

**THE COMPARATIVE STUDY OF SOME BODILY
VARIABLES IN *ARISTICHTHYS NOBILIS* AND
*HYPOPHTHALMICHTHYS MOLITRIX***

**STUDIUL COMPARATIV AL UNOR VARIABLE
CORPORALE LA *ARISTICHTHYS NOBILIS* ȘI
*HYPOPHTHALMICHTHYS MOLITRIX***

VASILE GABRIELA *, CIORNEA ELENA *, MISĂILĂ ELENA RADA **,
MISĂILĂ C.*

*Faculty of Biology, "Alexandru Ioan Cuza" University, Iași, România

**S.C.D.A.E.A., Iași, România

*The paper performs a comparative analysis of some bodily variables (maximum bodily height, circumference and bodily weight) in two cultured cyprinids species grown in a controlled system, namely: *Aristichthys nobilis* (bighead carp) and *Hypophthalmichthys molitrix* (silver carp), of various ages (starting with the first up to the fourth growth summer). The results obtained evidenced that, in the four-summer old the representatives of *Aristichthys nobilis* show slightly higher values than those of *Hypophthalmichthys* genus, for the all bodily variables taken into study.*

Key words: bodily variables, bighead carp, silver carp

Introduction

Fish are aquatic creatures, known and consumed by humans as early as the latter's occurrence on earth, constituting the initial and, in most cases, the main source of food, which explains the especially important role they play in the very process of mankind's evolution, to say nothing of the raw materials they provide to numerous economic branches, such as: pharmaceuticals, chemistry, workmanship, in fabrics of proteic fodders etc. (Bud *et al.*, 2004).

Materials and Methods

The experimental researches were accomplished on two fishy species from Chinese carps complex of culture (bighead carp and silver carp), funded out on different evolutionary levels (beginning with first summer of growth - 0₊ and up to fourth - 3₊). The main corporal variables investigated were the maxim height, the circumference and the bodily weight (Voican *et al.*, 1975; Pojoga and Negriu, 1988). Finally, was realized a statistical analyze of obtained data being calculated

the mean, the error and the standard deviation, median, mode, variance, the mean variation and precision coefficient, as well as limit (superior and inferior) of the confidence interval in which each variable oscillates (Dragomirescu, 1998; Gomoiu and Skolka, 2001; Varvara *et al.*, 2001).

Results and Discussions

The main objective of this study carried out the comparative analysis of some bodily variables (maxim height, circumference and bodily weight) on groups of age (0₊, 1₊, 2₊ and, 3₊, respectively) in *Aristichthys nobilis* and *Hypophthalmichthys molitrix*.

During on the first three years of growth is evidenced the bigger values of height and bodily average circumferences in the population of *Hypophthalmichthys molitrix*, and in four summer-old is in progress an overturn situation, that is species *Aristichthys nobilis* holds the superior thresholds for both bodily variables analyzed.

In the individuals of one summer-old bighead carp the bodily maximum height is contained in the interval of 3.006 - 3.101 cm, and in the four summer-old is between 19.786 - 20.723 cm, while in the silver carp oscillates between 3.337 - 3.422 cm in the stage of fry and 17.906 - 18.803 cm in fourth summer of growth (tables 1 - 2).

Table 1

The values of the main statistical indices of the average bodily height in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

Species	<i>Aristichthys nobilis</i>				<i>Hypophthalmichthys molitrix</i>			
Age (years)								
Statistical indices	0 ₊	1 ₊	2 ₊	3 ₊	0 ₊	1 ₊	2 ₊	3 ₊
Mean	3.054	9.5	13.497	20.255	3.38	11.11	15.902	18.355
Standard error	0.024	0.056	0.136	0.236	0.021	0.103	0.151	0.225
Median	3	9.5	13.4	20.5	3.5	11	15.5	18.75
Mode	3	9	13	21	3.5	12	15	16
Standard deviation	0.24	0.568	1.367	2.361	0.214	1.036	1.51	2.258
Variance	0.057	0.323	1.868	5.578	0.046	1.073	2.281	5.102
Confidence level (95%)	0.047	0.112	0.271	0.468	0.042	0.205	0.299	0.448
Upper limit	3.101	9.612	13.768	20.723	3.422	11.315	16.201	18.803
Lower limit	3.006	9.387	13.225	19.786	3.337	10.904	15.602	17.906
CV%	7.876	5.984	10.128	11.66	6.349	9.326	9.497	12.306
m%	0.787	0.598	1.012	1.166	0.634	0.932	0.949	1.23

CV% = mean variation coefficient, m% = mean precision coefficient

Table 2

The values of the main statistical indices of the average bodily circumference in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

Species	<i>Aristichthys nobilis</i>				<i>Hypophthalmichthys molitrix</i>			
Age (years)								
Statistical indices	0+	1+	2+	3+	0+	1+	2+	3+
Mean	6.838	20.415	29.25	41.395	6.88	22.74	32.805	39.12
Standard error	0.049	0.112	0.264	0.464	0.053	0.205	0.282	0.349
Median	7	20.5	30	41	7	23	32	38.5
Mode	7	20.5	31	42.5	7	23	40	39.5
Standard deviation	0.499	1.121	2.649	4.644	0.537	2.051	2.825	3.497
Variance	0.249	1.257	7.017	21.572	0.288	4.209	7.984	12.232
Confidence level (95%)	0.099	0.222	0.525	0.921	0.106	0.407	0.56	0.693
Upper limit	6.937	20.637	29.775	42.316	6.986	23.147	33.365	39.813
Lower limit	6.738	20.192	28.724	40.473	6.773	22.332	32.244	38.426
CV%	7.309	5.493	9.056	11.22	7.806	9.022	8.613	8.94
m%	0.73	0.549	0.905	1.122	0.78	0.902	0.861	0.894

CV% = the mean variation coefficient, m% = the mean precision coefficient

In *Aristichthys nobilis* the report among the final average height and one initial is 6.632, while in *Hypophthalmichthys molitrix* is 5.43. In the case of bodily average circumference the report of multiplication is 6.053 in bighead carp and 5.686 in silver carp (figs. 1 - 2).

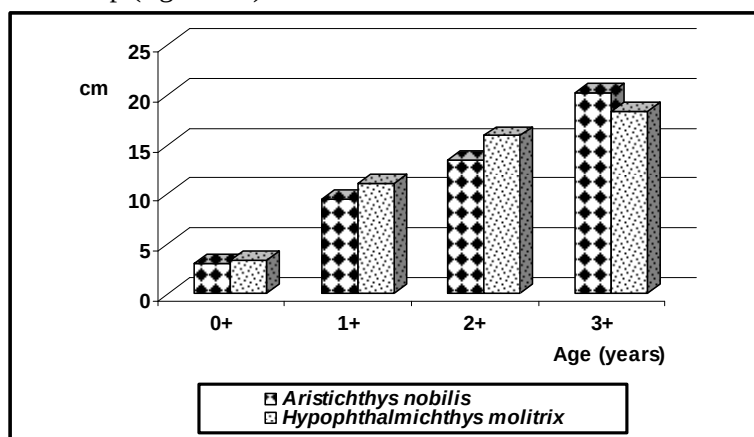


Fig. 1. Comparative graphical representation of the average bodily height in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

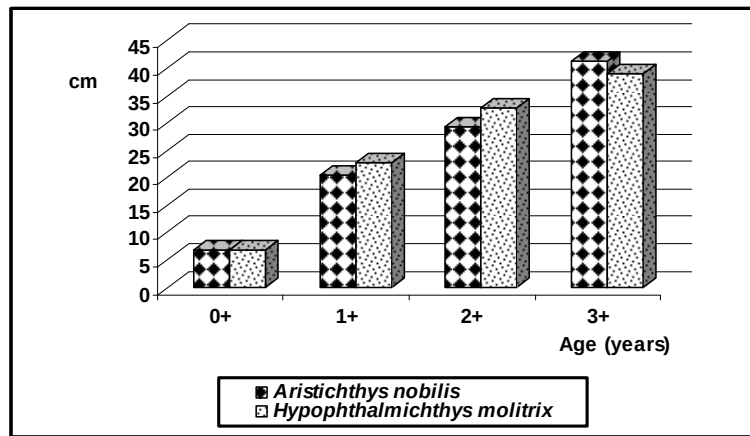


Fig. 2. Comparative graphical representation of the average bodily circumference in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

As to the rhythm of growth, the average weights values registered denote an active growth in both species, bighead carp holding the superior values than silver carp. The literature of the field mentions that *Aristichthys nobilis* is the species with most intense rhythm of growth among Chinese carps. From figure 3 is noticed that in the first and second summer of growth is not registered significant differences between two cultured cyprinids species, but for the past two developmental stages (third and fourth summer) individuals of bighead carp present a significant growth of bodily weight comparative with the one of silver. Thus, in three summer-old the average weight is 1702.5 g in bighead carp and 1529 g in silver carp, while in fourth summer is 3278.5 g in bighead carp and 3052 g in silver carp. The report among the final average weight and one initial in the bighead carp is 220.403, and in the silver carp is 176.416 (table 3).

Table 3

The values of the main statistical indices of the average bodily weight in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

Species	<i>Aristichthys nobilis</i>				<i>Hypophthalmichthys molitrix</i>			
Age (years)								
Statistical indices	0 ₊	1 ₊	2 ₊	3 ₊	0 ₊	1 ₊	2 ₊	3 ₊
Mean	14.875	562.47	1702.5	3278.5	17.3	572.7	1529	3052
Standard error	0.237	10.231	24.447	54.086	0.335	11.906	39.416	29.084
Median	15	564	1700	3300	19.25	580	1450	3000
Mode	16	450	2000	3400	19.5	700	1200	2900
Standard deviation	2.378	102.31	244.47	540.86	3.352	119.06	394.16	290.84

Species	<i>Aristichthys nobilis</i>				<i>Hypophthalmichthys molitrix</i>			
Age (years)								
Statistical indices	0 ₊	1 ₊	2 ₊	3 ₊	0 ₊	1 ₊	2 ₊	3 ₊
Variance	5.658	10468	59766	292538	11.237	14177	155362	84591
Confidence level (95%)	0.471	20.301	48.508	107.31	0.665	23.625	78.21	57.710
Upper limit	15.347	582.77	1751.0	3385.8	17.965	596.32	1607.2	3109.7
Lower limit	14.403	542.16	1653.9	3171.1	16.634	549.07	1450.7	2994.2
CV%	15.991	18.19	14.359	16.497	19.376	20.79	25.778	9.529
m%	1.599	1.819	1.435	1.649	1.937	2.079	2.557	0.952

CV% = mean variation coefficient, m% = mean precision coefficient

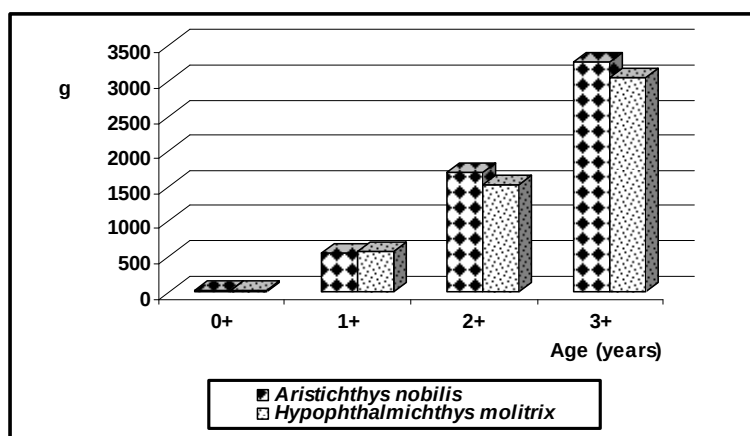


Fig.3. Comparative graphical representation of the average bodily weight in *Aristichthys nobilis* and *Hypophthalmichthys molitrix* of various ages

Species *Aristichthys nobilis* knows an impressive rhythm of growth when disposes of the sufficient amounts of food. In this sense, are known from literature (Baltadgi, 1979; Grozea and Bura, 2002) performance of growth in individuals of bighead carp which attain the maximum individual weights of 40 kg. After Waterman (1997) in fertile waters, with approximate temperatures of 13.9°C, bighead carp can attain a weight of 2.7 kg in less of a year. After arrive at a weight of 0.45 - 0.68 kg, he can take in weight 0.45 kg or just more per month (Stone *et al.*, 2000), being able to attain 18 - 23 kg in 4 - 5 years (Henderson, 1978) and a length of 1.5 m or just more. The biggest record registers in USA were of 40.8 kg in one representative captured from the Texas lake in 1999 (Howells, 2001). In period 1998 - 1999, in the Mississippi river, Nuevo *et al.*, (2004 a, 2004 b) pointed out for individuals of three years-old bighead carp, bodily lengths contained

between 75.7 - 85.2 cm and 80.7 - 90.9 cm in the five years-old representatives. As to the net production, in systems of culture, the bighead carp proved an elder potential of growth comparative with other two species from Chinese complex: silver carp and grass carp (Newton, 1980; Opuszynski, 1981).

As well as bighead carp, the silver carp can have a quick growing rhythm, exceeding 1.2 m length (Kamilov and Salikhov, 1996), and the maximum individual weight registered was 50 kg (Billard, 1997). The growth of silver carp is stricken in primordial way by the food availability as well as by the density of population (Tripathi, 1989; Hagiwara and Mitsch, 1994; Liang *et al.*, 1999).

Conclusions

➤ In the last stage of development individuals belonging to the *Aristichthys nobilis* species present the slightly higher values comparative with the representatives of *Hypophthalmichthys* genus, for the all bodily variables taken into study.

➤ In the two cyprinids species, the confidence interval limits, calculating on the basis of the average values and standard deviation, for all bodily variables taken into study are very limitary for all ages, what denote the existence of a phenotypic similarity between the individuals of two cultured carps genus.

Bibliography

1. **Baltadgi, R. A.** (1979) - *The artificial reproduction, feeding, and growth of the herbivorous fishes in the reservoirs with ordinary and higher thermal regimes*, Symposium on the Biology and Management of Herbivorous Freshwater Fishes in the Pacific Area, 49 - 50.

2. **Billard, R.** (1997) - *Les poissons d'eau douce des rivières de France. Identification, inventaire et répartition des 83 espèces*, Lausanne, Delachaux and Niestlé, 192 p.

3. **Bud, I., Diaconescu, Șt., Mudure, M.** (2004) - *Creșterea crapului și a altor specii de pești*, Ed. Ceres, București, 546 p.

4. **Dragomirescu, L.** (1998) - *Biostatistică pentru începători*, Ed. Constelații, București, 216 p.

5. **Gomoiu, T. M., Skolka, M.** (2001) - *Ecologie. Metodologii pentru studii ecologice*, Ed. Univ. „Ovidius” Constanța, 170 p.

6. **Hagiwara, H., Mitsch, W. J.** (1994) - *Ecosystem modeling of a multi-species integrated aquaculture pond in south China*, Ecological Modeling, **71**: 41 - 73.

7. **Henderson, S.** (1978) - *An evaluation of the filter feeding fishes, silver and bighead carp, for water quality improvement*, in Smitherman, R. O., Shelton, W. L., Grover, J. H., editors, Culture of exotic fishes symposium proceedings. Fish Culture Section, American Fisheries Society, Auburn, Alabama, 121 - 136.

8. **Howells, R. G.** (2001) - *Introduced non-native fishes and shellfishes in Texas water: an updated list and discussion*, Texas Parks and Wildlife Department Manangement Data Series 188, 27 p.
9. **Kamilov, B. G., Salikhov, T. V.** (1996) - *Spawning and reproductive potential of the silver carp Hypophthalmichthys molitrix from the Syr Dar'ya River*, Journal of Ichthyology, **36** (5): 600 - 606.
10. **Liang, Y., Cheung, R. Y. H., Everitt, S., Wong, M. H.** (1999) - *Reclamation of wastewater for polyculture of freshwater fish: fish culture in ponds*, Water Research, **33**: 2099 - 2109.
11. **Newton, S. H.** (1980) - *Catfish farming with Chinese carp*, Arkansas Farm Research, **29** (1): 8.
12. **Nuevo, M. R., Sheehan, R. J., Heidinger, R. C.** (2004 a) - *Accuracy and precision of age determination techniques for Mississippi River bighead carp Hypophthalmichthys nobilis (Richardson, 1845) using pectoral spines and scales*, Archive for Hydrobiology, **160**: 45 - 56.
13. **Nuevo, M. R., Sheehan, R. J., Willis, P. S.** (2004 b) - *Age and growth of the bighead carp Hypophthalmichthys nobilis (Richardson, 1845) in the middle Mississippi River*, Archive for Hydrobiology, **160**: 215 - 230.
14. **Opuszynski, K.** (1981) - *Comparison of the usefulness of the silver carp and the bighead carp as additional fish in carp ponds*, Aquaculture, **25**: 223 - 233.
15. **Pojoga, I., Negriu, R.** (1988) - *Piscicultura practică*, Ed. Ceres, București, 213 p.
16. **Stone, N., Engle, C., Heikes, D., Freeman, D.** (2000) - *Bighead carp*, Southern Regional Aquaculture Center Publication, Stoneville, 438 p.
17. **Tripathy, S.D.** (1989) - *Hypophthalmichthys molitrix (Val.) and Ctenopharyngodon idella (Val.) - Exotic elements in freshwater carp polyculture in India*, Exotic Aquatic Species in India, Asian Fisheries Society, Indian Branch, **1**: 27 - 33.
18. **Varvara, M., Zamfirescu, Șt., Neacșu, P.** (2001) - *Lucrări practice de ecologie*, Ed. Univ. „Alexandru Ioan Cuza” Iași, 152 p.
19. **Voican, V., Lustun, L., Rădulescu, I.** (1975) - *Practica selecției și reproducerii la pești*, Ed. Ceres, București, 192 p.
20. **Waterman, M. P.** (1997) - *Chinese bighead carp continues to draw interest*, Aquaculture Magazine, **23** (5): 15 - 18.