Complete kit for Aquaculture, that use the colorimetric method for determination, the samples being set beside of a Hach check gauge disc.

The biological material used for experimentations was represented by sturgeon larvae, namely bester (*H. huso* B. × *A. ruthenus* L.) at the age of 6 days post hatch. The experiment was carried out in 20 days. At the beginning of the experiment the average body mass of larvae was 0.14 g/ex.

During the experiment, larvae were feed (Table 2) with live diet, represented by zooplankton (*Daphnia sp.*) and worms (*Tubifex sp.*) as well as with Perla Larva fodder.

Table 2
Biochemical structure of delivered feed

Feed	Crude protein (g %)	Lipids (g %)	Ash (g %)
Perla Larva	62,00	11,00	10,00
Tubifex	10,50	2,86	1,50
Daphnia	46,56	3,90	25,85

The rearing experiment was carried out in three variants with three replications:

- Variant I – larvae were populated in rearing tanks at a density of 300 exemplars/tank. At the end of the experiment, survival rate was 70 %, and final average body mass of larvae 3 g/ex.

- Variant II – bester larvae were populated in rearing tanks at a density of 400 exemplars/tank. At the end of rearing period, survival rate was 66 %, and final average body mass 2.3 g/ex.
- Variant III – stocking density was of 500 exemplars/tank. At the end of the 20 days of the experiment, the survival rate of bester larvae was 48 %, and final average body mass 1.4 g/ex.

The conditions for rearing were identical for all experimental variants: the same type of tanks for larvae rearing (troughs), the same water supply debit, namely 0.2 – 3 l/minute. In all three experimental variants, delivery of feed was carried out in the same way, namely the same number of daily feedings; deliver in the same time for all variants. Daily ration of feed was gradually changed according to feeding intensity of larvae.

During the 20 days of experiment in order to determine the growth rate of biological material, 60 larvae were sampled from each experimental variant at every 5 days for biometric measurements.

In order to determine the weigh of larvae it was used an electronic analytical balance KERN ALJ 220-4NM.

RESULTS AND DISCUSSIONS

During the experiment it was observed that bester larvae did not show a marked cannibalism [6], this behavior being slightly emphatic in variant III.

At the end of experiment were enlisted some differences between experimental variants, reflected on average body mass (table 3), growth rate (table 4), specific growth rate and survival rate.

Table 3
Biotechnological indexes

Vârsta (zile)	Masa medie (g/ex)		
	Varianta I	Varianta II	Varianta III
6	0,14	0,14	0,14
10	0,45	0,38	0,30
15	0,95	0,78	0,55
20	1,60	1,25	0,84
25	3,00	2,30	1,40

Table 4
Daily growth rate of bester larvae in the three experimental variants

Vârsta (zile)	Sporul de creştere (mg/zi/ex)		
	Varianta I	Varianta II	Varianta III
10	62,0	48,0	32,0
15	81,0	64,0	41,0
20	97,3	74,0	46,7
25	143,0	108,0	63,0

For assessment of acquired results in the three experimental variants for rearing of bester larvae in flow-through superintensive system, charts were draw up for biotechnological indexes (Figure 1) and for daily growth rate (Figure 2).

Figure 1 Chart of growth rate of bester larvae

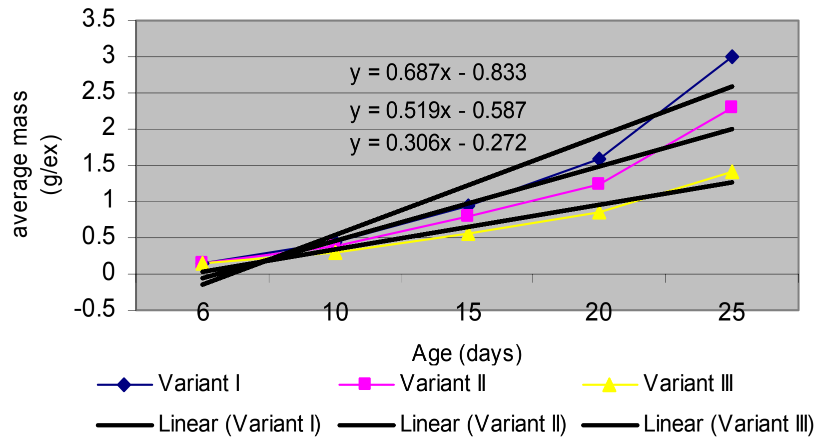
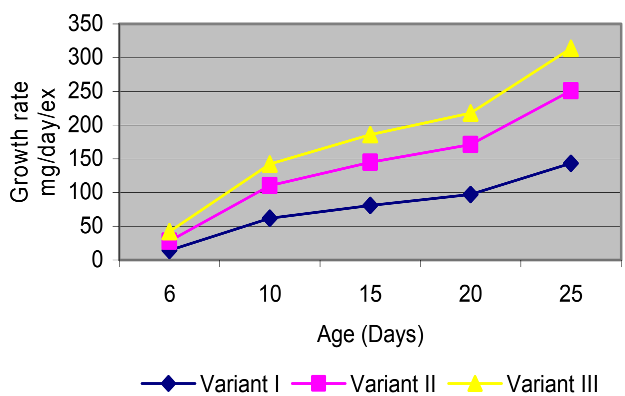


Figure 2 Chart of daily growth rate of bester larvae in all three experimental variants



It's can be observed that the best growth rate of bester larvae (Table 3, Figure 1) was accrue on variant I where was apply the smallest density. In variant II the final average biomass of larvae was 24 % smaller then biomass of larvae from variant I and 39% higher then biomass of larvae from variant III.

In variants I and II, the daily growth rate (Figure 2) presented a concurrent ascent comparatively with variant III where the ascent of daily growth rate was almost linear.

The gained results approve that initially the specific growth rate (Table 5, Figure 3) of larvae describe abatement in all experimental variants, starting with age of 20 days, the curve follow an ascendent wiring.

Table 5
Specific growth rate percentage on day of bester larvae

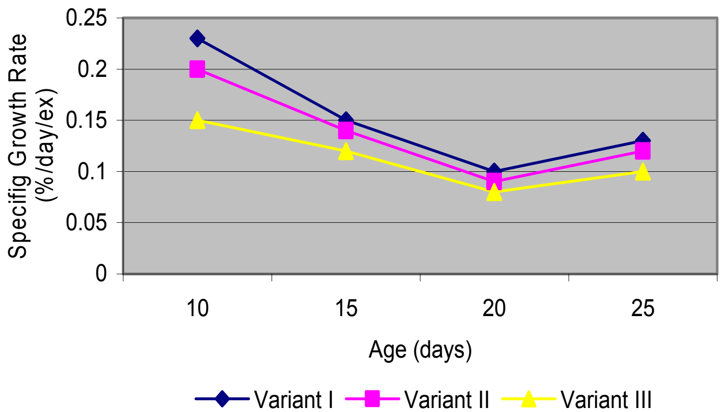
Vârsta (zile)	Ritmul specific de creştere (%/zi/ex)		
	Varianta I	Varianta II	Varianta III
10	0,23	0,20	0,15
15	0,15	0,14	0,12
20	0,10	0,09	0,08
25	0,13	0,12	0,10

The specific growth rate [4], was determined on the base of formula:

$$SGR = \frac{\ln w_t - \ln w_0}{t} \times 100\ ;$$

where:
w_0 and w_t – initial and final mass;
t – time period.

Figure 3 Chart of specific growth rate



This situation appear mainly because of the fact that during the experiment, bester larvae started to be feed also with commercial fodder (Perla Larva) mixed with live food, and larvae needed for some period of time to adapt at the new type of food. This situation was mentioned also by other authors ([3], [7], [8], [5]) on sturgeon rearing in different growing systems and different density formulas.

For drawing up of charts from this paper it was used the computer program Microsoft Office – Excel.

CONCLUSIONS

The rearing experiments achieved in 20 days of bester larvae follow for two aspects: the effect that different stocking densities may have on the behavior, survival and growth of larvae and the economical aspect that relieve the feasibility of a technology for growth of sturgeons in the first development stage.

On the intensive post hatch development technologies for sturgeons, determination of stocking densities must to be made concordantly with the possibility to maintain the environment parameters at optimum limits for growth and also to act on the effect of density on behavior of biological material in order to reduce technological loses.

After the accomplished studies it is can be assess that in case of first two experimental variants, the stocking densities used did not get to very large differences of survival and growth rate (Table 3). In variant III, was observed that because of stocking density used, start to appear size differences in larvae stock, thing that increase the exhibition of cannibalism occurrence, which was rarely observed in first two variants. This angle conducted in variant III to achievement of a much smaller survival rate comparatively with first two experimental variants.

Generally, size differences in a group should not exceed 20 % from the average value. In order to reduce the rate of cannibalism and facilitate proper feeding, in case of using high stoking densities it is necessary that periodically to make a grading of larvae.

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