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TAXONOMICAL CHARACTERISTICS OF CHUB *Leuciscus cephalus* (Linnaeus, 1758) FROM THE RIVER BABUNA (MACEDONIA)

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Summary

Systematic characteristics of chub *L. cephalus* are given by an analysis of eight meristic (on 550 specimen) and 23 plastic characteristics (on 588 specimen), of both genders including the non–mature examples from the river of Babuna, right tributary stream of the Vardar river (Aegean sea river–basin). The measurements were carried out according to the Pravdina scheme. The results were compared with the data of former researches of the material from the same river basin, the main river of Vardar or its major tributary streams, as well as on different materials belonging to various populations living in various biotops: small brooks, big lowlands rivers; in still biotops of both types, oligotrophic and eutrophic lakes; and finally in accumulation lakes. The author faced great difficulties while unifying and comparing the plastic characteristics of chub from various biotops, mainly because of lack of complete data made by various authors. The author claims that making a diagnosis regarding the belonging of chub on the level of sub–species only by a morphometric analysis is tricky since such results, when isolated from other systematic criteria such as the zoo–geographic, cito–genetic, bio–chemical ones and so on, can have a dubious scientific value.

Key words: Leuciscus cephalus, chub, Babuna, taxonomy

INTRODUCTION

The objective of this paper is to present the taxonomic characterization of the chub *L. cephalus* L. from the Babuna, as well as a taxonomic comparison with the other biotops through the very large European areal of the species.

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The Babuna rivulet originate by calcareous spring at the level of 1760 m (Gaševski, 1978, 1979), under the peak Solunska Glava (2540 m) and after a course of 61. 8 km (Manaković, 1963) km enter the Vardar in her meedle part at the level of 155 m. The meddle declination is 25 ‰, when the first 2 km are by more then 100 ‰ and cause waterfalls unpassable for fish, so this part of the flow is fishless. The next 15 km are by salmonid character inhabited only by *Salmo trutta* (L.), when the other is a typical Mediterranean water regime stream where *L. cephalus* L., together to *Barbus peloponnesius* Val., represent one of the most abundant species. Even relativelly large area of the flow, the Babuna river is still unpolluted course.

MATERIAL AND METHODS

Five hundred eighteen specimens of both sexes including juvenile one of chub were subject to a taxonomic analysis, according to Pravdin's diagram, where at 8 meristic and 23 morphologic charracters are determined with respect to the head length or standard body length. Material was catched combined: by autumn and winter, and by hook in the spring and summer seasonally during 1978 at the three parts of the shub distribution across the Babuna: upper, meddle and down. Fish have been instantelly conserved into a 4% formaldehyde solution.

RESULTS AND DISCUSSION

1. Meristic characters

Results by meristic characters investigation of *L. cephalus* L. from the river Babuna are shown on the table 1.

Number of rays in the dorsal fin (*Radii* D.)

For all 550 specimens *L. cephalus* from the river Babuna we have found three spiny eays and eight soft rays.

Steindachner (1895), for *Sq. cephalus* sp. L. var. *albus* Bonap. from Janina Lake in the South part of the Balkan Peninsula givs a datas about three spiny rays and eight soft rays. Also three spiny rays and eight soft rays for *Sq. c. cephalus* L. fron the Aegean Sea flow (Vardar and Dojran Lake), *Sq. c., cavedanus* Bonap, from Ohrid Lake and *Sq. c. cavedanus* v. *prespensis* n. var. from Prespa Lake (Adriatic sea flow) do cite Karaman (1924). Drensky (1951), for *L. c. cephalus* L. by the waters belonging to the Black and Aegean Seas flows, do cite three spiny eays and eight soft rays. Libosvarsky (1956), for *L. cephalus* L. from the river Svratka in the Black Sea flow do cite seven to eight spiny rays, the most of the fish have had eight soft

Table 1. Account of the results by the meristic characters of chub from the river Babuna
*Tablica 1. Prikaz rezultata meristi*čkih odličja klenova rijeke Babune

Number of rays in the dorsal fin (RADII **D**)		Number of rays in the pectoral fin (RADII **P**)							
spiny	soft	spiny			soft			Xæm/X/	dX
III	8	I	13	14	15	16	17		
550	550	550	1	61	273	211	4	**15,28**æ0,04	0,67

Number of rays in the anal fin (RADII **A**)					Number of rays in the ventral fin (RADII V)					
spiny	soft			Xæm/X/ dX	spiny		soft		Xæm/X/	dX,
III	7	8	9		**II**	7	8	9		
550	*49*	*461*	*40*	**7,98**æ0 0,40	550	49	496	5	7,92æ0	0,30

Number of rays in the caudal fin (RADII **C**)										
spiny up					soft	spiny down				
4	5	6	Xæm/X/	dX, 17	17	4	5	6	Xæm/X/	dX
16	508	26	**5,02**æ0,01	0.27	550	22	503	25	**5,00**æ0,01	0,29

Number of scales in the lateral line (SQUAMAE LINEA LATERALIS)							
n	43	44	45	46	47	48	Xæm/X/ dX
550	*5*	*148*	*158*	*212*	*24*	*3*	**45,20**æ0,04 0,93

Number of scalesup by the lateral line (SQUAMAE LINEA TRASV: SUPERIOR)				Number of scales down by the lateral line (SQUAMAE LINEA TRANSV. INFERIOR)				
7	8	Xæm/X/	dX	3	4	5	Xæm/X/	dX
219	*331*	7,60æ0,02	dX	223	320	7	**3,61**æ0,02	0,51

Number of branchiostegal rays (SPINAE BRANCHIALES)								Number of pharyngeal teeth (DENTES PHARINGALES)
n	8	9	10	11	12	13	Xæm/X/ dX	2,5–5,2
550	*20*	*189*	*224*	*84*	*30*	*3*	**9,86**æ0,04 0,90	550

rays. Banarescu (1964), for *L. c. cephalus* L. from Black Sea flow do cite three spiny and eight soft rays. Klimczyk (1965), for the river Visla, Sola and San in the Baltic Sea cites eight to nine soft rays. Krupka (1969), for the river Turiec in the Black Sea flow for *L. cephalus* L. cite three spiny rays and eight soft rays, Ivanović and Sekulović (1971), for *L. c. albus* Bonap., from the Skadar Lake in the Adriatic Sea flow cite three spiny rays and eight soft rays. Dimovski and Grupče (1971), for *L. c. vardarensis* Kar. from the river Bregalnica, vardar river confluent, the Aegean Sea flow, cite three three spiny rays and eight soft rays. Dimovski and Grupče (1972), for *L. c. vardarensis* Kar. from the river Treska, vardar river confluent, the Aegean Sea flow, cite three spiny eays and eight soft rays. Grupče and Dimovski (1972), for *L. c. vardarensis* Kar. from Vardar at her stream part into the Macedonian boundaries find two to three three spiny rays and eight soft rays. Ivanović (1973), for *L. c. albus* Bonap. from Skadar Lake find

three spiny rays and eight soft rays. Economidis (1974a), for *L. c. macedonicus* Kar. 1955 from Aegean Sea confluents in Greece, Bulgaria and river Strumica in Macedonia cites three to four spiny rays and seven to eight soft rays, Grupče and Dimovski (1982), for *L. c. albus* Bonap., from Ohrid Lake cite three spiny rays and eight to nine soft rays, mean 8, 02, for the same subspecies from Prespa lake three spiny and six to nine soft rays, eman 8, 00 and also for same subspecies from Skadar Lake three spiny rays and seven to nine soft rays: for *L. c. vardarensis* Kar., from Dojran Lake, Vardar and his confluents (among which also some specimens from the river Babuna, not precised how many) in the Aegean Sea flow three spiny rays and eight soft rays and for *L. c. macedonicus* Kar., from the river Strumica, also in the Aegean Sea flow, three spiny and seven to nine soft rays, mean 7, 98.

Number of rays in the anal fin (*Radii* A)

In the anal fin of chubs from the river Babuna there have been found three spiny and seven to nine soft rays, mean value 7, 98. Steindachner (1895), for chubs Janina Lake cite three spiny and eight to nine soft rays. Karaman (1924), for chub populations inhabiting river Vardar and Dojran, Ohrid and Prespa Lake also cite three spiny and unvariable number of eight soft rays. Drensky (1951), for chub populations inhabiting waters of Bulgaria cite three spiny rays and seven to nine soft rays. Libosvarsky (1956), for chubs from the river Svratka in the former Tchechoslovakia gives a datas only for the soft rays which do find seven to nine. Bonarescu (1964), for chub populations from Romania cite three spiny and seven to ten soft rays, among them the most frequently have been a specimens with eight soft rays. Klimczyk (1965), for the the populations of chub from three rivers in Poland cite next values: for the river Visla eight to nine soft rays, mean value 8, 9; for the river Sola eight to nine soft rays, mean value 9, 0 and for the river San eight to nine soft rays; those author also doesn't cite a datas about th number of spiny rays. Krupka (1969), for the river Turiec in the former Tchechoslovakia also on doesn't offer datas on spiny rays in anal fin of chubs, but only on soft which met seven or eight, mean value 7,6 Ivanović and Sekulović (1971), for population of chub inhabiting the Skadar Lake cite unvariable values of three spiny rays and eigth soft rays. Dimovski and Grupče (1971), for the river Bregalnica, the biggest left hand Vardar river confluent, cite three three spiny rays and eight soft rays. Dimovski and Grupče (1972), for the chubs from the river Treska, right hand full water and salmonide confluent of Vardar, cite also unvariable values of three spiny rays and eight soft rays. Grupče and Dimovski (1972), for a part of chub population from the river Vardar flow collected inside the river Vardar biotop herselve at her stream part into the Macedonian boundaries, find three spiny rays and seven to nine soft rays. Ivanović (1973), for chubs from Skadar Lake find three spiny and eight soft rays. Economidis (1974), for chub populations from north parts of Greece cites three spiny rays and

seven to nine soft rays. Grupče and Dimovski (1982), study a populations of some fluent and four stagnant ecosystems and offer next datas: for Vardar river with confluents and Dojran Lake seven to nine soft rays, mean 8; for Ohrid Lake seven to nine soft rays, mean 8,09, for Prespa Lake eight to nine soft rays, mean 8,20; for Skadar Lake six to nine soft rays, mean 7,98; for chubs by all cited ecosystems cite constant value of three spiny rays.

Number of rays in the pectoral fin (*Radii* P)

In the pectoral fin of chubs from the river Babuna there is one spiny ray when the number of soft rays is really a lot variable by 13–17 by mean value of 15, 28. Karaman (1924), for chub populations inhabiting river Vardar and Dojran, cite one spiny and 15–16 soft rays, for chubs from Ohrid Lake one spiny and constant number of 17 soft rays and for chubs from Prespa Lake one spiny and 15–17 soft rays. Klimczyk (1965), cite only the number of soft rays which were 15–18 and mean valyes are: for the river Visla 16,1 for the river Sola 16,2 and for the river San 16,3. Dimovski and Grupče, 1971, for the river Bregalnica cite one spiny ray and 14–16 soft rays, the most offen they've met a fish at 15 soft rays. Dimovski and Grupče (1972), for the chubs from the river Trseka cite one spiny and 15–16 soft rays. Grupče and Dimovski (1972), for river Vardar find one spiny and 14–17 soft rays. Economidis (1974), for chub populations from north parts of Greece cites one spiny and 14–17 soft rays, the most offen 15–16. Grupče and Dimovski (1982), study a populations od some fluent and four stagnant ecosystems and find one spiny and soft rays as follow: for Ohrid Lake 14–17, mean 15,48; for Prespa Lake 12–17, mean 14,94; for Skadar Lake 13–16, mean value 14,73; for Vardar river with confluents 14–17, mean 15,35 and for the river Strumica 14–17, mean 15,40.

Number of rays in the ventral fin (*Radii* V)

In the pectoral fins of chubs from the river Babuna there are two spiny rays and seven to nine soft rays, mean 7,92. A constant number of two spiny and eight soft rays for chubs from Vardar, Ohrid Lake and Prespa Lake has found Karaman (1924). The same values of two spiny and eight soft rays in the ventral fin for chubs from the Romanian waters cite Banarescu (1964). Klimczyk (1965), doesn't give a datas on spiny rays which were 7–9 and mean valye for the rivers Visla and San 8,0 when for the river Sola mean valye have been 7,9. Dimovski and Grupče (1971), for the river Bregalnica cite two spiny rays and the most offen 8 soft rays, rarelly they've met a exemplares with 7 soft rays. Dimovski and Grupče (1972), for the chubs from the river Treska met two spiny and more offen 8 but rarely seven soft rays. Ivanović (1973), for chubs from Skadar Lake cite unvariable number of two spiny and eight soft rays. Economidis (1974), for chubs from northeast part of Greece cites two soft rays. Grupče and Dimovski

(1982), for chubs' populations by five different ecosystems (three stagnant and two fluent) find two spiny rays when the number of soft rays has vary from 8 to 9 for chubs from Ohrid Lake, mean value 8,1 and 7 to 9 for chubs from Prespa Lake, mean value 8,02; Skadar Lake mean value 8,01, Vardar river mean 7,92 and river Strumica mean 7,99.

Number of rays in the caudal fine (*Radii* C)

In the caudal fin of chub from the river Babuna there heve been found 4–6 spiny rays at the dorsal side, mean value 5,02, also 4–6 spiny rays at the ventral side, mean value 5,00. The first spiny rays both at the dorsal and ventral side are far longer then the other spiny raus, becaming shorter and the lasts dissapear inside the scalls: the first soft rays are much longer than the soft whose number is constant of 17. Karaman (1924), gives a datas on caudal fin rays number of chubs from Ohrid and Prespa lake where cite a 19 soft rays, doesn't giving a datas about number of spiny rays. Klimczyk (1965), gives a datas only on soft rays for chubs from three rivers in Poland: 18–19 for river Visla, mean 18,9, 18–20 for the river Sola, mean value 18,9, also 18–20, mean 18,9 soft rays for chubs from the river San. Economidis (1974), for chubs from northeast part of Greece cites variable number of 17–19 soft rays, the most offen 19.

Number of scales in the lateral line (*squamae 1.1.)*

The number of scales in the lateral line for the chubs from the river Babuna vary in the area of 43 to 48, mean value of 45,2. Steindachner (1895), for chubs from Janina Lake in Greece has found 42–44 scales. Karaman (1924), for chubs from the river Vardar, Dojran and Ohrid Lake has found 43–45 scales, and for Prespa Lake has found a bit smaller number of 43–44 scales. Drensky (1951) for chubs from the Bulgarian waters cite 44–47 scales. Libosvarsky (1956), for chubs from the river Svratka cites 43–47 scales.

Banarescu (1964), for Romanian waters chubs cite 44–48 scales. Klimczyk (1965), cite for the rivers from Poland variation of scales number from 44–46, when mean values for the river Visla have been 45,1; for the river Sola 45,2 and for the river San 45, 1. Krupka (1969), for river Turiec finds a vary of scales number of 44–48, mean value 45,6. A large areal of variation for this taxonomic character for subspecies *L. c. cabeda* Ris., cite Vuković and Ivanović (1971). Dimovski and Grupče (1971), for the river Bregalnica cite 44–46 scales and the same authors Dimovski and Grupče (1972), for the chubs from the river Treska cite 45–47 scales. Grupče and Dimovski (1972), for river Vardar find 44–47 scales. Ivanović (1973), for chubs from Skadar lake cite 43–47 scales, mean value 44,61. Economidis (1974), for chub populations from north parts of Greece

cites 43–47 scales. Grupče and Dimovski (1982), for five populations belonging at three subspecies cite the largest variation of scales from 41–49. Those authors for chubs from Ohrid Lake cite 42–46, mean 44, 14; for Prespa Lake 41–17, mean 44, 11; for Vardar river 44–47, mean 45,22 and for the river Strumica 43–49, mean 45,86.

Number of scales up by the lateral line (*squamae l. transv. sup.)*

The number of scales up by the lateral line for the chubs from the river Babuna vary among 7–8, mean value 7,6. Steindachner (1895) for chubs from Janina Lake in Greece cite a data not exposed by whole number but by fractions, 7 1/2. Karaman (1924), for chubs from Ohrid, Prespa and Dojran Lake and river Vardar gives a constant number of seven scales. Drensky (1951), also for chubs from the Bulgarian waters cite constant whole number of seven scales. Krupka (1969), for river Turiec finds a vary of scales number among 7–8, mean 7,64. Ivanović and Sekulović (1971), for chubs from Skadar Lake cite unvariable number of seven scales. Libosvarsky (1956), for chubs from the river Svratka cites 7–9 scales. Dimovski and Grupče (1971), 1972, for the rivers Bregalnica and Treska cite 8–9 respectivelly 7–8 scales; also the same authors Grupče and Dimovski (1972), for the river Vardar cite 7–8 scales. Economidis (1974), for chub populations from north parts of Greece cites 8–9 scales. Grupče and Dimovski (1982), for chubs from Ohrid Lake cite 7–8, mean 7,52; for Prespa Lake 6–9, mean 7,92; for Skadar Lake also 6–9 range of scales, mean value 7,54; for Vardar river and his confluents 7–8, mean 7,57 and for the river Strumica 7–9, mean 7,2.

Number of scales down by the lateral line (*squamae l. transv. inf.)*

In the transversal line of scales under the lateral line for the chubs from the river Babuna met 3–5 scales, the most offen 3 and the mean values has been 3,61. Steindachner (1895), for chubs from Janina Lake in Greece find 2–3 scale ranges. The most of the authors: Karaman (1924), for chubs from Ohrid, Prespa and Dojran Lake and river Vardar; Oliva (1951), for *L. c. albus* Bonap. from Ohrid Lake: Ivanović and Sekulović (1971), for chubs from Skadar Lake, cite unvariable number of three scales. Drensky (1951), for chubs from Bulgaria and Economidis (1974), for chubs from north parts of Greece cite 3–4 scales. Krupka (1969), for river Turiec, Dimovski and Grupče 1971, 1972, for the rivers Bregalnica and Treska cite unvariable number of four scales. For the river Vardar Grupče and Dimovski (1972), cite 3–5 scales. Klimczyk (1965), for chubs from Poland cites: for the river Visla 3–4 scales, mean 3,06; for the river Sola 2–3, mean 2,96 and for the river San 2–4 scales, mean 3,02. Grupče and Dimovski (1982), for chubs from Ohrid Lake cite 3–4, mean

3,27; for Prespa Lake 3–4. mean 3,40; for Skadar Lake 2–4, mean 2,84; for Vardar river and her confluents 3–5, mean 3,71 and for the river Strumica 3–4 scales, mean value 3,27.

Number of spins at the first branchiostegal arch (*sp. br.)*

For the chubs from the river Babuna the number of spins at the inside range of the first branchial arch has vary from 8–13. mean value 9,86. Klimczyk (1965), for chubs from Visla has found a variation of those character from 7–11, mean 9; for chubs from Sola variation from 8–10, mean value 9,1 and for the river San 8–11 spins, mean 9,2. Krupka (1969), for river Turiec cite 7–10 spines, mean value 9. Ivanović (1971), for chubs from Skadar Lake, cite vary number from 8–13, mean 10,5. Economidis (1974), for chubs from north parts of Greece cite 7–13, the most of the fish have had 8–11 spines. Grupče and Dimovski (1982), for chubs from Ohrid Lake cite 8–14 spines, mean 10,18; for Prespa Lake 7–11, mean 9,1; for Skadar Lake 8–12, mean 9,87; for Vardar river and her confluents 6–11, mean 9,32 and for the river Strumica 7–11 spines, mean value 9,09.

Number of pharyngeal teeth (*d. ph.)*

The pharyngeal teeth as taxonomic character have shown the most stabyle values for chubs from the river Babuna, their number is 5,2 respectivelly 2,5. The same unvariable number is 5,2 respectivelly 2,5. The same unvariable number of pharyngeal teeth for chubs from Romanian waters cite Banarescu (1964); Economidis (1974), for chubs from the waters of Northeast Greece as and Vuković and Ivančević (1971), for subspecies *L. c. caphalus* (L.) from the flow of Danube and *L. c. macedonicus* Kar. from the river Strumica.

2. Morphometric characters

To analyze the morphometric characters of chub from the river Babuna there've been realized a 23 body proportions measurements. The results of relative body proportions values are shown at the table 2. and table 3.

Some of those characetrs show a constant values (*Dist. praeorbitalis, Dist. postorbitalis, Dist. inter oculi, Dist. praeanalis, Dis. praedorsalis, Dist. postdorsalis, Long. ped. caudae, Alt. corp. minima, Long. D, Long A in % Long. corporis*) when the other studied characters are by variable nature. That means, the younger fish to have relativelly shorter body, longer and lower head, bigger eyes, longer fins, lower body height, smaller distance among the pectoral and ventral fins, also among the ventral and anal fins. In relation to the head length constant are preocular and interocular space, when the postocular space and head height grow up with the growth by the fish. To the identical results for four examined morfometric characters whose relative

Table 2. Account of the results by the relativized values for the plastic characters of chub from the river Babuna for whole the studied at material

Tablica 2. Prikaz rezultata relativiziranih vrijednosti plastičnih odličja klenova rijeke Babune za sav istraženi materijal

Character	Vary	Xæmx	dX
		in % Longitudo total	*corporis*
Longitudo corporis	78–88	83.0æ0.80	0.06
		in % Longitudo	corporis
Longitudo capitis	23–19	26.2æ0.04	0.98
Distantia preaorbitalis	7–10	8.3æ0.01	0.29
Distantia postorbitalis	11–15	13.0æ0.02	0.58
Diameter oculi	4–9	6.5æ0.04	0.89
Altitudo capitis	15–20	17.0æ0.03	0.75
Distantia interocularis	9–12	10.1æ0.02	0.51
Distantia praenalis	64–77	71.8æ0.07	1.77
Distantia praeventralis	47–54	50.6æ0.05	1.29
Distantia praedorsalis	51–59	54.5æ0.05	1.24
Altitudo corporis maxima	20–28	23.6æ0.06	1.43
Altitudo corporis minima	10–12	10.9æ0.02	0.44
Distantia P–V	21–30	25.5æ0.06	1.40
Distantia V–A	17–27	21.1æ0.07	1.63
Longitudo D	9–12	10.4æ0.02	0.59
Altitudo D	14–22	18.5æ0.06	1.35
Longitudo P	16–22	18.6æ0.04	0.93
Longitudo V	13–18	15.7æ0.02	0.50
Longitudo A	7–12	9.1æ0.03	0.79
Altitudo A	13–18	15.3æ0.04	0.93
Longitudo corporis superior	20–29	24.5æ0.07	1.78
Longitudo corporis inferior	21–32	25.5æ0.07	1.80
Distantia postdorsalis	28–36	1.7æ0.05	1.34
Longitudo pedunculi caudae	13–20	16.2æ0.04	1.04
		in % Longitudo	corporis
Distantia preaorbitalis	28–36	31.6æ0.06	1.44
Distantia postorbitalis	44–56	49.6æ0.09	2.09
Diameter oculi	16–34	24.7æ0.12	2.90
Altitudo corporis	58–76	67.0æ0.12	2.87
Distantia interocularis	32–44	38.6æ0.08	2.04

Table 3. Account of the results by the relativized values for the plastic characters of chub from the river Babuna on the poles

Tablica 3. Prikaz rezultata relativiziranih vrijednosti plastičnih odličja klenova rijeke Babune po spolovima

A

L cm	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22
n	**12**	**18**	**19**	**20**	**17**	**12**	**10**	**2**	**3**	**2**	**2**	**3**
I	25.8	25.8	26.0	26.0	25.6	25.9	25.6	26.1	25.4	25.6	25.3	25.1
II	8.2	8.1	8.3	8.5	8.2	8.4	8.2	8.5	8.3	8.0	8.4	8.5
III	13.1	13.1	13.4	13.3	13.3	13.4	13.4	13.7	13.3	14.1	13.5	13.4
IV	6.1	5.8	5.9	5.7	5.3	5.2	5.2	5.0	5.0	5.0	4.8	4.4
V	17.6	17.7	17.8	18.3	17.8	18.0	17.8	18.0	18.7	17.9	18.0	17.4
VI	10.0	9.9	10.1	10.2	10.1	10.4	10.4	10.6	10.7	10.5	10.6	10.7
VII	73.0	72.3	72.9	72.8	73.0	73.8	73.9	73.4	75.2	71.9	74.3	72.5
VIII	51.1	50.7	51.0	50.8	50.9	51.5	50.7	52.0	51.5	50.6	51.1	50.1
IX	54.3	54.4	54.5	55.0	54.2	54.8	54.8	54.2	54.3	54.8	53.6	52.9
X	16.0	16.2	16.3	16.4	16.4	16.1	16.1	16.9	16.2	16.3	16.4	15.9
XI	23.7	24.4	24.5	24.7	24.7	25.3	25.1	25.9	25.8	26.1	25.7	25.8
XII	10.8	10.9	11.0	11.1	10.9	11.1	11.3	11.2	11.2	10.8	11.1	11.1
XIII	26.3	25.8	26.3	26.0	26.6	26.7	26.1	27.0	26.7	24.0	27.0	26.8
XIV	10.8	10.8	10.6	10.7	10.8	10.9	10.8	10.7	11.1	10.7	11.8	11.4
XV	18.7	18.3	17.9	17.8	17.3	17.7	17.6	16.9	17.2	17.0	17.2	17.0
XVI	18.4	18.3	18.3	18.1	17.8	17.9	18.2	18.1	18.0	18.1	17.7	17.7
XVII	15.5	15.3	15.5	15.2	15.2	15.2	15.6	15.5	15.5	15.7	15.3	15.1
XVIII	9.0	9.0	8.9	8.8	8.8	9.1	9.7	9.3	9.0	10.5	10.0	9.5
XIX	15.6	15.4	15.1	15.1	14.6	14.9	14.9	14.4	14.6	14.9	14.2	15.3
XX	23.7	23.9	23.6	23.3	23.3	22.9	23.7	22.9	22.7	23.8	22.4	21.9
XXI	24.5	25.0	34.5	24.4	24.0	24.1	24.4	23.5	21.1	25.5	23.3	23.1

B

L cm	10–11	11–12	12–13	13–14	14–15	15–16	16–17
n	**35**	**31**	**23**	**15**	**9**	**14**	**3**
I	26.0	25.8	25.7	25.3	25.0	25.2	24.8
II	8.2	8.3	8.4	8.2	8.2	8.2	8.4
III	13.0	12.9	12.9	13.0	12.8	13.0	13.0
IV	6.2	6.0	5.7	5.5	5.4	5.3	5.0
V	17.7	17.7	17.7	17.5	17.1	17.6	17.5
VI	9.8	9.8	10.0	10.0	9.7	10.1	10.5
VII	72.5	72.6	72.4	72.6	72.5	72.9	72.9
VIII	50.9	51.0	50.4	50.4	50.2	50.9	50.9
IX	55. 0	55. 8	54. 8	54. 8	53. 8	54. 2	54.5
X	16. 1	16. 2	15. 9	16. 2	15. 9	15. 8	15. 6
XI	24. 0	24. 2	24. 4	24. 4	24. 6	24. 7	25. 1
XII	11. 0	11. 1	11. 0	11. 1	10. 8	11. 1	11. 3

Legend

I	Long. cap. in % Long. corp.
II	Dist. preorbit. in % Long. corp.
III	Dist. postorbit. in Long. corp.
IV	Diam. oculi in Long. corp.
V	Altit. cap. in Long. corp
VI	Dist. interocul. in Long. corp.
VII	Dist. praeanal. in Long. corp.
VIII	Dist. praeventr. in Long. corp.
IX	Dist. praedors. in Long. corp.
X	Alt. corp. max. in Long. corp.
XI	Alt. corp. min. in Long. corp.
XII	Dist. P–V in Long. corp.

XIII	28. 2	28. 3	25. 8	26. 1	26. 2	26. 5	26. 5	XIII	Dist. V–A in Long. corp.
XIV	10. 7	11. 0	10. 9	10. 7	11. 1	10. 8	11. 2	XIV	Longit. D in Long. corp.
XV	18. 4	18. 0	17. 9	17. 5	17. 8	17. 5	17.2	XV	Altitudo D in Long. corp.
XVI	18. 4	18. 5	18. 1	18. 0	18. 8	17. 9	17. 0	XVI	*Longitudo P in Long. corp.*
XVII	15. 3	15. 4	15. 3	15. 4	15. 0	15. 0	14. 7	XVII	*Longitudo V in Long. corp.*
XVIII	9.2	9.4	9.1	9.3	8.8	9.6	9.8	XVIII	Longitudo A in Long. corp.
XIX	15. 3	15. 1	15. 0	14. 6	14. 8	14. 4	14. 6	*XIX*	Altitudo A in Long. corp.
XX	24. 2	23. 6	23. 4	23. 0	22. 5	22. 7	22.4	*XX*	Long. caud. sup. in Long. corp.
XXI	25. 2	24. 5	24. 4	24. 4	23. 5	24. 0	23. 0	XXI	*Long. caud. inf. in Long. corp.*

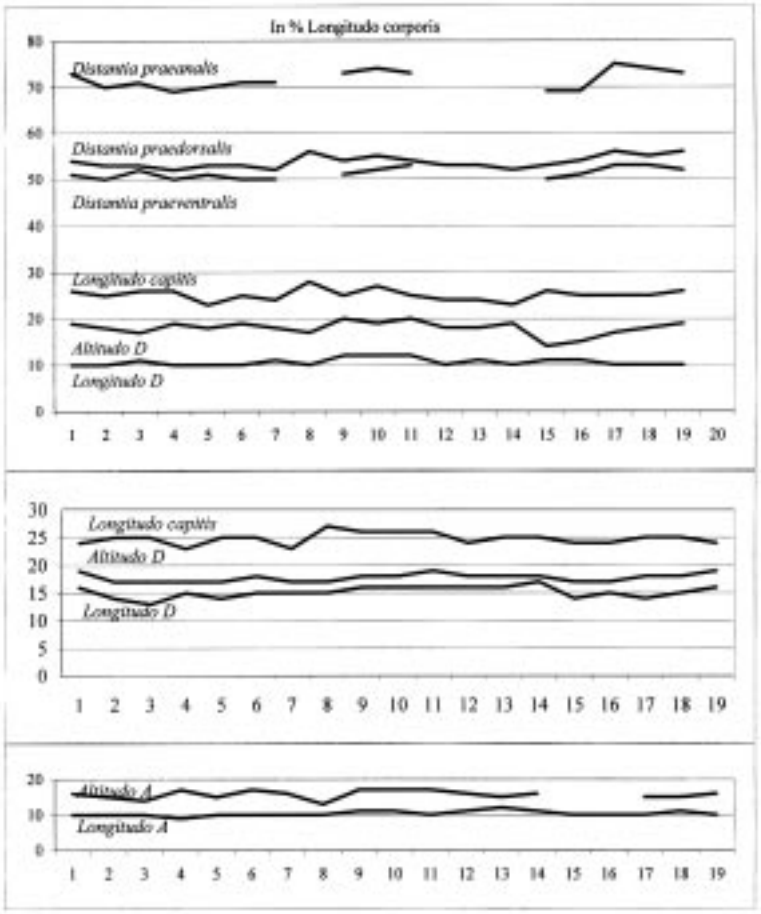
values to the body or head length inputed into the coordinate system (*diameter oculi in % longitudo capitis, longitudo* V *in % distantia* V–a; *longitudo* C *in % longitudo corporis* and *altitudo pedunculi caudae* in *% longitudo pedunculi caudae*) for *L. cephalus* from the river Svratka in former Tchechoslovakia has come Libosvarsky (1956). Whell, when copmarison the morfometric characters of the fish population from the different ecosystems, among the respecting the phenotypic influence by the ecologic factors to the somatic characters, respectivelly to the genotype by the concrete population, it's necessary to take care to the level length of the population studied.

At the figures 1 and 2 are shown comparativelly some of the results to the datas of the other authors. Some of the characters show more constant values (*longitudo* D, *longitudo* P, *longitudo* V, *longitudo* A), when for the other author the oscilations in the relative relations bigger. For sorry, many of the authors doesn't give a data on the mean values fish body length, but only the maximum and minimum, when the others give a values for total fish length (together to caudal fin), so there wasn't be possible to compare a relative change of values for some morfpmetric characters to the body length.

CONCLUSIONS

Comparising the results for the morpfometric characters of chub from the river Babuna, to those by the other authors, one can be stated to exist a large differency by the data studiund and their preparation, what make difficulties when comparison the results. Only one author, for example, Lewandowska–Jarzynowa (1969), gives a data on postdorsal space (*distantia postdorsalis*). Our results for caudal body length are convenient only to those of Libosvarsky (1956), the others data related to both mentioned above, show drastic differences, when are in concordance compared among them. This talk on different ways when data's taking, really a different methodology.

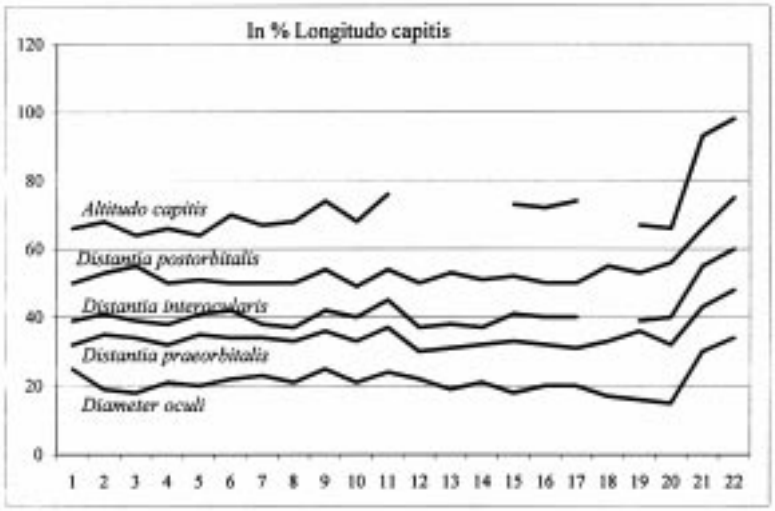
Libosvarsky (1956), pointed at for the eye to be a good taxonomic mark but to be exposed at the important postmortal change.



1.	Babuna	our results	11.	Skadar	Ivanovic (1973)
2.	Ohrid	Grupče&Dimovski (1982)	12.	Tanew	Levand–Jarzin (1969)
3.	Prespa	"	13.	Bukowa	"
4.	Dojran	"	14.	Wirova	"
5.	Skadar	"	15.	Orava I	Balon (1956)
6.	Vardar	"	16.	Orava II	"
7.	Strumica	"	17.	Svratka fem.	Libosvarsky (1956)
8.	Struma	Ekonomidis (1974)	18.	Svratka mal.	"
9.	Blafonis	"	19.	Svratka juv.	"
10.	Evros	"			

Fig. 1. Graphic account of some results by the relativized values for the plastic charact ers of chub from the river Babuna in relation to the body length to those from the other biotops
Slika 1. Grafički prikaz nekih rezultata relativiziranih vrijednosti plastičkih odl ičja klenova rijeke Babune u odnosu na dužinu tijela uspoređenih s onima iz drugih biotopova

All those facts indicate the existance by the objective risque for giving a diagnoses on differenciation of the chub at the subspecies level only at the morphometric analyse. Such a results can be by the suspicious scientific validity accepted separatelly by the other taxonomical criteria as they are zoogeografical, citogenetic, biochemical etc. In contribution to this sattement and necessity of the complementare morphometric and the others, modern methods when taxonomical studies, talk the vorks of some suthors, Vuković (1973, 1977), Onofri (1980), Imsiridou *et al.* (1997).



1. Bauna	our results	12. Skadar	Ivanovic (1973)
2. Ohrid	Grupče&Dimovski (1982)	13. Struma	Ekonomidis (1974)
3. Prespa	"	14. Blafonis	"
4. Dojran	"	15. Evros	"
5. Skadar	"	16. Svratka fermales	Libosvarsky (1956)
6. Vardar	"	17. Svratka males	"
7. Strumica	"	18. Svratka juvenile	"
8. Treska min	Dimov.&Grup. (1972)	19. Orava I	Balon (1956)
9. treska max	"	20. Orava II	"
10. Vardar min	Dimov.&Grup. (1972)	21. Bregalnica min	Dimov.&Grup. (1971)
11. Vardar max	"	22. Bregalnica max	"

Fig. 2. Graphic account of some results by the relativized values for the plastic charact ers of chub from the river Babuna in relation to the body length to those from the other biotops

Slika 2. Grafički prikaz nekih rezultata relativiziranih vrijednosti plastičkih odl ičja klenova rijeke Babune u odnosu na dužinu tijela uspoređenih s onima iz drugih biotopova

In any case, Bianco (1983), describe a new species inside the genus *Leuciscus, L. lucumonis,* Bianco, 1983 for the Toscanian area in Italy, on the basis of 8 meristic and 17 morfometric characters, as well as at the grow rate based on the total collection of 15 examples.

For species *G. albipinnatus,* Libosvarsky and Kux (1982) have found to be possible, on the basis of two characters (barbel lenght and eye diameter), compared at the coordinate's system, a separation by the species, the other three examined characters have not a taxonomical validity.

Mišik (1962), has found for the species *Abramis brama* (L.), a vary of the morfometric characters even in the different seasons along the year. Especially negative effect for the body's proportions should to manifestate a physiological state of fish caused by the starvation or seasonally by the reproductive cycle fr Salmonidae species what about give the example Ashley (1972), Rezshetnikov (1976), Savvaitova (1976).

Sažetak

TAKSONOMSKE KARAKTERISTIKE KLENA *Leuciscus cephalus* (Linnaeus, 1758) IZ RIJEKE BABUNE (MAKEDONIJA)

S. Georgiev*

Sistematske osobitosti klena *L. cephalus* prikazane su analizom osam merističkih (na 550 primjeraka), te dvadeset i tri plastična obilježja (na 588 primjeraka), obaju spolova, uključujući i nedozrele jedinke iz rijeke Babune, desnog pritoka rijeke Vardara (slijev Egejskog mora). Mjerenja su provedena prema Pravdinovoj shemi. Rezultati su uspoređeni s podacima prijašnjih istraživanja na materijalu iz istoga slijeva, glavne rijeke Vardara ili njegovih većih pritoka, također na materijalu koji pripada različitim populacijama koje žive u različitim biotopima: malenim potocima, velikim nizinskim rijekama i u stajaćim biotopima obaju tipova, oligotrofnim i eutrofnim jezerima, te napokon umjetnim hidroakumulacijama. Autor je naišao na velike poteškoće pri unifikaciji i uspoređivanju plastičnih osobitosti klenova iz različitih biotopa, prije svega zbog nepotpunih podataka kod različitih autora. Autor je ustvrdio da je rizično davati dijagnoze o pripadnosti klena na razini podvrste samo morfometrijskom analizom, jer takvi rezultati mogu biti sumnjive znanstvene vrijednosti prihvaćenih izolirano od ostalih sistematskih kriterija kao što su zoogeografski, citogenetski, biokemijski i sl.

Ključne riječi: Leuciscus cephalus, klen, Babuna, taksonomija

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