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Some morphological features of carp (*Cyprinus carpio* Linnaeus, 1758) in different stages of development

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Abstract. The present paper investigates some representative morphological characters (total length, standard length, head width, maximum body width, body girth and body weight) of carp (*Cyprinus carpio*) during three stages of development (one, two, and three summer old). Biometric analyses was performed on 70 individuals for each age from Fish Farm Tigănaşi, Iaşi County. Morphological characters were statistically processed and the measurements revealed new data regarding the characterstics of the examined population. This population of carp may be considered as homogeneous.
Key Words: characters, descriptive statistics, *Cyprinus carpio*.

Résumé. Le but de cette ouvrage est d'etudier certains caracteres metriques (la longueur totale, la longueur standarde, la longueur du tête, l'hauteur maxim, circonference et le poids du corp) du carpe (*Cyprinus carpio*) dans le trois stade de developpement. Les analyses biometriques on été réalisés sur 70 individus pour chaque age issu du Ferme de Pêche Tigănaşi, Iasi Comté. Les propriétés morphologiques on été statistiquement analysés et les mesures montrent nouveaux dates du caracteres d'éxaminée population. On peut consideré la population de carpe homogène.
Mots clés: caracteres morphologiques, description statistique, *Cyprinus carpio*.

Introduction. Common carp (*Cyprinus carpio* L.) is generally considered to be one of the most ecologically detrimental of all freshwater invasive fish species (Crivelli 1983; Zambrano et al 2001; Davidson 2002; Dean 2003; Koehn 2003). Their ability to reach high biomass and their feeding behaviour have been implicated in causing major environmental degradation in many freshwater ecosystems (Crivelli 1983; Roberts et al 1995; Zambrano et al 1999; Barton et al 2000; Zambrano et al 2001). *Cyprinus carpio* is one of the most economically important and outspread species of our fresh waters. It is breed in monoculture or in policulture. Policulture is preferred in an extensive breeding programme for a better exploitation of the trophic resources for the aquatic basins and in case of an semi-intensive breeding programme and intensive one the population is made in mixed monoculture and respectively a simple one (Grozea 2002).

Material and Method. The experimental studies were carried out on 70 individuals of carp (*Cyprinus carpio*) for each stage of development studied. The main external corporal variables investigated were total length (L), standard body length (l), head width (c), the maximum body width (H), the body girth (G) and the body weight (W) (Bănărescu 1964). All the biometric results were statistically analyzed; Descriptive statistics as mean, standard error, standard deviation, median, mode, range and precision coefficient variation, as well as lower and upper limits of the confidence intervals were calculated (Dragomirescu 1998; Gomoiu & Skolka 2001; Varvara et al 2001).

Results and Discussion. Based on the standard error of the mean and on the *t* value given by α = 0,05 (95% probability) and *n-1* degrees of freedom (DF) (where *n* represents the number of the analyzed individuals) there were calculated the limits of the confidence intervals (CI) for all the corporal variables analyzed.

The total length for *Cyprinus carpio* has a mean value of 19.854 cm for one year old individuals, 27.285 cm for two years old individuals and 48.634 cm for three years old individuals (Table 1). The variation limits varies between 19.342 and 20.366 cm for one summer old individuals between 26.987 and 27.584 for two summers old individuals and between 48.107 and 49.161 cm for three summers old individuals. The smallest variation coefficient is found for the three summers old individuals.

Table 1

Descriptive statistics of the total length for *Cyprinus carpio*

Age (years)	0+	1+	2+
Statiscal indices			
Average	19.854	27.285	48.634
Standard Error	0.256	0.149	0.264
Median	19.7	27.25	48.4
Mod	19.5	26.2	49.5
Standard Deviation	2.148	1.251	2.210
Sample Variance	4.614	1.565	4.885
Range	7.8	4.6	8.4
Minimum	16.1	25.3	45
Maximum	23.9	29.9	53.4
Confidence level (95%)	0.512	0.298	0.527
Lower limit	19.342	26.987	48.107
Upper limit	20.366	27.584	49.161
CV%	10.820	4.584	4.544
m%	1.293	0.547	0.543

CV%= mean variation coefficient; m% = mean precision coefficient.

The main standard length is 16.654 cm for the one summer old individuals, 23.58 cm for two summer old individuals and 41.502 cm for three summer old individuals (Table 2). The variation limits are between 16.146 cm and 17.161 cm for one year old individuals, between 23.160 cm and 23.999 cm for two years old individuals and between 41.101 cm and 41.904 cm for three years old individuals.

Table 2

Descriptive statistics for the standard length of *Cyprinus carpio*

Age (years)	0+	1+	2+
Statistical indices			
Average	16.654	23.58	41.502
Standard Error	0.254	0.210	0.201
Median	16.35	23.85	41.25
Mod	17	22.3	39.2
Standard Deviation	2.129	1.758	1.684
Sample Variance	4.532	3.092	2.835
Range	8	12.1	6.2
Minimum	13.5	13.8	38.7
Maximum	21.5	25.9	44.9
Confidence level (95%)	0.507	0.419	0.401
Lower limit	16.146	23.160	41.101
Upper limit	17.161	23.999	41.904
CV%	12.783	7.457	4.057
m%	1.527	0.891	0.484

CV%= mean variation coefficient; m% = mean precision coefficient.

The head width had a mean value of 5.458 cm for one summer old individuals, 6.985 cm for two summers old individuals and 11.981 cm for three summers old individuals (Table 3). The limits of the CI vary between 5.264 and 5.653 cm for the first year of development, between 6.860 and 7.110 cm for the second one and between 11.846 and 12.116 cm for the third one.

Table 3

Descriptive statistics for the head width of *Cyprinus carpio*

Age (years)	0+	1+	2+
Statiscal indices			
Average	5.458	6.985	11.981
Standard Error	0.097	0.062	0.067
Median	5.35	7.1	12.1
Mod	5.3	7.2	12.5
Standard Deviation	0.815	0.523	0.565
Sample Variance	0.665	0.273	0.319
Range	3.5	1.9	2.4
Minimum	3.9	6	11
Maximum	7.4	7.9	13.4
Confidence level (95%)	0.1945	0.124	0.134
Lower limit	5.264	6.860	11.846
Upper limit	5.653	7.110	12.116
CV%	14.946	7.489	4.719
m%	1.786	0.895	0.564

CV%= mean variation coefficient; m% = mean precision coefficient.

The mean value of the maximum body width is 6.872 cm and CI varies between 6.685 cm and 7.060 cm for one year old individuals. For two summer old individuals the mean value is 10.558 cm, and CI varies between 10.377 cm and 10.739 cm. For three years old individuals the mean value is 19.818 cm and CI varies between 19.609 and 20.027 cm (Table 4).

Table 4

Descriptive statistics for the maximum body width of *Cyprinus carpio*

Age (years)	0+	1+	2+
Statiscal indices			
Average	6.872	10.558	19.818
Standard Error	0.093	0.090	0.104
Median	6.8	10.6	19.75
Mod	6.5	11.3	19.5
Standard Deviation	0.785	0.758	0.878
Sample Variance	0.616	0.574	0.771
Range	3.4	3	3.9
Minimum	5.1	8.9	18.2
Maximum	8.5	11.9	22.1
Confidence level (95%)	0.187	0.180	0.209
Lower limit	6.685	10.377	19.609
Upper limit	7.060	10.739	20.027
CV%	11.426	7.181	4.430
m%	1.365	0.858	0.529

CV%= mean variation coefficient; m% = mean precision coefficient.

The body girth had a mean value of 15.088 cm for the one year old individuals, 19.507 cm for two years old individuals and 39.771 cm for three years old individuals (Table 5).

CI of the girth vary between 14.724 cm and 15.452 cm for one summer old individuals, between 19.303 cm and 19.710 for two summer old individuals and also between 39.408 cm and 40.134 cm for three summer old individuals.

Table 5

Descriptive statistics for the body girth of *Cyprinus carpio*

Age (years)	0+	1+	2+
Statiscal indices			
Average	15.088	19.507	39.771
Standard Error	0.182	0.101	0.182
Median	15	19.5	39.9
Mod	14.5	19.5	38.5
Standard Deviation	1.527	0.852	1.523
Sample Variance	2.332	0.727	2.320
Range	5.5	4.1	7.3
Minimum	12.7	18	35.7
Maximum	18.2	22.1	43
Confidence level (95%)	0.364	0.203	0.363
Lower limit	14.724	19.303	39.408
Upper limit	15.452	19.710	40.134
CV%	10.120	4.371	3.830
m%	1.209	0.522	0.457

CV%= mean variation coefficient; m% = mean precision coefficient.

One summer old individuals presented a mean value of the body weight of 130.885 g. For the second year of life the mean value of the body weight was 427.114g and for the third year the value was of 1553.571 g (table 6). CI of the body weight of one summer old individuals vary between 122.596 g and 139.175 g, also between 415.033 g and 439.194 g for two summer old individuals and between 1514.484 g and 1592.659 g for three summer old individuals.

Tabel 6

Descriptive statistics for the body weight of *Cyprinus carpio*

Age (years)	0+	1+	2+
Statiscal indices			
Average	130.885	427.114	1553.571
Standard Error	4.155	6.054	19.593
Median	124	428.5	1522.5
Mod	114	410	1450
Standard Deviation	34.764	50.651	163.930
Sample Variance	1208.566	2565.581	26873.29
Range	126	166	600
Minimum	82	341	1250
Maximum	208	507	1850
Confidence level (95%)	8.289	12.077	39.087
Lower limit	122.596	415.033	1514.484
Upper limit	139.175	439.194	1592.659
CV%	26.560	11.859	10.551
m%	3.174	1.417	1.261

CV%= mean variation coefficient; m% = mean precision coefficient.

As it can be seen from the graphical representation (Figs 1-3) the limits of the confidence intervals (CI) are very limited for all the investigated corporal variables which shows a homogeneity of the carp populations in all the development stages.

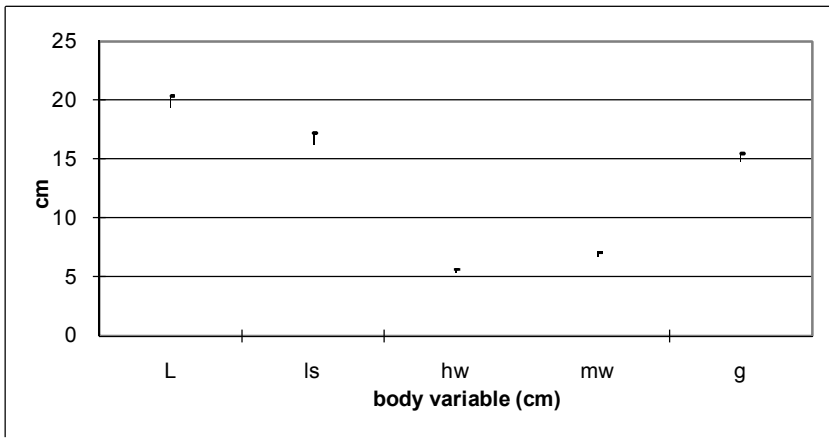

Figure 1. Confidence intervals of the corporal variables for one year old individuals of *Cyprinus carpio*.

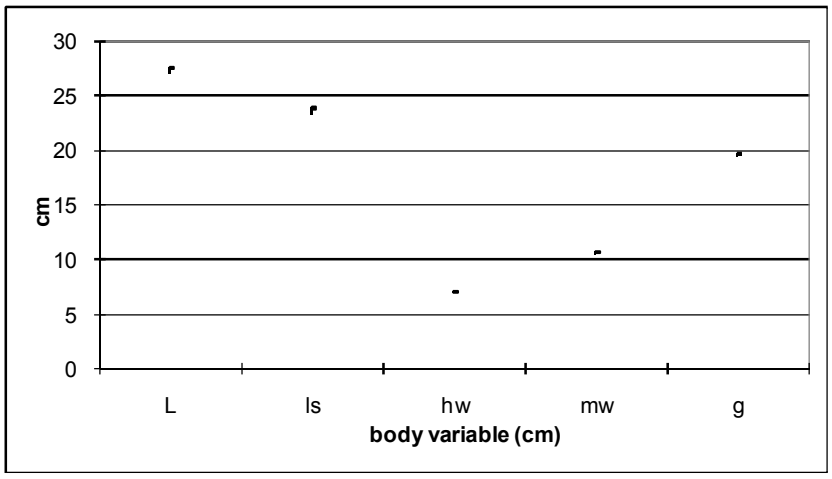

Figure 2. Confidence intervals of the corporal variables for two years old individuals of *Cyprinus carpio*.

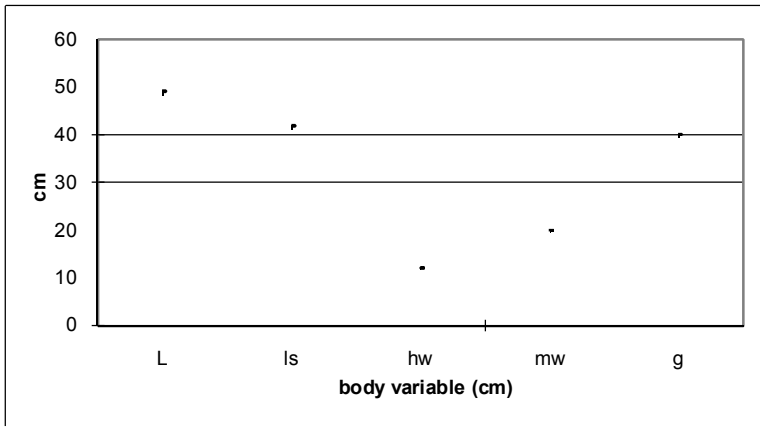

Figure 3. Confidence intervals of the corporal variables for three years old individuals of *Cyprinus carpio*.

It can be noticed a certain tendency towards higher values of corporal variables with increasing age. The decreasing tendency for the coefficent of variance for the analyzed characters can be explained by a decrease of the intraspecifical variability determined by the adjustement mechanisms of the populational level as a response to the selection pressure.

Conclusions. The statistical analysis of the morphological characters shows a homogeneity of the individuals of *Cyprinus carpio* all the three ages analyzed.

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