

INFLUENCE OF SELECTION FOR INCREASING RESISTANCE TO INFECTIOUS DISEASES ON MORPHOLOGICAL AND REPRODUCTIVE CHARACTERISTICS OF MOLDAVIAN CARP BREEDS

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Abstract. It was revealed that the selection for increasing resistance to infectious diseases has led to some changes in morphotype of carp breeds and clarified necessary conditions when choosing of selection-valuable genotypes in selection. Is presented the comparative rating of reproductive characteristics of Moldavian breeds carp (*Cyprinus carpio*). Was defined the efficiency of selection: to the fifth generation were increased main indicators of reproduction in comparison to the standards of these breeds and norms.

Keywords: morphotype, breed, fecundity, generation, reproduction.

Rezumat. Influența selecției pentru mărirea rezistenței la bolile infecțioase asupra caracteristicilor morfologice și reproductive ale raselor de crap din Moldova. A fost determinat faptul, că selecția la mărirea rezistenței la bolile infecțioase a dus la unele modificări în morfotipul raselor de crap și au fost identificate condițiile necesare pentru alegerea genotipurilor selectiv-valoroase în selecție. Este prezentată evaluarea comparativă a caracteristicilor de reproducere a raselor de crap din Moldova (*Cyprinus carpio*). A fost determinată eficacitatea de selecție: în a cincea generație au fost ameliorați indicii de reproducere în raport cu standardele acestor rase și normative.

Cuvinte cheie: morfotip, rasă, prolificitate, generație, reproducție.

INTRODUCTION

A target of selection the important point is to evaluate the prospects of selection in the source material and the choice of selection-valuable genotypes.

Important role is represented by the so-called "signal genes", as which can be used by the genes of the morphological and biochemical characteristics (KIRPICHNIKOV, 1987; MERLA, 1959; IZIUMOV & KASYANOV, 1981).

Moldova is realised a program of selective breeding of carps selection the role is to increase resistance to infectious diseases with the use of mass selections, also combined selections and family selection (KURKUBET, 1994). Consequently were created and tested two carp breeds: Teleneshtskiy Scaly and Teleneshtskiy Frame carp with the increased resistance to infectious diseases (KURKUBET & DOMANCHUK, 2005).

Sometimes, in the course of selection to increase the resistance of carp to rubella, are observed a negative correlation between resistance and growth of the rate of fish (KIRPICHNIKOV et al., 1987).

That's why the task of breeders is to strengthen of the subsequent generations also the results of selection and maintaining of the high productivity characteristics of breeds at the level of their standards.

The aim of this work is to determine the influence of selection for increase the resistance to infectious diseases on the morphological and reproductive characteristics of the Moldavian carps, based on previously identified and genetically determined relations between morphotype and signs of viability (KURKUBET, 1994; 2010).

MATERIALS AND METHODS

Analyses was performed on the base of data collected from 1981-2011 in the result of selection years of Carp Teleneshtskiy Scaly (Ts) and Carp Teleneshtskiy Frame (Tf) in hatcheries of Verezhny of Teleneshty Branch of the E.S. "Aquaculture-Moldova".

To determine the degree of the influence of selection on morphotype created breeds and on their reproductive characteristics was performed on breeding material 1 - 5 generations of selection (F₁-F₅) of the aforementioned breeds.

The reproductive indicators of females of new generations of the approved Moldavian carp breeds: of Carp Teleneshtskiy Scaly (Ts₅) and Carp Teleneshtskiy Frame fifth generation (Tf₅) were evaluated in comparison with the previous generations (F₁-F₄); data standards breeds (F₃) and existent norms.

RESULTS AND DISCUSSIONS

In the selection of Moldavian carp breeds for increase the resistance to infectious diseases by the most rigid selection (with a total tension for Carp Teleneshtskiy Frame - 9.2%, for Carp Teleneshtskiy Scaly - 20.2%) had a mass selection in the initial bloodstock (F₀).

In carrying out of family selection (F₁, F₂) in the result of testing of carp at different stages of viability, of resistance to aeromonoz in bioassay and of susceptibility to diseases under fields conditions (cultivation in ponds on the

provocative background) were distributed to families in these contrasting characteristics of the group. We have identified differences between morphotypes among families with high and low viability (KURKUBET, 1994, 2010).

In the most differentiated groups of families (F2), the stepwise regression is identified several traits that are associated with the overall viability in the ponds and sustainability in the bioassay: body length (l), head length (C), head height (hC), the maximum body height (H). These signs are commonly used by breeders in the form of indices: the index body height l/H and the index of ratio of the head C/hC . In the least differentiated groups - (F3) are released by only one informative sign hC.

Based on this, on the investigated material were counted values of these indices for families with high viability: $l/h - 2.5$ and $C/hC - 1.5$ and with reduced: $l/h - 2.0$ and $C/hC - 1.0$. These indices can be used in the selection of the target standard and in the elaboration of selection methods.

According to our data there is a negative correlation between body height and overall viability, including the resistance to disease.

In the process of the formation of new broodstocks of Carp Teleneshtskiy Scaly (Ts) and Carp Teleneshtskiy Frame (Tf), conducted individual, mass and combined selections for 4 generations of selection resulted to increase the resistance to infectious diseases, and as a consequence, to change the main exterior indices. The average value of the index of body height (l/H) of Carps scaly increased from 2.09 to 2.30 - in the females and 2.16 to 2.28 - in males; of Carps Frame - from 2.11 to 2.34 and from 2.14 to 2.40, respectively (Table 1, Fig. 1).

Indicators of ratio of head length to its height also increased: in females scaly up to 1.38, in males - up to 1.33; in females frame - 1.44 and 1.44, respectively (Fig. 2).

Table 1. Change the morphometric parameters of breeds carp in result of selection for increasing resistance to infectious diseases.

Exterior indices	Females				Males			
	Ts(F ₁)	Tf(F ₁)	Ts(F ₅)	Tf(F ₅)	Ts(F ₁)	Tf(F ₁)	Ts(F ₅)	Tf(F ₅)
Body weight, P.g	5855	5350	2400-4800	2900-4500	5600	4580	2400-4100	3600-4300
Body length, l,cm	49.4	48.2	43.0-50.0	40.0-44.0	49.8	46.7	41.0-56.0	40.0-42.0
Indices:								
Head length/ body length, %C	25.5	25.7	25.0-27.9	26.0-28.0	25.4	25.2	24.0-29,3	26.2-28.0
Body height, I _n	2.09	2.11	2.09-2.47	2.05-2.44	2.16	2.14	2.21-2.31	2.20-2.56
Body thickness, I _{br}	21.4	21.2	19.1-20.9	18.1-21.4	21.1	20.7	18.5-21.9	17.5-19.5
Body girth, I _o	0.85	0.86	1.10-1.18	1.04-1.19	0.91	0.88	1.07-1.14	0.97-1.09
Relations:								
Length of caudal peduncle /height of his, pl/h	1.13	1.12	1.06-1.14	1.00-1.14	1.13	1.10	1.00-1.05	1.00-1.16
Head length/height of its, C /hC	1.21	1.24	1.20-1.38	1.30-1.44	1.23	1.22	1.20-1.33	1.27-1.44

More intensive selection of carps frame, related to their greater susceptibility to infectious diseases, has led to more significant changes in their morphology, as compared with scaly forms.

Selection of carps for increasing resistance to infectious diseases was accompanied by a double effect: on one hand, the indices had been identified that determine the prospects of selection for increased stability, by the other hand, in the result of selections of the best families on the viability and sustainability in the bioassay, we approach their exterior to the counted values.

When we chose a target standard the most important is the determination of the optimal level of resistance, which would give the production effect and was not accompanied by negatively correlated effects - declined in productive characteristics (decrease in growth rate, fecundity or meatiness). That's why, in parallel, performed the selection by body weight at a moderate tension - 64.6% and intensity - 1.95 and maintaining exterior.

Fecundity is one measure of productivity and depends on environmental conditions, and is under the control of hereditary factors (MASLOVA, 2005).

Comparative evaluation of reproductive characteristics of females of Carp Teleneshtskiy Scaly and of Carp Teleneshtskiy Frame of 1-5 generation is shown by the result of the selection process in 4-5 generations observed.

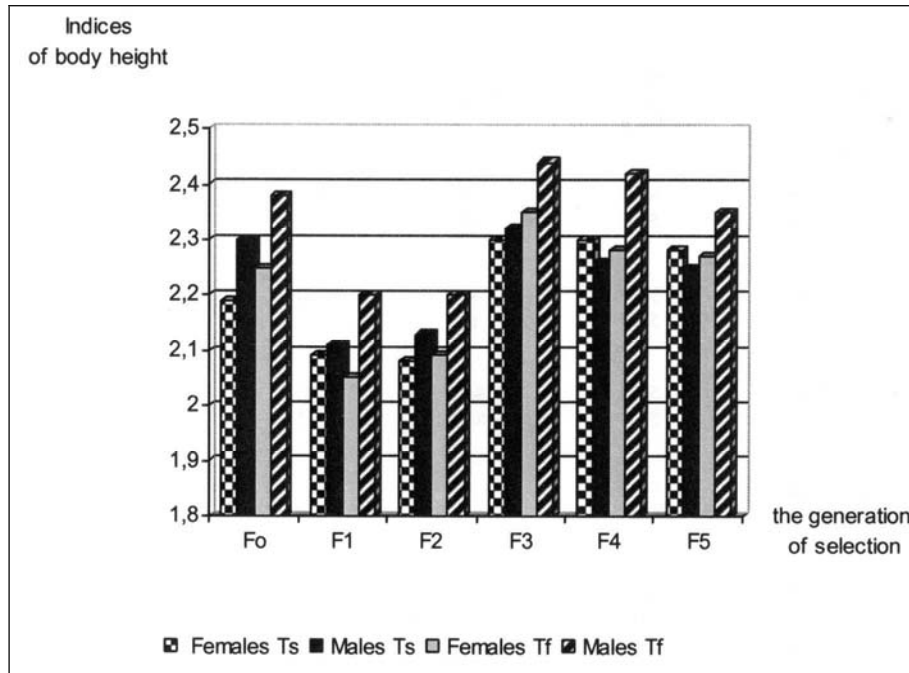


Figure 1. Change the indices of body height of Teleneshtskiy breeds carp in result of selection for increasing resistance to infectious diseases.

Increased in the percentage of fertilization to 93.3% in carps scaly and to 92.6% - in carps frame; percent of development of eggs - up to 82 and 80% and yield the three-day larvae - up to 490 and 480 thousand units, respectively. Yield of larvae from eggs increased in 1.9-1.7 times, respectively on breeds (Table 2).

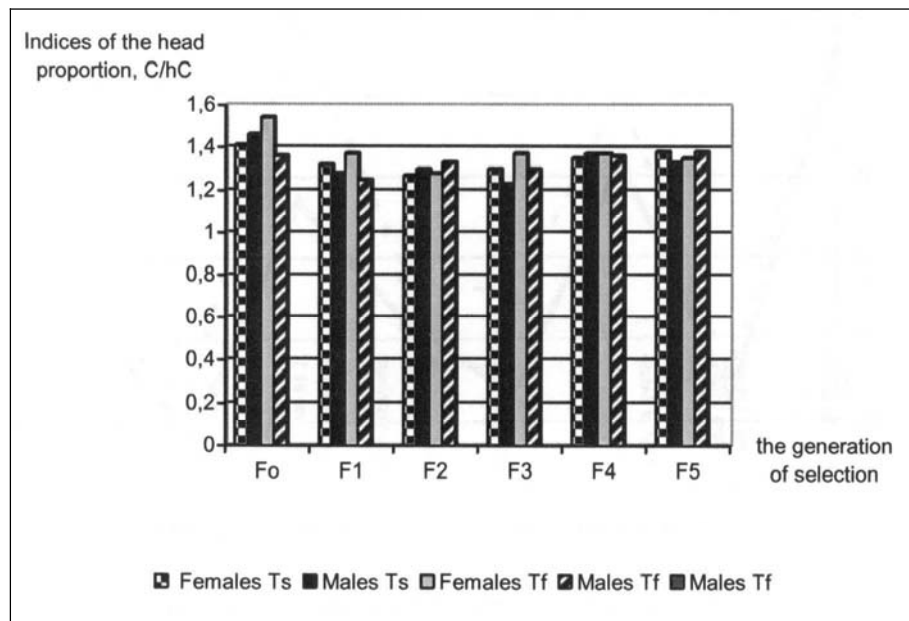


Figure 2. Change the indices of the head proportion of Teleneshtskiy breeds carp in result of selection for increasing resistance to infectious diseases.

Analysis of reproductive characteristics of Carps Teleneshtskiy of third generation of selection at the time approbation rocks (breed standard) is showed by working fecundity, yield of the three-day larvae and productivity of females on I-st year of both breeds are superior exceed standards of values, with some advantage Teleneshtskiy Scaly carp (Fig. 3).

Table 2. Change the reproductive parameters of breeds of carp in result of selection for increasing resistance to infectious diseases.

Generations, breeds	Average weight of females, g	Fertilization, %	Development of eggs, %	Yield the three-day larvae, thousand units	Yield of larvae from eggs, %
1 generation					
Carp Teleneshtskiy Scaly Carp	6500	91	76.3	330	30.2
Teleneshtskiy Frame	5800	82	71.3	320	33.2
2 generation					
Carp Teleneshtskiy Scaly Carp	5600	88	73.9	350	49.8
Teleneshtskiy Frame	5700	86	73	320	40.2
3 generation					
Carp Teleneshtskiy Scaly Carp	6000	84.2	73	429	51
Teleneshtskiy Frame	5700	85.8	73.4	399	50.4
4 generation					
Carp Teleneshtskiy Scaly Carp	5900	93.3	74	490	56.2
Teleneshtskiy Frame	5700	92.6	73.7	480	55.8
5 generation					
Carp Teleneshtskiy Scaly Carp	5280	93	82	410	57
Teleneshtskiy Frame	5360	90	80	430	56.6

Percent of yield larvae from eggs and the survival underyearlings from eggs of carps Teleneshtskiy (F3), relating to carps of "fattening-type", selection which was carried out in the direction conservation of body height, meatiness, increasing the rate of growth, fecundity and resistance to infectious diseases, not to exceed normative (DOMANCHUK & KURKUBET, 2002; KURKUBET & DOMANCHUK, 2005).

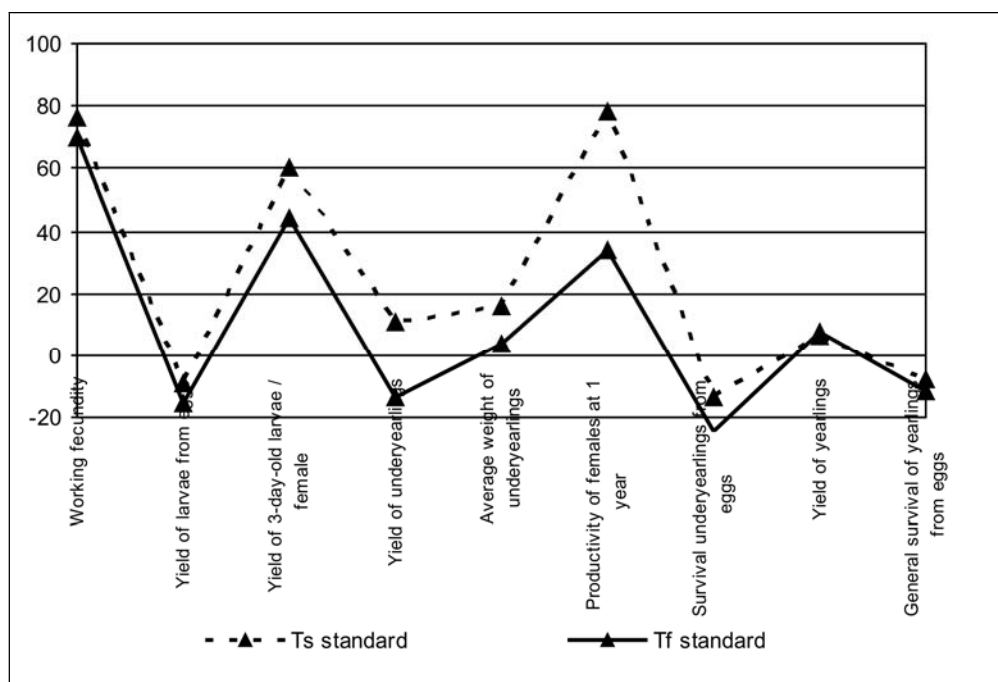


Figure 3. Comparative evaluation standards (F3) of the two breeds on indicators productivity with the norms.

Females and males of a new generation of two breeds of the 5th generation of selection were characterized by typical data breeds exterior indices: index body height of Carp Teleneshtskiy Scaly and of Carp Teleneshtskiy Frame was within 2.28-2.38 and showed good adaptability to the artificial methods of reproduction, to respond positively to hormonal stimulation. Number of spawned ranged from 86.7 to 90.0%. The working fecundity of females reaches 910-930 thousand of eggs and the relative fecundity meet the standards of rocks: 150-152 thousand units per kilogram of body weight. Realized fecundity, is expressed as a yield of three-day larvae was significant: 495-500 thousand per female. Survival of larvae from eggs was 53-55% (Table 3).

Table 3. Reproductive characteristics of females of the two breeds carp of subgeneration new fifth generation at the age six years.

Breed	Parameters	norms	Ts 5	Tf 5
	Average female weight, g	5500	6000	6200
	Number of spawned females, %	85.0	86.7	90.0
	Eggs per female, g	400-600	1180	1200
	Maturity rate, %	14.0	19.7	19.4
	Working fecundity, thousand	300-500	910	930
	Relative fecundity, thousand / kg	110-120	152	150
	% of fertilization	80.0	91.0	88.0
	Development of egg, %	70.0	74.0	77.0
	Yield of 3-day-old larvae/female, thousand	150-250	500	495
	Yield of larvae from eggs, %	50.0	55.0	53.0

In general, the usage in the reproduction of the females of new generations (F5) had higher reproductive performance and a number of indicators significantly exceeded standards.

Relative to the standard of breads in the next two generations (F4; F5) were increased in virtually all the analyzed productive factors: most benefits were manifested in productivity of the females at the first year: Carp Teleneshtskiy Scaly (F5) - 91.6%, Carp Teleneshtskiy Frame (F5) - 138.8%, both by increasing the body weight and survival underyearlings - 91.6% (Fig. 4).

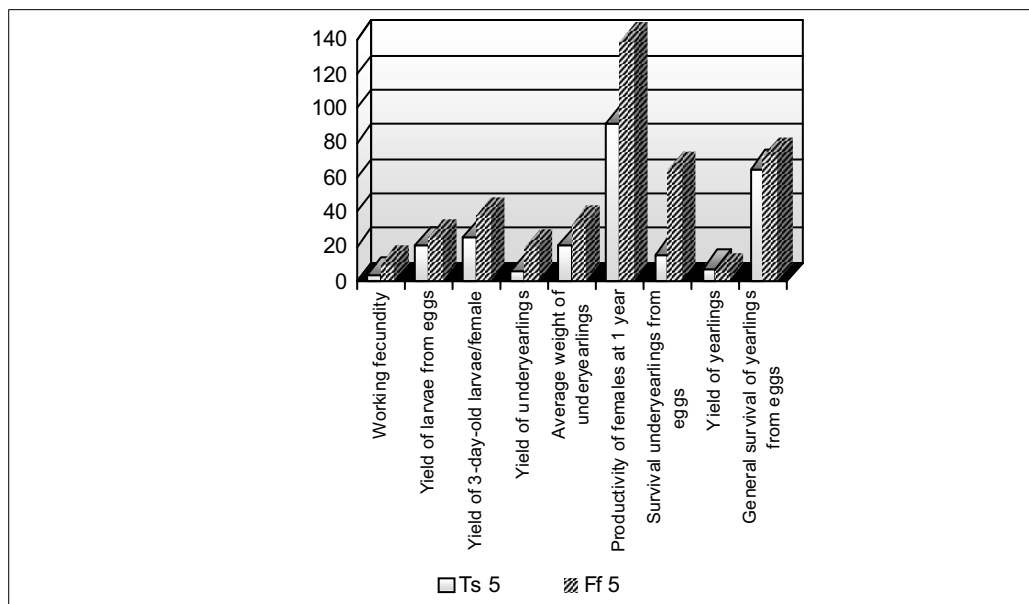


Figure 4. The advantage of the new generations of the two breeds on indicators productivity over their standards (%).

A clear advantage of the researched breeds of new generation in comparison to their standard is also observed on survival of yearling from eggs: Carp Teleneshtskiy Scaly (F5) - 65%; Carp Teleneshtskiy Frame (F5) - 72.6%; on survival underyearlings from eggs: 15.4%; 64.8% and on yield three days of larvae per female: 25.0%, 37.5%, respectively.

It should be noted that after approbation of breeds (2000) over the next two generations we carried only correcting selection on body weight, exterior and degree of sexual characteristics with the moderate intensity.

As a result of selection in several generations with greater intensity (to approbation) were increased three reproductive parameters that were included in the target program: realized fecundity (working fecundity + yield of three-day larvae) and productivity of females on underyearlings.

The next two generations of selection is indicated the excess of all breeds over their standards for all investigated indicators of productivity, with precedence on productivity females at the first year, general survival of yearling from eggs and survival underyearlings.

CONCLUSIONS

The effectiveness of selection of carps Teleneshtskiy for increased resistance to infectious diseases throughout 3-4 generations has led to an increased resistance and, as a consequence, to changes in the main exterior indicators (change of morphotype): much tension selection among carps frame contributed to more significant change in their morphological features compared with scaly carps.

The target selection of Moldovan carp breeds for increasing resistance to disease, directed at maintaining the productivity of characteristics led to a significant improvement in the last two generations of selection the main indicators of reproduction is compared to the standards of these rocks and norms.

When you select a target standard for selection for resistance to disease, they can not be conducted by one-way match only on the counted indices, should be guided by them, while maintaining a balance between the indicators of viability and maintaining high productivity characteristics.

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