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ARRANGEMENT AND NUMBER OF RADIAL CHANNELS ON THE SCALES OF PRUSSIAN CARP (Carassius auratus gibelio Bloch) FROM THE DEAD THEISS — BISERNO OSTRVO

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Abstract

The number and arrangement of radial channels is an important taxonomic character, helpful in determining the species, especially the natural hybrids frequent with fish. It is of a great importance to konw the radial channels when analysing the intestinal content of adephagans, where frequently scales of different fish can be found. The material for this work consisted of 177 specimens of Prussian carp (*Carassius auratus gibelio* BLOCH), from the Dead Theiss. The number of primary and secondary radial channels on the oral and caudal sides of scales was analysed, in relation to age, standard length and mass, in order to determine which channels and on which side of the scales vary the least, this being the most stable taxnomic character. The variation of primary and secondary radial channels is less on the caudal, than on the oral side of scales. The most stable is the number of primary radial channels on the caudal side of scales, while most variable is the number of secondary radial channels on the oral side of scales.

Introduction

The scales are frequently used for ichthyologic research, since they can give a lot of information about the life of fish. Besides the age, spawning and nutritional rings, an important element of scales relief are the radial channels. They can serve as taxonomic characters as they can be easily observed and they stay preserved, regardless how long the material is kept, or whether the scales passed through intestines. Букирев and Костарев (1961) and Бурдак (1979) stress that the morphologic characters of scales are a constant feature of the species. BALON (1963) and PUJIN et *al.* (1978) gave a key for determination of species within the genus *Abramis,* based on the number and arrangement of radial channels on scales, while SUSLOWSKA and URBANOWICZ (1984) propose a key for determination of 25 species of carp fish. The radial channels can help to determine natural hybrides (VUKOVIĆ 1971).

With regard to the fact that, about the morphology of silver carp scales, there is not much data in our literature, by this work we wanted to show the arrangement and number of radial channels and their variations.

Materials and Methods

The material was collected out of the Dead Theiss Biserno Ostrvo, in the period 1983—1985 and it consisted of 177 specimens of prussian carp. The scales were taken according to Чугунова (1959) above the side line vertrically in front of the dorsal fin. The primary and secondary radial

channels were counted, separately on the oral and caudal side of scales. Surveyed were also the lateral radial channels. The mass and standard length was measured, while the age was determined on the basis of scale rings. The number of radial channels is shown in relation to these parameters.

Results and Discussion

The protective function of scales of the prussian carp is more apparent, since in question is a benthonectonic form. For this reason the scales are thicker, larger and more deeply inserted in the cuticle. The oral side of scales is very creased.

The scales are classified into oral, caudal and lateral sides.

The primary radial channels always extend from the center towards the edges of scales. The secondary radial channels do not reach the edges or the center. One of the scale features of the prussian carp are the lateral radial channels, appearing on the scales of this species from the Dead Theiss — Biserno Ostrvo in the amount of 26% of individuals, mostly on the left side of scales.

As shown in Table 1, according to the variation coefficient (Kv) it is concluded that on scales the most stable is the number of primary radial channels on the caudal side, and that the variation number of primary and secondary radial channels is far smaller on the caudal than on the oral side of scales. The highest variation rate is for the number of secondary radial channels on the oral side scales. ŠENK (1969) is of the opinion that the secondary radial channels are one of the aberrations of scales. We are of the opinion that possibly they are one of the aberrations, but they could be considered as taxonomic characters. ŠENK and KALUDJERČIĆ (1963) analysed the relation between secondary radial channels and the growth rate of *Barbus meridionalis petenyi* and concluded that these channels are created equally in spring and autumn, most frequently in front or in the middle of damaged sclerite rings.

Tables 2, 3 and 4 show that the number of primary radial channels on the oral side of scales grows with age, while related to standard length and body mass, the number of these channels varies.

The number of secondary radial channels on the oral side grows from the age $\hat{3}+$ to $5+$ at body length 141—300 mm and body mass up to 300 g and from 401 to 1000 g. ŠENK and KALUDJERČIĆ (1963) state that the total number of secondary radial channels with *Barbus meridionalis petenyi,* increased with age, while the creation of new channels decreased with age. The creation of secondary radial channels is in connection with the more intensive growth of the individuals, since they are far more intensively created at younger individuals. The creation of these channels is also connected with the sexual maturity, since they are created mostly in the years of sexual maturity.

Similar data are also given by KNEŽEVIĆ (1984) regarding creation of secondary radial channels with rudd *Scardinius erytrophtalmus,* in which the most intensive creation is in the first year of life in groups of narrow sclerite zones. PUJIN et *al.* (1978) state that in *Abramis brama* the number of channels on the caudal sides of scales was increased with age. This was not established on the oral side. For bream the increase of channel number was not established in relation to age.

The high maximal number of secondary radial channels on the oral sides of scales of prussian carp from the Dead Theiss — Biserno Ostrvo (14), and also the relatively high mean value (2.84) (Table 1.) could possibly be connected as per the quoted authors to age, because from this locality the caught fish were of older age categories.

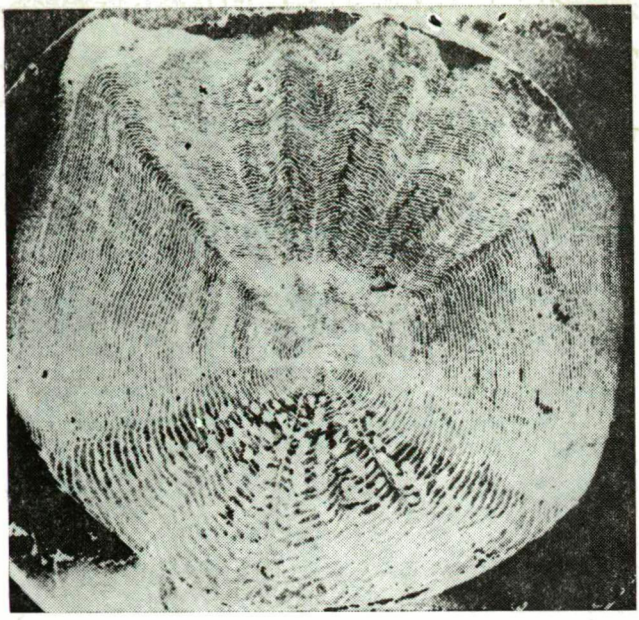

Fig. 1. Arrangemenet and number of radial channels on the scales of *Carrassius aurafus gibelio* from the depo Theiss-Biserno Ostrovo

Tab. 1. *The number of radial channels on the scales of Carassius auratus gibelio* BLOCH *in the Mrtva Tisa-Biserno ostrva (The Dead Theiss)*

Species and position of the channels	min—max	$\bar{x} \pm S\bar{x}$	σ	Kv
Primary radial channels on oral side of the scales	1—8	4,37±0,08	1,11	25,40
Secondary radial channels on oral side of the scales	1—14	2,84±0,16	1,83	64,44
Primary radial channels on caudal side of the scales	2—5	3,68±0,05	0,72	19,56
Secondary radial channels on caudal side of the scales	1—2	1,11±0,05	0,32	28,83

The primary radial channels on the caudal side of scales do not vary a lot in relation to age (Table 2), while in relation to standard length (Table 3) and body mass (Table 4) there are variations, but not so much as on the oral side of scales.

The number of secondary radial channels on the caudal side of scales does not vary a lot as compared to the stated parameters, and variation is also less than on the oral side of scales.

Conclusion

— The prussian carp is a benthonectonic form so that the scales are thicker, larger and more deeply inserted in the cuticle, and the oral side is more creased.

— One of the features of the scale of the prussian carp are the lateral radial

Tab. 2. *The number of radial channels on the scales of Carassius auratus gibelio* BLOCH *in the Mrtva Tisa-Biserno ostrvo (The Dead Theiss) according to the growth*

GROWTH	Primary radial channels on oral side of the scales		Secondary radial channels on oral side of the scales			Primary radial channels on caudal side of the scales		Secondary radial channels on caudal side of the scales		
	min—max	$\bar{x}$	min—max	$\bar{x}$	n	min—max	$\bar{x}$	min—max	$\bar{x}$	n
2+	1—5	3,00	5	5,00	1	3—4	3,50	—	—	—
3+	2—7	4,18	1—5	2,53	15	2—5	4,00	1—2	1,25	4
4+	1—8	4,37	1—7	2,65	61	2—5	3,61	1	1,00	20
5+	2—7	4,46	1—14	3,21	38	2—5	3,70	1—2	1,19	16
6+	2—6	4,37	1—5	2,77	9	2—4	3,12	1—2	1,25	4
7+	6	6,00	—	—	—	3	3,00	—	—	—

n — fish number

Tab. 3. *The number of radial channels on the scales of Carassius auratus gibelio* BLOCH *in the Mrtva Tisa-Biserno ostrvo (the Dead Theiss) according to the standard length*

Standard. length (mm)	Primary radial channels on oral side of the scales		Secondary radial channels on oral side of the scales			Primary radial channels on caudal side of the scales		Secondary radial channels on caudal side of the scales		
	min—max	$\bar{x}$	min—max	$\bar{x}$	n	min—max	$\bar{x}$	min—max	$\bar{x}$	n
141—160	3—5	3,80	1—4	1,50	4	3—5	3,80	—	—	—
161—180	4—5	4,60	3	3,00	1	3—4	3,40	2	2,00	1
181—200	1—5	3,66	3—5	4,00	2	3—4	3,66	—	—	—
201—220	3—7	4,50	1—3	1,66	6	4—5	4,10	1	1,00	1
221—240	3—6	4,43	1—5	1,87	8	2—5	3,86	1	1,00	5
241—260	4—8	5,28	1—6	2,18	17	3—5	3,86	1	1,00	7
261—280	2—7	4,13	1—8	2,71	28	2—5	3,64	1—2	1,28	7
281—300	1—6	4,24	1—14	3,39	46	2—5	3,57	1—2	1,05	20
301—320	2—6	3,83	2—6	3,36	11	2—4	3,25	1—2	1,33	3
321—340	4	4,00	2	2,00	1	4	4,00	—	—	—

n — fish number

Tab. 4. *The number of radial channels on the scales of Carassius auratus gibelio* BLOCH *in the Mrtva Tisa-Biserno ostrva (the Dead Theiss) according to the body mass*

BODY MASS (g)	Primary radial channels on oral side of the scales		Secondary radial channels on oral side of the scales			Primary radial channels on caudal side of the scales		Secondary radial channels on caudal side of the scales		
	min—max	$\bar{x}$	min—max	$\bar{x}$	n	min—max	$\bar{x}$	min—max	$\bar{x}$	n
1—100	3	3,00	2	2,00	1	4	4,00	—	—	—
101—200	3—5	4,25	1—4	2,50	4	3—5	3,62	—	—	—
201—300	1—5	4,00	1—5	3,00	3	3—4	3,60	2	2,00	1
301—400	3—6	4,50	2—3	2,50	2	4—5	4,17	1	1,00	1
401—500	3—7	4,44	1—5	1,92	12	2—5	4,08	1	1,00	4
501—600	2—8	5,32	1—6	2,13	15	2—5	3,72	1—2	1,14	7
601—700	2—6	4,17	1—5	2,18	11	3—5	3,58	1	1,00	4
701—800	2—6	4,22	1—8	3,06	35	2—5	3,37	1—2	1,06	16
801—900	1—7	4,17	1—14	3,48	27	2—5	3,60	1—2	1,28	7
901—1000	2—5	4,20	2—6	3,80	10	2—5	3,90	1	1,00	4
1001—1100	3—4	3,33	1—3	2,00	3	3—4	3,66	—	—	—
1201—1300	4	4,00	2	2,00	1	4	4,00	—	—	—

n — fish number

channels, appearing at 26% of individuals from the Dead Theiss — Biserno Ostrvo most frequently on the left side of scales.

— The most stable is the number of primary radial channels on the caudal side of scales, while the most highly varied is the number of secondary radial channels on the oral side of scales.

— The variation of primary and secondary radial channels is less on the caudal side, as compared to the oral side of scales.

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Az ezüst kárász pikkelyei csíkjainak elrendeződése és száma

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A halpikkelyek radiális csíkjainak száma és elrendeződése jelentős rendszertani bélyeg, amely elsősorban a természetes hibridek meghatározását segíti elő. A radiális csíkok ismeretének nagy jelentősége van a ragadozók emésztőcsatornája tartalmának elemzésekor is.

A szerzők összesen 177, a Holt-Tiszából származó ezüst kárász egyedének vizsgálatát végezték el. A pikkelyek orális és kaudális részén jelenlevő elsődleges és másodlagos radiális csíkjainak vizsgálata az életkor, a testhossz és a testtömeg összevetésével történt. Megállapítást nyert, hogy a pikkelyek kaudális részén elhelyezkedő, mind az elsődleges, mind a másodlagos barázdái kisebb méretűek az orálisokéihoz viszonyítva. Másrészt a pikkelyek orális részén elhelyezkedő másodlagos csíkok nagy változékonyságához viszonyítva az elsődleges kaudális csíkok állandósága nyilvánvaló.

Расположение и количество радиальных каналов на чешуях серебряного карася (Carassius auratus gibelio Bloch) из мертвой Тисы

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Резюме

Количество и расположение радиальных каналов у рыб являются важными классификационными характеристиками, которые могут в значительной степени содействовать при определении видов, особенно природных гибридов, часто появляющихся у рыб. Опытность в определении радиальных каналов имеет большое значение при анализе кишечного содержания хищных рыб.

Материалом для этой работы были серебряные караси *(Carssius auratus gibelio* Bloch) из Мертвой Тисы, в количестве 177 шт. Анализировалось количество первичных и вторичных радиальных каналов на губной и хвостовой частях чешуи по отношению к росту (возрасту), стандартной длине и весу рыбы.

Варьирование первичных и вторичных радиальных каналов меньше в хвостовой части, чем в губной части чешуи. Самым постоянным является количество первичных каналов хвостовой части чешуи, а самые большие вариации наблюдаются в количестве вторичных радиальных каналов губной части чешуи.

Raspored i broj radijalnih kanalića na krljuštima srebrenog karasa (Carassius auratus gibelio Bloch) iz Mrtve Tise

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Izvod

Broj i raspored radijalnih kanalića riba je važan taksonomski karakter koji može dosta da pomogne kod odredjivanja vrste, a naročito prirodnih hibrida koji su kod riba dosta česti. Poznavanje radijalnih kanalića je od velikog začaja kod analize crevnog sadržaja grabljivica.

Materijal za ovaj rad se sastojao od 177 primeraka srebrenog karaša (*Carassius auratus gibelio* Bloch) iz Mrtve Tise. Analiziran je broj primarnih i sekundarnih radijalnih kanalića na oralnoj i kaudalnoj strani krljušti u odnosu na starost, standardnu dužinu i masu ribe.

Variranje primarnih i sekundarnih radijalnih kanalića je manje na kaudalnoj nego na oralnoj strani krljušti. Najstabilniji je broj primarnih radijalnih kanalića na kaudolnoj strani krljušti, a najviše varira broj sekundarnih radijalnih kanalića na oralnoj strani krljušti.