# STUDY CONCERNING THE ESTIMATION OF GENETIC DETERMINISM FOR ECONOMICAL TRAITS IN FRASINET, INEU AND ROPSA CARPS BREEDS

**Nicolae Carmen Georgeta, Popa Razvan, Popa Dana, Maftei Marius, Costache Mioara**

Faculty of Animal Science, University of Agricultural Sciences and Veterinary Medicine, Bucharest, 59 Marasti, sector 1, 011464, Bucharest, Romania; carmennicolae19@yahoo.com

***Abstract***

*Establish the genetic determinism is a very important step in animal breeding. According to heritability value is underlie the breeding system, selection objective and selection method. Furthermore the heritability is a part of any mathematical relation in animal breeding (estimation of breeding value, genetic gain). At studied carp breed the heritability values shows a medium and intense genetic determinism.*

**Key words:** economical traits, heritability, carp breeds

## INTRODUCTION

Broadly, two individuals complete identically can't be found into fish populations. The origin of private quantitative traits into a population is induced, on a hand, by the genotype effects and, on the other hand, by the environmental factors in which the organism develops (Popescu-Vifor, 1985).

The result of fish selection depends directly on the statistical relationship between the coefficient value of heritability and phenotype. That is why, the research made on heritability provides some valuations for the traits of economic interest, valuations that need to be completed by a higher number of traits. With that point of view, the present work is to estimate the heritability for more traits into a pattern of three different breeds of carp individuals, Frasinet, Ineu and Ropsa (Bércseny, 1983). The studied trait was represented by: body weight, length, utmost height, H/l proportion.

## MATERIAL AND METHOD

The biological stuff used in this experiment derives from the Dâmbovița district, "Fish Breeding Research Station", Nucet. It is composed by a group of individuals of three different carp breeds: Frasinet, Ineu and Ropsa.

The research was made on 5 crofts of one summer age sampling, provided by 5 families, a family being formed by a female and two males. Each lot was constituted by 50 individuals measured during three years; at the finish of each summer of breeding, the body weight, length, maximum height and H/l ratio was determined (Lustun, 1985; Popa, Jecu, 2002).

In this research we used the variant's analysis method with two sources of variation. With the square average we estimate the value of each source of variation, this being the observational constituents of variant ($S_F^2=V_T$; $S_M^2=V_I$; $S_e^2=V_i$).

On the basis of these values we persuade then the causative constituents of variant, as follows (Falconer, 1969):

$V_F = S_F^2$ ($V_F$ – variant of phenotype);

$V_A = 4 \cdot S_M^2$ ($V_A$ – variant addition);

$V_M = V_F - V_A$ ($V_M$ – variant environment).

The heritability is one of the most important genetic parameters of quantitative traits. The method used for establishing the heritability (noted $h^2$) of different traits, was based in our case, on the analysis of variant's constituents, which divides genetic variant from the entire variant, to make possible the calculation of $V_A/V_F = h^2$ ratio. In the variant analyze we used the half-brother groups method, which is the half-brother are groups of individuals with a common genetic matter, provided by one of the parents, this common genetic matter being the same for all half-brother from the group (Petre, Negruțiu, Pipernea, 1975).

This method is for dividing the genetic variant from the entire variant; the purpose was to identify the following variation sources:

- the inner half-brother groups variant, measured by the mothers and the environmental variant;
- the variant between half-brother groups, measured by the genetically variant of the males, and the inner half-brother groups variant.

The estimation of heritability error was performed by using the Robertson's simplified method (Drăgănescu, Grosu, 2003; Tacu, 1968):

$$s_h^2 = (h^2 + \frac{4}{n}) \times \sqrt{\frac{2}{s}}$$ , in which:

s – is the number of the families

n –is the average size of these families.

The lower **s**'s and **n**'s values are, the higher the error of heritability is, and if the number of the used families, as much as the average size of those is high, the standard deviation of the heritability is low (Kirpitchikov, 1999).

**RESEARCH RESULTS**

From the offspring of each breed was held back and introduced for breeding in first summer, five lots of larvae of seven days old, provided from five families. This lot was monitories until two years and a summer years old.

The heritability ($h^2$) is defined as the rate of genetically additive variant from phenotypic variant. As the selection and reproduction programs may action only over additive genetic variations from the population, the other genetic variations constituents being limited by the gross stuff and by the peculiar environment in which the experiment is developed.
After the calculation of the observational and causal constituents of variant, the heritability for the main studied traits, in all three breeds and for three ages was established.
All period long, the weight and length body of the Frasinet carp inhabitants have values which place these traits in weakly to medium heritable ones (table 1).
Because of the fact that the heritability is that percentage from total variant which may be assigned to the medium effect of genes, we may say that these traits have a low to medium genetic determinism.
For the heritability, the maximal body height fluctuates over the three summers of breeding. Thus, after the first summer, the traits have a medium genetic determinism (0,395±0,503), while into the second summer, the genetic determinism is low (0,135±0,338), and after the third summer it returns to a medium value (0,264±0,420) (Nicolae, 2004).
About the body length, the heritability value has a decreasing tendency according to age, from the fledgling to adult stage respectively.

*Table 1*

The heritability values of studied traits at Frasinet carp

| Trait | 0+ | 1+ | 2+ |
|---|---|---|---|
| | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ |
| Body weight (g) | 0,246±0,408 | 0,240±0,405 | 0,297±0,441 |
| Maximum height (mm) | 0,395±0,503 | 0,135±0,338 | 0,264±0,420 |
| Body length (mm) | 0,294±0,439 | 0,223±0,295 | 0,214±0,302 |
| H/l ratio | 0,478±0,555 | 0,369±0,401 | 0,502±0,571 |

H/l ratio is a intensely heritable trait after the first and the third summer of breeding, except for the second summer, in which it has an medium genetic determinism; the obtained value (0,369±0,401) is near to the superior limit of the heritable intermediate trait, this being 0,400.
According to the suitable determinations, in Ineu carp population, we found that the body weight has a medium genetic determinism for the entire breeding period, with an increasing tendency according to the age (table 2).
Unlike the Frasinet carps, at Ineu, maximum body height has low heritability values after the second summer (0,148±0,347) and the third summer of breeding (0,139±0,241), following a low genetic determinism.

The body length of Ineu becomes a heritable intermediate trait after the first and the third summer of breeding, in comparisons with the second summer, in which the value is 0,499±0,569, placing it into the intense heritable ones.

*Table 2*

The heritability values of studied traits at Ineu carp

| Trait | 0+ | 1+ | 2+ |
|---|---|---|---|
| | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ |
| Body weight (g) | 0,207±0,384 | 0,250±0,411 | 0,347±0,472 |
| Maximum height (mm) | 0,278±0,429 | 0,148±0,347 | 0,139±0,241 |
| Body length (mm) | 0,233±0,400 | 0,499±0,569 | 0,251±0,412 |
| H/l ratio | 0,321±0,450 | 0,398±0,505 | 0,456±0,541 |

The H/l ratio becomes a heritable intermediate trait after the first summer of breeding (0,321±0,450); after the second summer, it has a heritability near to the lower limit of the intense heritable traits (0,398±0,505) and becomes intense heritable after the third summer of breeding (0,456±0,541)
Regarding the body weight, almost the same situation as in Frasinet carp population, is in Ropsa carp population, too (table 3). Thus, in Ropsa carp population; this trait becomes an intermediate heritable one at the finish of each breeding period, after the determinations are performed.

*Table 3*

The heritability values of studied traits at Ropsa carp

| Trait | 0+ | 1+ | 2+ |
|---|---|---|---|
| | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ | $h^2 \pm S_{h^2}$ |
| Body weight (g) | 0,270±0,424 | 0,251±0,412 | 0,266±0,422 |
| Maximum height (mm) | 0,218±0,381 | 0,259±0,417 | 0,284±0,432 |
| Body length (mm) | 0,254±0,414 | 0,280±0,430 | 0,276±0,427 |
| H/l ratio | 0,504±0,572 | 0,246±0,208 | 0,309±0,448 |

Unlike the Frasinet and Ineu carps, for entire experiment period, the maximum body height trait is an intermediate heritable trait.
After the second and the third summer, the body length has a relatively invariable heritability with 0,03 % lower then the first summer of breeding.
Regarding the H/l ratio, after the second summer breeding, it has an intense heritability (0,504±0,572) and a medium one, after the next two summers (0,246±0,208, respectively 0,309±0,448).

## CONCLUSIONS

The present study leads to the following conclusions:

1. After the first summer of breeding, the highest values of maximum body height and length are found at Frasinet breed, with a bended back profile. Regarding the heritability of body weight and H/l ratio, the individuals from the Ineu carps are exceeded by Ropsa breed.
2. After the second summer of breeding, the supremacy in body length and H/l ratio is for Ineu (a breed with a high body), followed by Ropsa (for body weight and maximum height). This fact can be owed to the body profile of Ineu, but also to the fact that the Ropsa arisen better rendered profitable the natural recourses, even in conditions of lean supplement food.
3. Unlike the first summer of breeding, after the third summer, there are high values of heritability for maximum height and body length in Ropsa, in spite of the beginning of the breeding period in Frasinet. But Frasinet breed has the highest H/l ratio of heritability value for change, Ineu possessing the body weight one.

**Acknowledgments**

This research work was carried out with the support of Centre of Rechearches and Development of Aquaculture (C.C.D.P.), Nucet-Dambovita.

**REFERENCES**

1. Bércseny, M., 1983, Îndrumător pentru aprecierea raselor de crap în cadrul țărilor membre CAER, HAKI-Szarvas.
2. Drăgănescu, C., H., Grosu, 2003, Ameliorarea animalelor, Editura Agrotehnica, Bucureşti.
3. Falconer, D.S., 1969, Introducere în genetica cantitativă, Editura Agrosilvică, Bucureşti.
4. Kirpitchnikov, V. S., 1999, Genetics and breeding of common carp, revised by R. Billard, J. Reperant, J. P. Rio and R. Ward, Institut National de la Recherche Agronimique, Paris.
5. Lustun, L., 1985, Lucrări practice de piscicultură, A. M. C. al I.A.N.B. Bucureşti.
6. Nicolae, Carmen, Georgeta, 2004, Studiul determinismului genetic al procesului de creştere la peşti, Teză de doctorat, USAMV, Bucureşti.
7. Petre, A. and E., Negruțiu, 1975, Genetică animală. Editura Didactică şi Pedagogică, Bucureşti.
8. Popa, Carmen and Elena, Jecu, 2002, Selecția şi ameliorarea peştilor, Editura Macarie, Târgovişte.
9. Popescu-Vifor, Şt., 1985, Genetica procesului de dezvoltare la animale. Editura Ceres, Bucureşti.
10. Tacu, A., 1968, Metode statistice în zootehnie şi medicină veterinară. Editura Agrosilvică, Bucureşti.