

## THE EVALUATION OF THE REPRODUCTIVE INDICATORS OF THE NEW GENERATIONS OF SELECTION OF THE MOLDAVIAN CARP BREEDS *Cyprinus carpio* Linnaeus 1758 (MOLDOVA)

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**Abstract.** The present paper renders the evaluation of the reproductive indicators of the new generations of the Moldavian carp breeds and their conformity to the breed standard. It was emphasized that the diameter of small and large yolk granules, as well as of cortical vacuoles changed depending on carp breed and fish age. The results of the studies also showed degenerative modifications in ovulated spawn.

**Keywords:** breed, carp, female, fecundity, oocyte.

**Rezumat. Evaluarea indicilor reproductivi a noilor generații de selecție a raselor de crap moldovenești *Cyprinus carpio* Linnaeus 1758 (Moldova).** Este prezentată evaluarea indicilor reproductivi a noilor generații de selecție a raselor de crap moldovenești și conformitatea lor standardului rasei. A fost subliniat faptul că diametrul de mici și mari granule a gălbenușului, precum și de vacuole corticale se schimbă în funcție de rasa de crap și de vârsta peștelui. Rezultatele studiilor au arătat, de asemenea, modificări degenerative în icre ovulate.

**Cuvinte cheie:** rasă, crap, femele, prolificitate, oocite.

### INTRODUCTION

Carp represents the traditional object of breeding and rearing in Moldova's Aquaculture, enhancing the productive qualities, which play an important role in increasing its production. For increasing the production of pond fish, it is very important to use high productive fish breeds, lines and interbreeding.

The works in this direction include the task of originating and introducing new selective achievements with increased productivity and high quality.

As a result of focused selection, three new Moldovan breeds were created and approved: Teleneshtskiy Scaly Carp and Teleneshtskiy Frame Carp, the fourth generation of selection; and Kuboltskiy Scaly Carp, the sixth generation of selection (DOMANCIUC, 1993; DOMANCIUC & CURCUBET, 2002). The selection was done in the direction of increasing the resistance to infectious diseases, the growth rate, improvement of tolerance to cold and fecundity (CURCUBET, 1994). These breeds of carp are remarkable because their productive, reproductive characteristics exceed present norms (CURCUBET & DOMANCIUC, 2005). Their good body indices and increased resistance to infectious diseases (Teleneshtskiy Carp), hardiness, high survival rate and advanced ability to utilize natural fish food resources (Kuboltskiy Scaly Carp) are also among those characteristics which make them so productive.

Since 2003, the carp breeds Teleneshtskiy Scaly, Teleneshtskiy Frame and Carp Kuboltskiy Scaly have been widely introduced into production. These carp breeds form more than 95% of the carp bloodstocks in the Republic of Moldova.

At present, there has been created the fifth generation of Teleneshtskiy Carps and the seventh generation of Kuboltskiy Scaly Carp.

One of the most significant indicators of productivity is fecundity that depends on both the environmental conditions as well as on the hereditary factors (MASLOVA, 2005).

The aim of the present work is the evaluation of the reproductive indicators of the new generations of indigenous breeds and their conformance to the breed standard.

### MATERIAL AND METHODS

The works on artificial reproduction were carried out in the certified selection fish farm – Teleneshty Branch of the State Enterprise in the Researches and Production of Aquatic Biological Resources "Aquaculture-Moldova" (fish hatchery Verezhny).

For the analyses of the reproductive characteristics of the new generations of three approved Moldavian carp breeds: Teleneshtskiy Scaly Carp and Teleneshtskiy Frame Carp, the fifth generation (5) and Kuboltskiy Scaly Carp, the seventh generation (7) of selection, there were used females aged 6 and 7 years.

As indices, there were identified: number of spawned females (%), eggs per female (g), maturity rate (%), working fecundity (thousand), relative fecundity (thousand/kg), fertilization (%), development of eggs (%), yield the three-day larvae per female (thousand), survival rate of larvae from eggs (%), body weight of fingerlings (g), survival rate of yearlings from eggs (%).

For the histological examination of the ovulated eggs, there were used two groups of females of different ages from the three breeds of the new generations-five and seven years old.

The samples of sexual cells were fixed in Bouin liquid and filled in paraffin wax with further histological processing by the standard technique. All the studied females were subjected to the general biological analysis with calculation of gonad-somatic index (GSI). The stages of gonad maturity were determined according to the recommendation of SAKUN & BUTSKAIA (1963) and development degree of oocytes – after the classification of KAZANSKII (1949) with additions proposed by MAKEEVA & EMELIANOVA (1989). The cuts of gonads were coloured after Mallory's method (ROSKIN & LIVENSON, 1957). The diameter of oocytes was determined using the ocular-micrometre. All data were processed statistically (LAKIN, 1980). The microphotos were taken with the help of the microscope with videocamera "Lomo, Mikmed-2".

## RESULTS AND DISCUSSIONS

The reproducers of the three breeds of the 5<sup>th</sup>, 7<sup>th</sup> generations of selection used for reproduction process had a positive reaction to hormonal stimulation. The percentage of spawning females of Teleneshtskiy Scaly Carp, Teleneshtskiy Frame Carp and Kuboltskiy Scaly Carp was 86.7, 90.0, 88.9 %; the working fecundity of females - 910, 930, 870 thousand units of eggs, respectively to the breeds. The values of the coefficient at maturity of Teleneshtskiy Carps were similar, while in case of Kuboltskiy Scaly Carp were slightly lower.

The realized fecundity, the yield of the three-day larvae, was considerable: 500, 495, 470 thousand units per female that is 1.88-2.0 times higher than the norms. The survival rates of larvae from eggs were 55, 53, 54%, correspondingly.

Re-spawning females of the new generations of selection had high reproductive characteristics and a number of indicators considerably exceed normative parameters: on working fecundity – 74-88%; yield of the three-day larvae per female – 88-100% (Fig. 1).

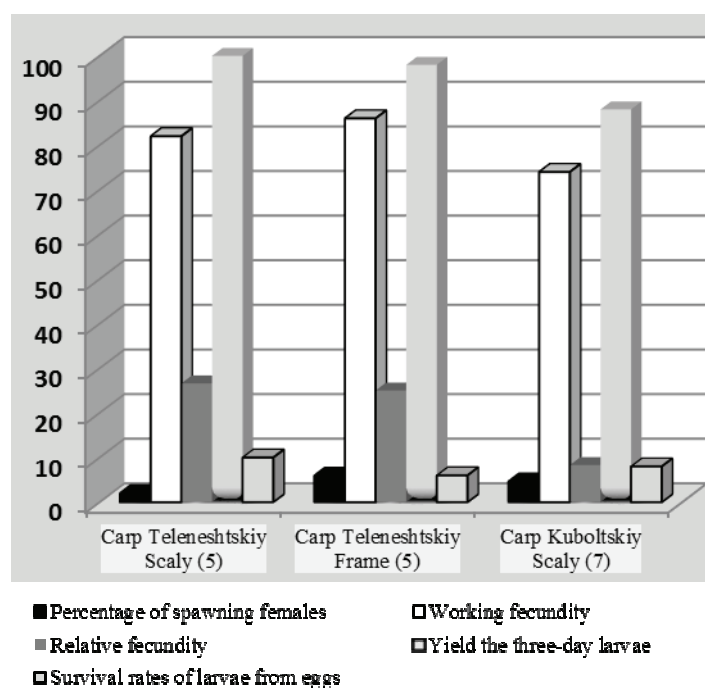


Figure 1. Comparative evaluation of productivity indicators of the new generation of carp breeds with the norms.

By comparing the breed standards, it was noted not only their conformity, but also a clear advantage in terms of females productivity: Teleneshtskiy Scaly Carp (5) – 91.6 % higher, Teleneshtskiy Frame Carp (5) – 138.8% higher both by increasing the average weight of fingerlings and their survival, Kuboltskiy Scaly Carp (7) – 132.8% higher – mainly due to the survival rate of three-day larvae, yearlings from eggs (Fig. 2).

In order to define the state of the gonads of the native-born breeds of carp female in the period of artificial reproduction, there were performed histological studies of ovulated eggs.

In preparations, the ovulated eggs have weakly coloured their own covering with conspicuous radial striations. The animal pole covering has a pronounced funnel micropyle (Fig. 3).

Directly under the covering, there are located 2-3 rows of cortical vacuoles, the diameter of which in the studied species of carp has a different value. At the animal pole, the number of rows of cortical vacuoles is reduced and close to the micropyle, or they are absent at all. Almost the entire amount of eggs is filled with the granules of yolk in different shapes and sizes, the diameter of which varies depending on the species of carp and body weight (Table 1).

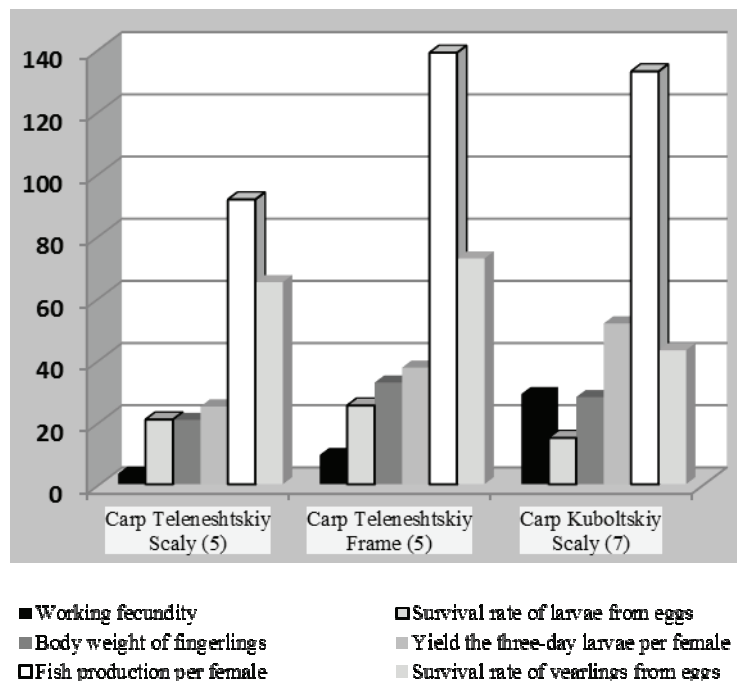


Figure 2. Comparative evaluation of the productivity indicators of the new generation of carp breeds on with the breed standard.

At the same carp females, regardless of their breed, microscopic picture of the ovulated eggs has distinctive features. In certain number of eggs, the plasma and trophic inclusions polarization have not been completed yet and the animal pole is poorly showed (Fig. 4).

Table 1. Dimensions of trophic inclusions in ovulated oocytes of different breeds of carp.

Breeds of carp, generations	Diameter of yolk granules, um		Diameter of cortical vacuoles, um
	large	small	
females aged five (5.5- 5.6 kg)			
Kuboltkiy Scaly Carp, the seventh generation of selection	25.5 18.6-31.0	17.3 12.4-21.7	17.4 15.5-21.7
Teleneshstkiy Frame Carp, the fifth generation of selection	23.4 18.6-27.9	16.1 12.4-21.7	14.6 12.4-18.6
Teleneshstkiy Scaly Carp, the fifth generation of selection	23.6 18.6-27.9	15.8 12.4-21.7	16.8 12.4 .4-21.7
females aged seven (7.5-8.0 kg)			
Teleneshstkiy Scaly Carp, the fifth generation of selection	27.0 24.8-31.0	17.5 15.5-21.7	19.6 15.5-24.8

In another group of gametal cells, there occurs the sticking of yolk granules in large conglomerates (Fig. 5). Between yolk granules in the centre of the eggs, there are observed some portions of the cytoplasm, which later would join the animal pole and form the blastodisc.

The histological studies showed heterogeneity of ovulated eggs. Among them, there are gametal cells, the morphological condition of which show the different degree of their degenerative changes. For some eggs, the swelling of their own covering, destroying the integrity of cortical vacuoles, yolk granules with the following sticking of their contents into a homogeneous mass is typical, (Figs. 6, 7), for others - penetration of vacuole content into the yolk mass (Figs. 8, 9).

In the female ovulated eggs of Teleneshstkiy Scaly Carp in age of seven, there were also revealed some destructive changes that are expressed in the destruction of yolk granules, followed by homogenization of their contents (Fig. 10).

The similar state of cellular structures was observed in the ripe roe of Ropsha Carp during its artificial reproduction (SACUN & LEMANOVA, 1974).

In even-aged females, there were revealed the dimensional distinction of trophic inclusions by breeds and different quality of ovulated spawn of the same female: there are gametal cells, the morphological state of which shows different degrees of degenerative changes.



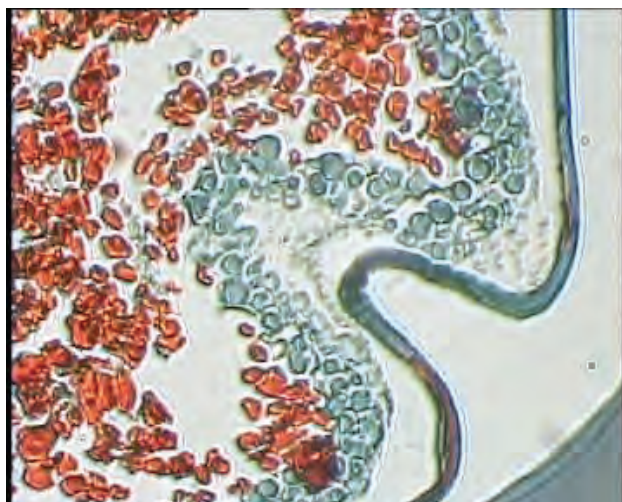


Figure 3. The micropyle of ovulated oocyte (orig.).

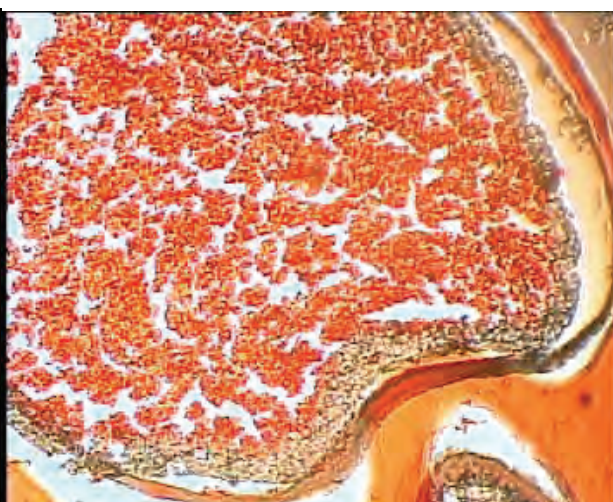


Figure 4. The mature oocyte at the female of Kuboltskiy Scaly Carp. Polarization of yolk is not completed. The micropyle expressed weakly (orig.).

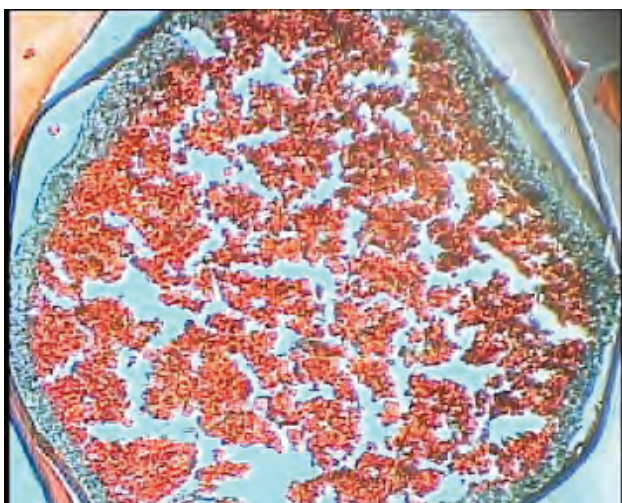


Figure 5. The oocyte at the female of Teleneshtskiy Frame Carp. Yolk granules clumped into large conglomerates (orig.).

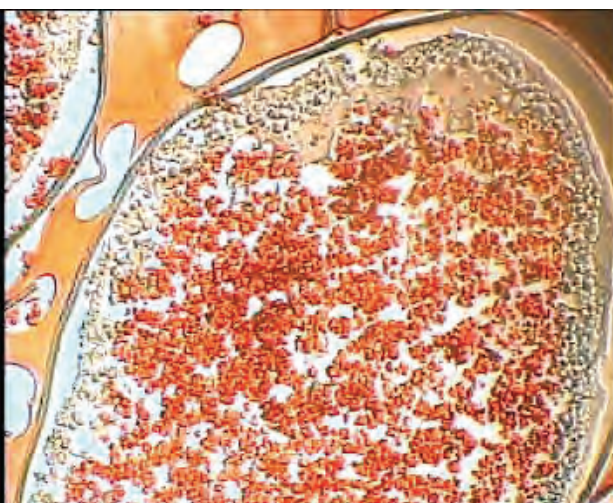


Figure 6. The oocyte the female of Teleneshtskiy Frame Carp. Merging the contents of cortical vacuoles into a homogeneous mass. The swelling of own membrane (orig.).

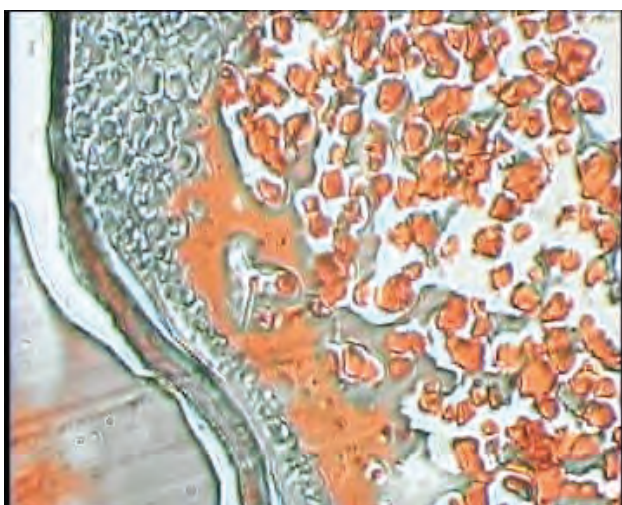


Figure 7. The fragment of the oocyte at the female of Teleneshtskiy Scaly Carp (7.5 kg). Destruction of cortical vacuoles the contents of yolk granules in the animal pole. (orig.).

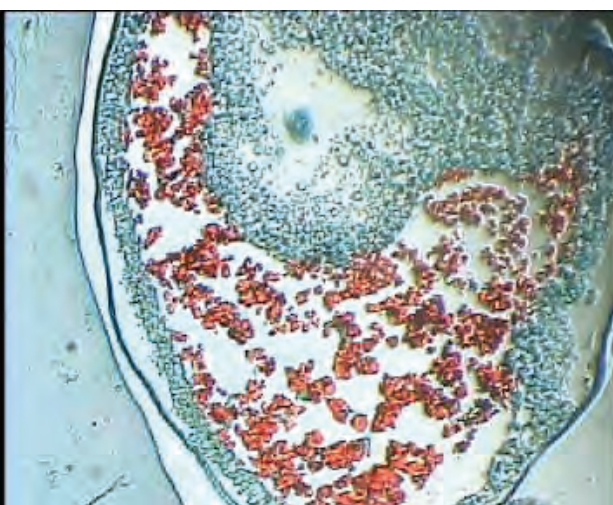


Figure 8. Degeneration of the oocyte at the female of Teleneshtskiy Scaly Carp (7.5 kg). Destruction and merging and moving them to the centre of the cell. (orig.).



In old aged females of Teleneshtskiy Scaly Carp, there were also revealed destructive changes that are expressed in the destruction of yolk granules, followed by homogenization of their contents.

According to the data of some authors (STATOVA et al., 1982), irregularities in the structure of egg cell do not detain ovulation and spawning but lead to decreasing of its fecundating ability and further healthy embryo development.

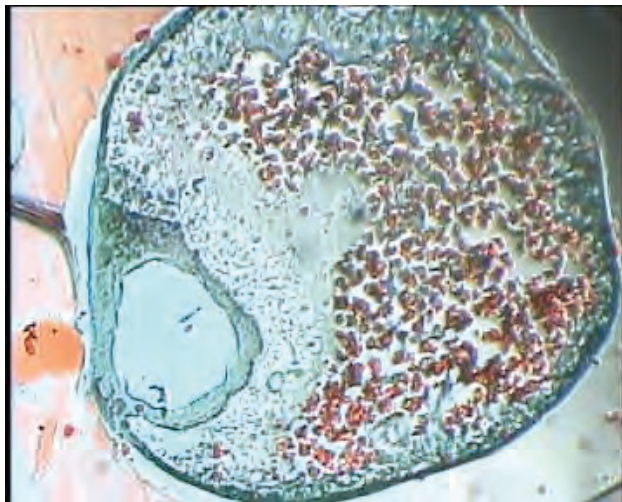


Figure 9. Degenerative changes of the oocyte at the female of Carp Teleneshtskiy Scaly Carp (5.5 kg). The formation of vacuoles in animal pole cells. Destruction of vacuoles and penetration their contents in the mass yolk granules (orig.).

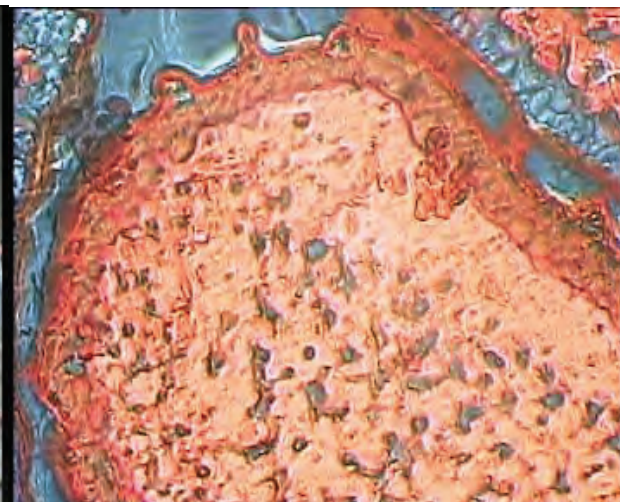


Figure 10. The fragment resorption of the oocyte at the six years old female of Teleneshtskiy Scaly Carp (orig.).

The changes revealed in the gametal cells of the females of the three breeds are caused by asynchronous growth of oocyte in the period of vitellogenesis that in a particular way affects the technological characteristics of carp during artificial reproduction at different stages of ontogeny, in some way reducing the percentage of fertilization, egg development and yield of the three-day larvae. These should be taken into account during selection works with the target program - fish fecundity increase.

### CONCLUSION

1. Re-spawning females of the new generations of selection have high reproductive characteristics and a number of indicators considerably exceed normative parameters: working fecundity; yield of the three-day larvae per female. It was noted not only conformity, but also the advantage over the breed standards.
2. In even-aged females, there were revealed dimensional contrast of trophic inclusions by breeds and different quality of ovulated eggs due to different degrees of degenerative changes in the cells of the same female.
3. In old aged females of Teleneshtskiy Scaly Carp, there were also revealed destructive changes that are expressed in the destruction of yolk granules, followed by homogenization of their contents.
4. The changes in the gametal cells of females occurred due to asynchronous growth of oocyte in the period of vitellogenesis that reduces the percentage of fertilization, egg development and yield of the three-day larvae. It has to be taken into account in the selection works with the aim of fish fecundity increasing.

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