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OSTEOLOGICAL CHARACTERIZATION OF FOUR SPECIES OF THE GENERA *GOBIO* AND *ROMANOGOBIO* WITH SOME REMARKS TO THE STATUS OF THE FORMER SUBGENUS *RHEOGOBIO*

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Purpose. *The aim of this work is to clarify the matter of suitability of current Gobioninae systematics, where Rheogobio is used as a synonym of Romanogobio or as a separate taxon by comparing four species of the genera Gobio and Romanogobio on the basis of osteological data and the structure of swimming bladder.*

Methodology. *Four gudgeon species were examined based on the structure of axial skeleton and cranium. Osteological specimens were prepared after cleaning and staining with alizarin red S. Measurements were performed with ScopePhoto using DCM 500 digital camera. Calculations were performed using Statistica 8.0. For determination differences between species we used Student's t-test and discriminant analysis. Drawings were made with CorelDRAW X5.*

Findings. *R. uranoscopus is a specific species, swimming bladder of which reduced and its size is on average 10,6 % of SL, while in other gudgeons it reaches 21,0 to 31,8 % of SL. It may be an adaptation for occupying sites with high velocity, where it concentrates.*

Mahalanobis distance clearly demonstrates the difference of R. uranoscopus from other investigated species, the most similar species to R. uranoscopus by a complex of osteological data is R. kesslerii the least similar is G. carpathicus. According to discriminant analysis, R. uranoscopus is distinctly different from the genera Romanogobio and Gobio.

The structure of separate elements of cranium, number of vertebrae and pectoral girdle bones also shows high distinction of R. uranoscopus from other species.

Originality. *Originality of this work is a new look on the systematic status of the subgenera Rheogobio based on osteological and other data.*

Practical value. *Practical value of this work is an clarification of systematic status of the subgenera Rheogobio for agreement of nature protection documentation for avoiding different interpretations of the systematic status of species belonging to these subgenera.*

Key words: *Osteology, systematics, taxonomy, Romanogobio, Gobio, Rheogobio.*

PROBLEM STATEMENT AND ANALYSIS OF RECENT ACHIEVEMENTS AND PUBLICATIONS

Cyprinidae is one of the most numerous and widespread family of freshwater fishes. It consists of over 220 families with more than 2 420 species [31]. The subfamily *Gobioninae* consists of about 30 genera and 130 species, which are widely spread in northern Eurasia [5, 7, 10, 18, 31, 32, 37]. In Europe, this subfamily is presented by three genera: *Gobio* Cuvier, 1816, *Romanogobio* Bănărescu, 1961 and *Pseudorasbora* Bleeker, 1860. Among almost 50 *Gobioninae* species, which are present in Europe [32], 13 occur in Ukraine [24].

Romanogobio (type species *Gobio kesslerii* Dybowski, 1862) and *Rheogobio* (type species *Gobio uranoscopus* Agassiz, 1828) were described by Bănărescu in 1961 [3] as subgenera of *Gobio*. *G. ciscaucasicus* Berg, 1932 was included in the genus *Rheogobio* and such a structure of the genus remained until 1992 [4, 5, 2], when it was divided into new species: *G. rivuloides* Nichols, 1925, *G. huanghensis* Lo, Yao and Chen, 1977, while *G. uranoscopus* was subdivided by Bănărescu into three subspecies: *G. u. uranoscopus*, *G. u. frici* Vladykov, 1925 and *G. u. elimeius* Kattoulas, Stephanidis et Economidis, 1977 [5]. In 1996, the status of the subgenus *Romanogobio* was elevated to the level of genus [29], where *R. uranoscopus* was included into the genus *Gobio,* but this change of taxonomic status was not taken into consideration by Bănărescu, who in 1999 included the subgenera *Romanogobio* and *Rheogobio* to the genus *Gobio*. In particular, he included *G. uranoscopus* (with the subspecies *G. u. uranoscopus*, *G. u. frici* and *G. u. elimeius*) and *G. rivuloides* to *Rheogobio* and *G. ciscaucasicus* into the genus *Romanogobio* [6]. Other scientists did not use such a distribution and included all above mentioned specimens to the genus *Gobio* [14, 15, 16, 19, 25, 26].

In 2004, Nalbant [27] in his paper on *Percottus glenii*, Dybowski, 1877, mentioned the stone gudgeon as *Rheogobio uranoscopus frici*. In the same year, Naseka and Freyhof [28] as the first description of *R. parvus* Naseka, Freyhof, 2004, determined that *R. uranoscopus* is very similar to *R. kesslerii* and using the features of first revisers they combined the genera *Rheogobio* and *Romanogobio* under general name *Romanogobio.* This structure did not change in following works and was accepted implicitly [18, 22, 23, 32].

HIGHLIGHT OF THE EARLIER UNRESOLVED PARTS OF THE GENERAL PROBLEM. AIM OF THE STUDY

Taxonomic structure and compositions of separate genera of *Gobioninae* are far from final determination. Even now, there are some controversial situations when the status of one or another taxon needs clarification with attraction of more data. Controversial is the composition of the genus *Romanogobio*, which is presented in Ukraine by 6 species [24], with an ambiguous status of the genus *Rheogobio* [3].

Many scientists mentioned that the ambiguity in the taxonomy of gudgeons is an actual problem which is caused by changes in taxonomic status of different taxa and this predetermines some misunderstanding in different types of nature protection documentation [17, 20, 22]. As an example is the status of *R. uranoscopus* in the Red Book of Ukraine [1], which is incorrectly related to the subgenera *Gobio*.

The aim of this work is to clarify the matter of suitability of current *Gobioninae* systematics, where *Rheogobio* is used as a synonym of *Romanogobio* or as a separate taxon by comparing four species of the genera on the basis of osteological data and the structure of swimming bladder.

MATERIALS AND METHODS

Four species were examined based on the structure of axial skeleton and cranium, two of which are type specimens of following subgenera: *R. kesslerii* of *Romanogobio* and *R. uranoscopus* of *Rheogobio* [3].

Discovering of *G. carpathicus* Vladykov, 1925 and *R. vladykovi* (Fang, 1943) was realized for comparing the distance *R. uranoscopus* to other species from *Romanogobio* and *Gobio* subgenera. In total, 62 gudgeon skeletons were processed, among which: *R. uranoscopus* — 18 individuals (by 3 specimens from each river: Latorica, Teresva, Tereblia, Uzh, Siret and Rika); *R. kesslerii* — 18 individuals (by 3 specimens from each river: Dniester, Ulichka (Uzh tributary), Tisza, Siret, 2 ind. From Prut and 4 from Latorica); *R. vladykovi* — 9 individuals (by 3 speciments from each river: Latorica, Ublia (Uzh tributary), Tisza) and *G. carpathicus* — 17 individuals (by 3 specimens from each river: Uzh, Prut, Siret; 2 ind. from Tisza and 5 from Latorica). Due to very small individual and population changeability of osteological data, usually three specimens of one species were examined for one river [8].

Osteological specimens were made after cleaning and staining them with alizarin red S [36]. Standard body length (SL) was measured from the tip of snout to the posterior-most point of the last scale in midlateral row using an electronic caliper, with an accuracy 0,1 mm. L bas. n. — length of the base of neurocranium without pharyngeal process. Measurements were performed with ScopePhoto using DCM 500 digital camera with an accuracy of 0,01 mm.

The terminology of vertebral regions and subregions follow those given by Naseka [29]: T — total number of vertebrae, A — number of abdominal vertebrae, a1 — number of predorsal vertebrae, i — number of intermediate vertebrae, C — number of caudal vertebrae, c1 — number of preanal caudal vertebrae, c2 — number of postanal vertebrae.

The terminology of cranium bones is given according to the standard classification [11] with some additions made by Bogutskaya [8, 9]. Osteological measurements were taken according to Vasil'eva and Kuga [34], which were thereafter used for another objects [35]: Sfr — width of the cranium at the level of minimal width of frontalia, Ssp — width of the cranium at the level of sphenotica, Hsoc — height of the cranium at the level of supraoccipitale, WBoc — width of the masticatory plate at the basioccipital pharyngeal process, Lsent — supraethmoideum lengh, WIn1 — width of fifth infraorbital, WIn3 — width of third infraorbital, WOp — operculum width, Wpop — praeoperculum width, Hiop — interoperculum height, HPm — praemaxillare height, HpPm — praemaxillare height at the level of processus ascendens dorsalis maxillaries, HD — dentale height, HpD — dentale height at the level of processus coronoideus dentalis, HQ — quadratum cut depth. Except the determination of the ratio of the maximal width to the length of bone measurements of visceral skeleton and pectoral arch, we also measured its percent dimension to the L bas. n.

The terminology of cephalic sensory canals is given according to Illick [13]: CIO — infraorbital canal, CPM — preopercular-mandibular canal, CSO — upraorbital canal, CST — supratemporal canal. For determination of the number of pores in cephalic canals were examined 175 gudgeons: *R. uranoscopus* — 41 individuals, *R. kesslerii* — 41 individuals, *R. vladykovi* — 17 individuals and *G. carpathicus* — 76 individuals. For determination of swimming bladder structures were examined 100 gudgeons by 25 for each species. For discovering cephalic canals and structure of hydrostatical organs were used fish from all main rivers of Ukraine where they occur, in particular: *R. uranoscopus* from Uzh, Tisza, Siret; *R. vladykovi* from Prut, Uzh, Tisza, Latorica; *R. kesslerii* from Dniester, Prut, Uzh, Tisza, Latorica, Siret; *G. carpathicus* from Prut, Uzh, Tisza, Latorica, Siret.

Calculations were performed using Statistica 8,0. For determination of differences between species we used Student's t-test and discriminant analysis for analyzing the Mahalanobis distance between different species — SqMD. Abbreviations used in the text: p — level of authenticity, n — number of specimens, M — mean value of the feature, m — standard error, lim — feature limits. All drawings were made by the author based on different individuals from several rivers of Ukraine: *R. uranoscopus* — Teresva, Transcarpathian region, Tiachiv district, Kriva village, SL = 81,6 mm, L bas. n. = 15,39 mm.; *R. kesslerii* — Latorica, Transcarpathian region, Svaliava district, Dratchino village, SL = 82,8 mm., L bas.n. = 15,53 mm.; *R. vladykovi* — Latorica river, Transcarpathian region, Mukachivskij district, Stare Davidkovo village, SL = 93,7 mm., L bas. n. = 18,7 mm.; *G. carpathicus* —Tisza river, Transcarpathian region, Hustskij district, Veliatino village, SL = 90,8 mm, L bas. n. = 18,5 mm. All skulls were drawn in thr identical size. Bones of visceral skeleton and pectoral arch were drawn with saving proportions that gives a possibility for comparing not only the form of the bones but even their sizes by comparing the bones, which were taken from different species of different sizes. Final drawings were made with CorelDRAW X5.

STUDY RESULTS AND THEIR DISCUSSION

Some special features of the skeleton, which characterize the shape and the location of some bones relatively each other and are presented below. Neirocranium has similar structure in all four compared gudgeon species but some individual peculiarities should be shown. As for the form and distribution of individual parts of neirocranium, *R. uranoscopus* has the wider skull, which is the widest in *G. carpathicus.*

Form and the size of processus preotici in *R. uranoscopus* are comparatively small and are pointed at the tip. *R. vladykovi* has smaller processus preotici. The most distinct is this structure in *G. carpathicus*: it has the same length but more rounded than in *R. kesslerii.*The structure of fossa dilatatoris operculum clearly distinct *Romanogobio* species from *G. carpathicus,* and the last one has comparatively little surface of it from dorsal view.

Lateral branch of the sphenoticum is narrow in *R. uranoscopus* and *R. kesslerii*, thick in *R. vladykovi* and thicker in *G. carpathicus*. The ends of the sphenoticum are pointed in *R. uranoscopus* and are orientated towards the anterior part of the neirocranuim. The sphenoticum in other species is placed at the right angle to the skull axis (*G. carpathicus* and *R. vladykovi*) or is sent to the back of the skull (*R. kesslerii*). The form of the trigeminal-facial canal in all four species is distinct with different forms of the first and second apertures. *R. uranoscopus* is sharply different from other species because he has the biggest and elongated form of the posterior aperture. *R. kesslerii* is different from all other gudgeons by thick arculus bone, which is formed by postlateral process of pterosphenoideum and a part of ascending process of parasphenoideum.

Epioticum has a convex shape and exceeds the boundaries of the bone edge of the occipital part of neirocranium in all species except of *R. uranoscopus.*

The shape of parashenoideum is very variable in the examined gudgeons but some peculiarities were found, which characterize intraspecific relations. The articulation zone of parasphenoideum and vomer in *R. uranoscopus* is the smallest among all *Romanogobio* species. Parasphenoideum in *R. kesslerii* does not reach the boundary of the articulation zone of supraethmoideum with frontale, while on the contrary in *R. vladykovi* it reaches this zone. *G. carpathicus* has a unique structure of parasphenoideum, which is represented by the articulation zone with vomer located closer to basioccipitale than to the lateral process of ethmoidale laterale. Also it is necessary to mention that the surface of the articulation zone of parasphenoideum and vomer in *G. carpathicus* has relatively small area.

The depth of the notch in the posterior part of parasphenoideum has a similar structure in *R. kesslerii* and *R. uranoscopus* but with the expantion in the latter species. *G. carpathicus* has the shortest and widest shape of this notch. By the thickness of parasphenoideum at the level of orbitosphenoideum, *R. kesslerii* is different from other gudgeons; he has very thin bone there. Quite specific is asymmetrical development of parasphenoideum in *R. vladykovi.* Structure of supraehtmoideum complex in all four species has great species specificity (Fig. 1).

The most distinct structure of supraehtmoideum is in *R. uranoscopus*, in which it is elongated and narrow in the zone of connection with frontale and is widened (by 1,5 times) in the anterior part due to the widely deployed processus lateralis anterior supraethmoidei. The shape of supraehtmoideum is similar in *R. kesslerii* and *R. vladykovi;* somewhat different is in *G. carpathicus*. *G. carpathicus* has developed processus medialis anterior supraehmoidei, which is similar to that of *G. krymensis* [34].

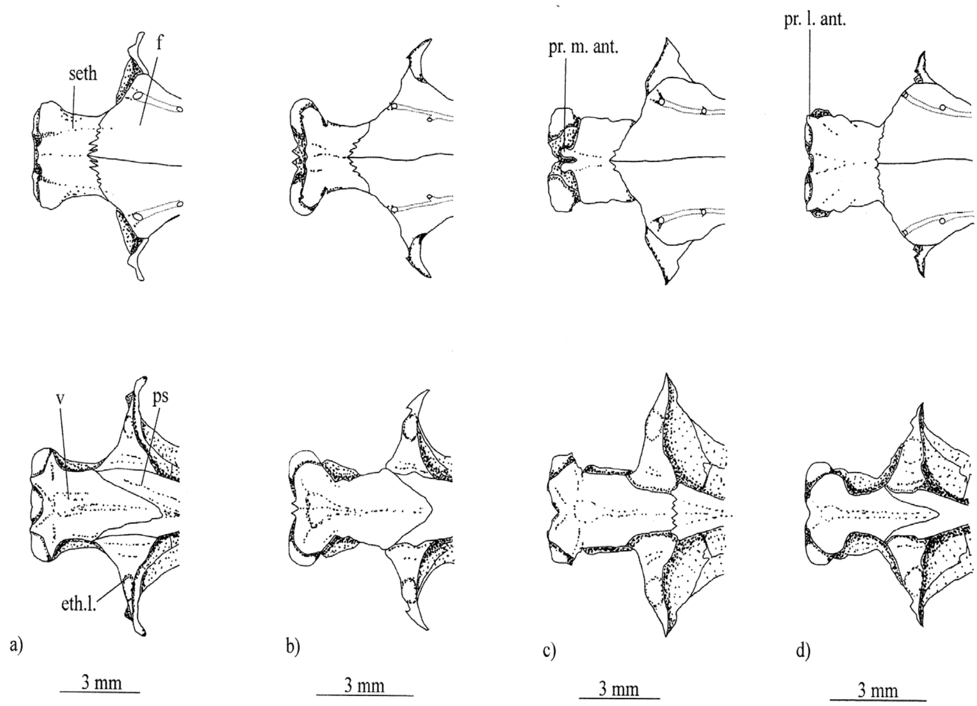

Fig. 1. **Anterior part of neirocranium (dorsal and ventral view): a) *R. vladykovi*, b) *R. uranoscopus*, c) *G. carpathicus*, d) *R. kesslerii.* seth — supraethmoideum; pr. l. ant — processus lateralis anterior supraethmoidei; pr. m. ant. — processus medialis anterior supraehmoidei;f — frontale; ps — parasphenoideum; eth. l. — ethmoidale laterale; v — vomer.**

Vomer in *R. uranoscopus* is similar to that of *R. kesslerii* but is wider in the articulation zone with parasphenoideum and is rounded at the distal side. Vomer in *R. kesslerii* is elongated and narrow in the articulation zone with parasphenoideum and is rounded on another side. Vomer in *R. vladykovi* has similar structure to that in *G. carpathicus* except the connection with the parasphenoideum what is marked above. Praeethmoideum in *R. uranoscopus* is comparatively bigger and by the maximum length is greater from *R. kesslerii* and *R. vladykovi* twice as much. Praeethmoideum is similar in *R. kesslerii* and *R. vladykovi* but in the last one its more oval. In all fishes praeethmoideum is covered by cartilage layer what is typical for other gudgeons [30].

In *Romanogobio* species, the upper part of the lateral branches of ethmoidale laterale is comparatively thinner with convexities in the anterior parts. *R. uranoscopus* is different from the other species because it is pointed in ethmoidale laterale and are orientated to the axis. The lateral branches of ethmoidale laterale in *G. carpathicus* are wide without convexities in the anterior parts. Foramen in mesethmoideum is typical only for *R. uranoscopus*.

Lateral view of neirocranium in *R. vladykovi* and *R. kesslerii* shows a foramen between orbitosphenoideum and ethmoidale laterale, which in other species is covered by branches of ethmoidale laterale. By the shape of the masticatory surface of processus pharyngealis, all gudgeon species are different. The masticatory surface in *R. uranoscopus* and *R. kesslerii* is the most complicated and has relatively small size in the latter species. Processus pharyngealis in *R. vladykovi* is the biggest and has a flat surface. Processus pharyngealis in *R. uranoscopus* is orthogonal, more rounded than in *R. vladykovi* and almost round is in *R. kesslerii* and *G. carpathicus*.

Circumorbitals are shown at Fig. 2.

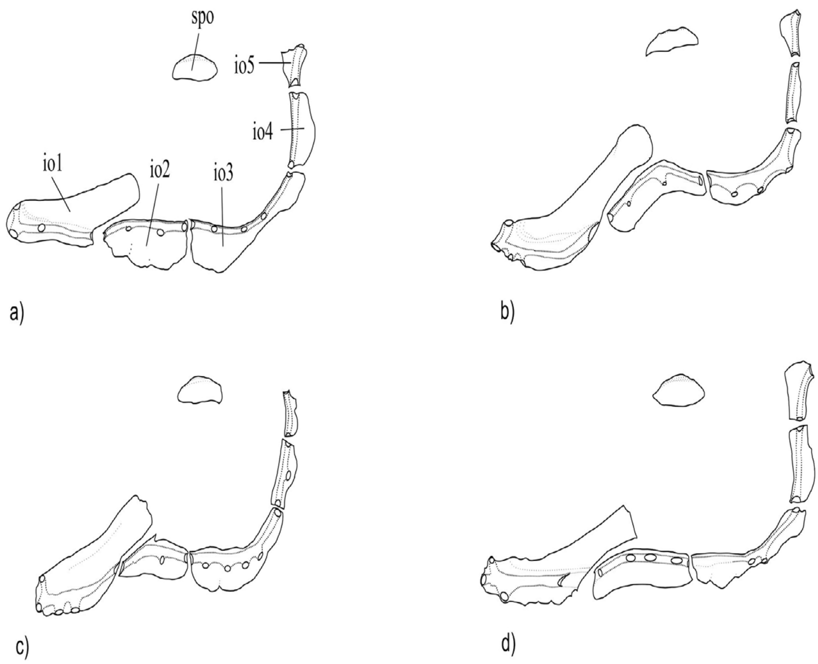

Fig. 2. **Circumorbitals of 4 gudgeon species: a) *R. vladykovi*, b) *R. uranoscopus*, c) *G. carpathicus*, d) *R. kesslerii*. io 1 – 5 — infraorbitalia; spo — supraorbitale.**

Supraorbitale is oval with the bulge at the top in all species except *R. uranoscopus.* Supraorbitale in *R. uranoscopus* is more elongated and has a little curved anterior part. Location of io1 of all species is similar; it has an elongated shape and is situated above io2. Respectively infraorbital canal is opened in the lower part of io1 (within the recess), where begins io2. Io1 is sharply different in *R. uranoscopus* by its size and the rounded shape of its posterior part, which is situated above io2. Io2 in *R. uranoscopus* is also different and is characterized by curved towards the anterior part whereas this bone in other species is more orthogonal. Io3 in *R. vladykovi* and *R. kesslerii* has an original shape, which has a thickened anterior part and very narrow center of the bone that is not typical for *G. carpathicus* and *R. uranoscopus*. In *R. kesslerii*, infraorbital canal is sometimes placed above io1 — io3 bones. In io4, there are two segments only in *G. carpathicus*. Io5 is similar in all *Romanogobio* species; this bone is rounded in its anterior part with a segment of the canal in the posterior part. It should be mentioned that the shape of io5 is very variable in all species; therefore use of it for comparison of different species is unsuitable.

Operculum bones are similar in all gudgeons (Fig. 3).

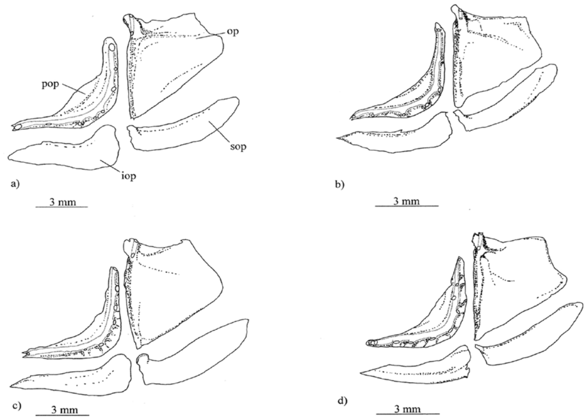

Fig. 3. **The bones of the gill apparatus of 4 gudgeon species: a) *R. vladykovi,* b) *R. uranoscopus,* c) *G. carpathicus,* d) *R. kesslerii.* iop — interoperculum; op — operculum; pop — praeoperculum; sop — suboperculum.**

Bones of the upper and lower jaws (Fig. 4) are different in *G. carpathicus* and *Romanogobio* species; they are more massive in latter one.

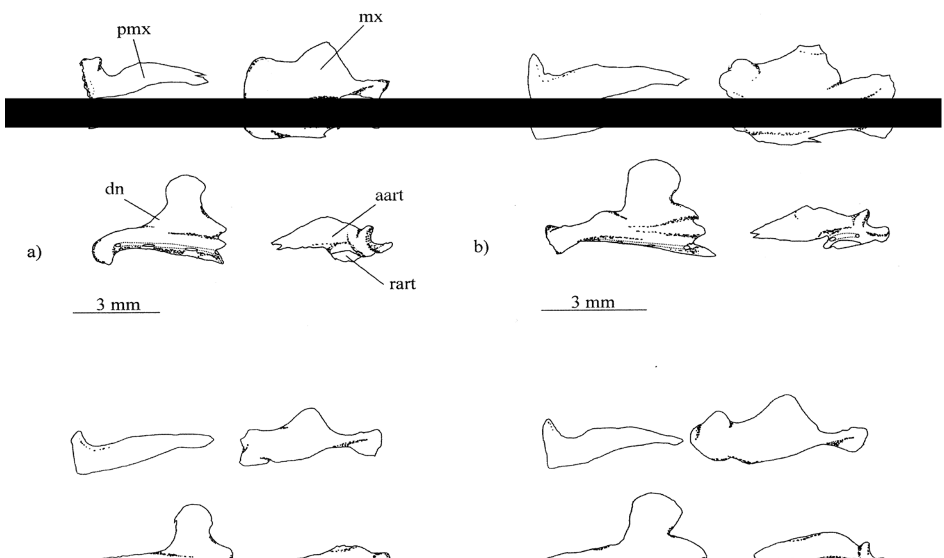

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Fig. 4. **The bones of the upper and lower jaws of 4 gudgeon species: a) *R. vladykovi*, b) *R. uranoscopus,* c) *G. carpathicus,* d) *R. kesslerii.* aart — anguloarticulare; dn — dentale; mx — maxillare; pmx — praemaxillare; pr. asc. ant — processus ascendens dorsalis; pr. cor — processus coronoideus.**

The palato-quadrato complex is very variable by shape and size of different bones (Fig. 5).

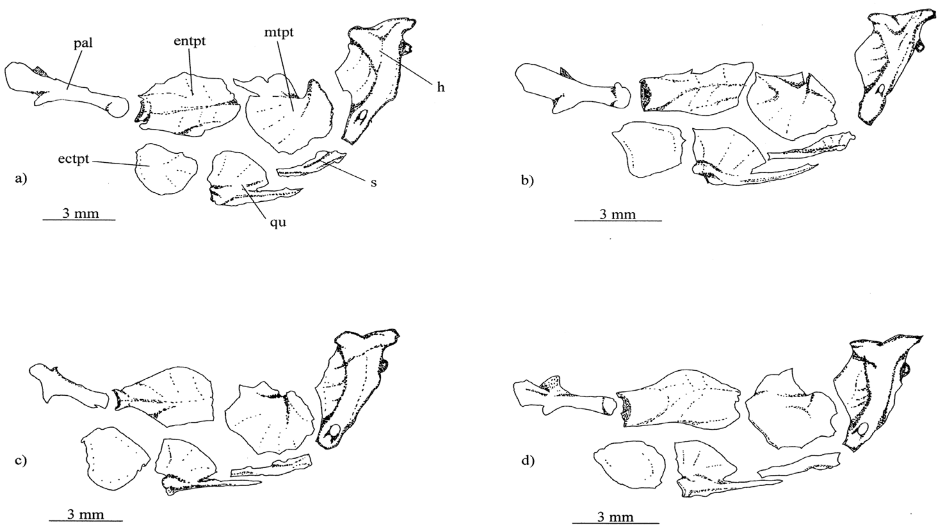


Fig. 5. **The bones of the palato-quadrato complex of 4 gudgeon species: a) *R. vladykovi*, b) *R. uranoscopus*, c) *G. carpathicus*, d) *R. kesslerii*. ectpm — ectopterygoideum; entpm — entopterygoideum; h — hyomandibulare; mtpm — metapterygoideum; pal — palatinum; qu quadratum; s — symplecticum.**

A common clear similarity is seen *R. uranoscopus* and *R. vladykovi* by having a rounded lower part of quadratum.

Table 1a. **Morphometric characterization of craniological features of gudgeons of the genera of Gobio and Romanogobio from Ukrainian waters**

Feature	*R. uranoscopus* (n=18)		*R. kesslerii* (n=18)		*R. vladykovi* (n=9)		*G. carpathicus* (n=17)	
	M ± m	Lim	M ±m	lim	M ± m	lim	M ± m	lim
1	2	3	4	5	6	7	8	9
l, mm	83,1 ± 0,77	76,8 – 90,1	81 ± 1,81	64,7 – 96,1	89,8 ± 1,69	81,5 – 96,6	98,4 ± 1,43	90,8 – 112,1
lc, mm	20,7 ± 0,18	19,3 – 22,3	19,5 ± 0,43	16,2 – 23,8	20,8 ± 0,5	19 – 23,1	25,5 ± 0,42	23,2 – 29,6
L bas.n., mm	16,6 ± 0,22	15,4 – 18,3	15,9 ± 0,32	13,9 – 19,1	17,3 ± 0,41	15,3 – 18,7	20,1 ± 0,25	18,5 – 22
			As % L bas.n.					
cl	59,0 ± 0,97	49,5 – 63,7	59,2 ± 0,78	53,7 – 67	61,4 ± 0,94	56,4– 66,2	64,4 ± 1,4	54 – 75,3
scl	27,7 ± 0,65	22, – 33	29,6 ± 0,33	27,6 – 31,8	31,4 ± 0,71	28,5 – 34,6	31,6 ± 0,5	24,8 – 34,7
Sfr	20,8 ± 0,29	18,9 – 22,9	22,2 ± 0,37	18,5 – 24,7	23,7 ± 0,31	22,5 – 25	24 ± 0,37	21,5 – 26,8
Ssp	45,9 ± 0,42	42,9 – 49,8	49,4 ± 0,32	47,1 – 52,5	51,4 ± 0,62	47,5 – 53,3	49,6 ± 0,38	46,8 – 52
Hsoc	26,7 ± 0,23	25,5 – 28,5	26 ± 0,32	24,1 – 30,1	28,4 ± 0,48	25,7 – 30,5	28,6 ± 0,25	27 – 30,5
WBoc	13,8 ± 0,34	10,9 – 16,6	13,1 ± 0,34	9,1 – 15,1	13,8 ± 0,41	13 – 16	12,1 ± 0,20	10,9 – 13,9

Continuation of table 1a

1	2	3	4	5	6	7	8	9
Lsent	18,4 ± 0,36	15,3 – 21,8	17,7 ± 0,34	13,9 – 19,9	17,6 ± 0,37	16 – 19,1	16,4 ± 0,64	11,3 – 19
Io5	7,8 ± 0,23	5,7 – 9,9	8,8 ± 0,34	6,1 – 11,7	9,25 ± 0,26	7,6 – 10,3	7,5 ± 0,33	5,4 – 9,5
Io3	22,3 ± 0,51	17,2 – 25,3	26,3 ± 0,41	23,7 – 29,8	26,4 ± 0,54	24,3 – 30,4	25,5 ± 0,47	19,7 – 28
Op	36,3 ± 0,51	31,7– 40	37,1 ± 0,55	31,2 – 41	40,4 ± 0,71	36 – 42,4	42,7 ± 0,39	39,8 – 45,8
pop	42,1 ± 0,54	36,1 – 45,4	43,6 ± 0,29	41,1 – 45,2	48 ± 0,68	45,5 – 51,9	48,9 ± 0,35	45,8 – 51,8
iop	38,7 ± 0,65	32,4 – 43,1	38 ± 0,35	34,4 – 40	41,3 ± 0,49	38,9 – 44,2	46,1 ± 0,53	42,3 – 48,9
pm	28,6 ± 0,43	24,7 – 31,4	29,7 ± 0,31	27,3 – 32,3	26,7 ± 0,52	24,5 – 29,9	30 ± 0,38	27,7 – 32,7
dn	32,1 ± 0,44	27,1 – 34,7	34,2 ± 0,64	30,1 – 42,8	29 ± 0,34	27,6 – 30,8	33,7 ± 1,22	26 – 47,3
qu	25,8 ± 0,47	21,9 – 28,7	25,8 ± 0,26	24 – 27,7	25,5 ± 0,46	23,0 – 27,6	27,1 ± 0,31	25,1 – 29,5
In % of head length								
WIn1	53,4 ± 2,16	36,1 – 66,1	52 ± 4,7	26,7 – 110,3	56,5 ± 3,1	42,3 – 68,8	52,7 ± 4,62	20,5 – 94,7
WIn3	22,2 ± 0,8	17,1 – 31,1	19,9 ± 0,74	14,8 – 24,7	25 ± 1,24	19,8 – 30,9	24,5 ± 0,82	18,6 – 30,4
WOp	82,5 ± 0,86	76,8 – 92,2	79,7 ± 1,57	68,4 – 97,5	76 ± 1,03	71,0 – 79,5	80,7 ± 1,19	73,6 – 88,5
Wpop	20,6 ± 0,47	16,8 – 23,6	23,4 ± 0,44	20,7 – 26,8	23,2 ± 0,72	21,1– 27	24,8 ± 0,53	20,8 – 29,8
Hiop	29,6 ± 0,85	23,8 – 36,5	32,3 ± 0,73	26,9 – 38,6	38± 1,83	26,7 – 44,2	37,5 ± 1,14	26,8 – 46,3
HPm	23,6 ± 0,67	18,9 – 28,6	20,3 ± 0,28	18,2 – 23,7	23,2 ± 0,51	21,5 – 25,9	21,1 ± 0,52	16,8 – 25,1
HpPm	37,1 ± 0,7	30,5 – 43,8	36 ± 0,5	32,3 – 40,6	37,8 ± 0,95	35 – 42,6	33,3 ± 0,71	28,4 – 37,4
HD	19,7 ± 0,52	16,1 – 23,6	20,8 ± 0,77	15,8 – 26,3	26,2 ± 0,94	22 – 31,5	23 ± 1,02	13,4 – 29,7
HpD	51,5 ± 0,78	46,5 – 58,5	49,9 ± 1,39	40 – 61,9	60,8 ± 1	56,5 – 65,7	56,3 ± 1,5	40,4 – 67,9
HQ	12,9 ± 0,64	9,6 – 17,0	11,7 ± 0,79	4,6 – 18,8	14 ± 1,57	4,4 – 19,3	16 ± 0,79	8,6 – 21,5

Depth of the notch in quadratum is very variable in *R. kesslerii* (Table 1), but in other species this feature is characterized by lower variability.

Praemaxillare is the largest in *R. uranoscopus*. Praemaxillare in *R. vladykovi* has an orthogonal shape of processus ascendens dorsalis maxillaries.

There is a specific process in the lower part of maxillare in *R. uranoscopus* and *R. vladykovi,* which is absent in *G. carpathicus* and *R. kesslerii*.

Dentale in *R. uranoscopus* is massive with wide processus coronoideus dentalis, while others *Romanogobio* species have it more thickly than it is in *G. carpathicus*.

Anguloarticulare in *R. uranoscopus* and *R. vladykovi* is similar by having a hollow in the anterior part. A specific deep hollow in the lower part in anguloarticulare is typical only for *R. uranoscopus*.

Table 1b. **Morphometric characterization of craniological features of gudgeons of the genera of Gobio and Romanogobio from Ukrainian waters**

Feature	***t***					
	R. uranoscopus – R. kesslerii	*R. uranoscopus – R. vladykovi*	*R. uranoscopus – G. carpathicus*	*G. carpathicus – R. kesslerii*	*G. carpathicus – R. vladykovi*	*R. kesslerii – R. vladykovi*
In % L bas.n.						
cl	0,14	1,55	3,16	3,26	1,44	1,69
scl	2,63	3,53	4,6	3,19	0,22	2,63
Sfr	2,99	6,21	6,81	3,34	0,53	2,53
Ssp	6,39	7,36	6,32	0,43	2,7	3,29
Hsoc	1,98	3,47	5,57	6,55	0,52	4,27
WBoc	1,44	0,03	4,15	2,44	4,04	1,2
Lsent	1,39	1,45	2,85	1,91	1,33	0,24
Io5	2,59	3,98	0,74	2,85	3,58	0,84
Io3	6,05	4,94	4,54	1,27	1,16	0,13
Op	1,07	4,72	9,94	8,24	3,08	3,6
pop	2,42	6,51	10,56	11,95	1,42	7,01
iop	0,93	2,66	8,8	13,01	5,92	5,53
pm	2,05	2,63	2,43	0,65	5,09	5,23
dn	2,79	4,56	1,31	0,37	2,76	5,55
qu	0,07	0,38	2,24	3,29	2,91	0,51
As % of head length						
WIn1	0,28	0,82	0,15	0,11	0,56	0,64
WIn3	2,11	1,94	2,02	4,19	0,31	3,73
WOp	1,57	4,63	1,31	0,47	2,59	1,59
Wpop	4,32	3,15	5,88	1,97	1,68	0,19
Hiop	2,44	4,8	5,6	3,88	0,25	3,49
HPm	4,55	0,37	2,95	1,34	2,67	5,5
HpPm	1,25	0,58	3,76	3,15	3,75	1,84
HD	1,22	6,57	2,93	1,71	2,03	4,19
HpD	1,01	7,14	2,91	3,15	2,1	5,2
HQ	1,24	0,75	3,08	3,93	1,31	1,49

* values marked in bold $p<0,05$.

Some bones of shoulder-girdle are shown in Fig. 6. Postcleithrum in *R. vladykovi* has a specific shape with thickened lower part. Supracleithrum is similar in all *Romanogobio* species but is more elongated in *G. carpathicus*. Cleithrum is very variable, the most complicated structure it is in *R. uranoscopus.*

The form of the notch in urohyale (Fig. 7) allows very easily distinguishing *Romanogobio* and *Gobio*, in the latter one it is more orthogonal that was determinated earlier (Naseka, pers. com.). From the lateral view, urohyale is similar in *R. uranoscopus* and *G. carpathicus*: it is without the notch in the posterior upper part of the bone. In the majority of *R. kesslerii* specimens lateral processes are asymmetric.

Characterization of the spinal column of four gudgeons is shown in Table 2. The total number of vertebrae is: *G. carpathicus* — 38,4: (9,5) 19,4 (3,2) + (2,1) 19 (16,9); *R. kesslerii* — 39,3: (9,9) 17,4 (3,6) + (3,5) 21,3 (17,9); *R. vladykovi* — 39,7: (10) 19.1 (3.7) + (2,7) 20,6 (17,7); *R. uranoscopus* — 39,2: (9.9) 19,2 (3,4) + (1,4) 20 (18,6). All four species differ the most by the number of caudal vertebrae, where *R. uranoscopus* differs significantly (Table 2): it has only 1,4 preanal vertebrae and 18,6 postanal vertebrae, respectively.

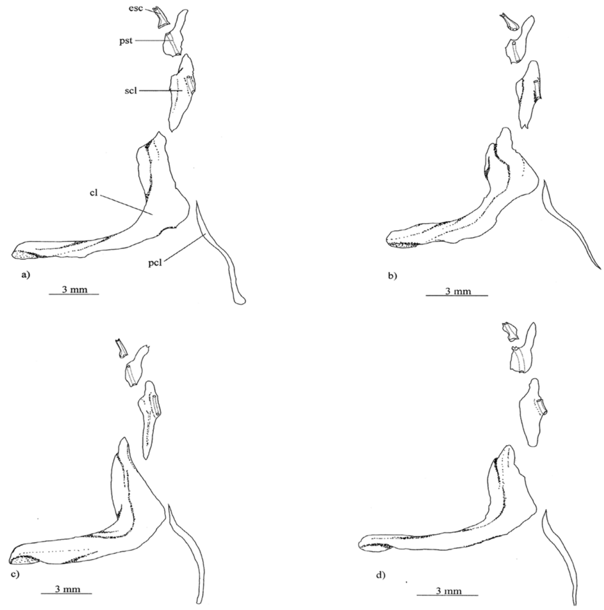


Fig. 6. **The bones of the shoulder girdle of 4 gudgeon species: a) *R. vladykovi*, b) *R. uranoscopus*, c) *G. carpathicus*, d) *R. kesslerii*. cl — cleithrum; pcl — postcleithrum; scl — supracleithrum; pst — posttemporale; es — extrascapulare.**

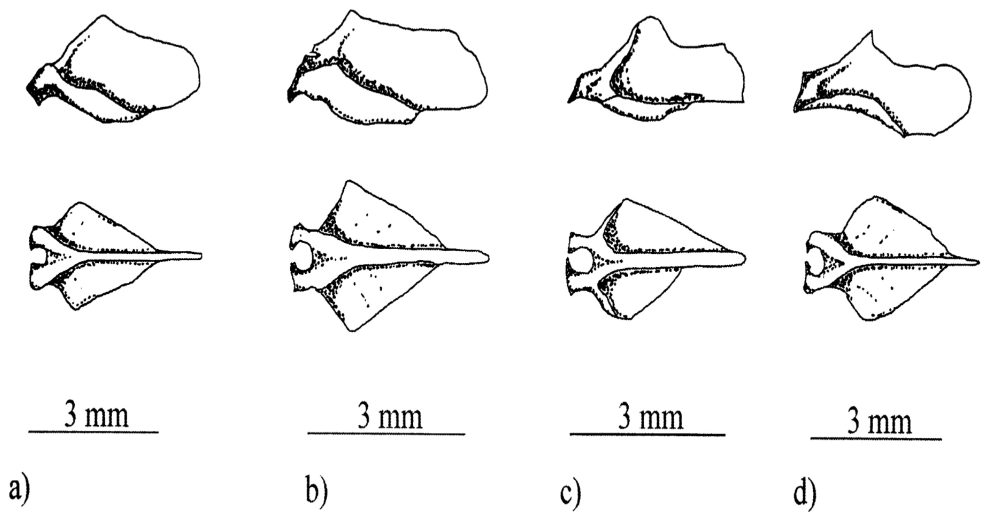


Fig. 7. **Urohyale of 4 gudgeon species: a) *G. carpathicus*, b) *R. uranoscopus*, c) *R. kesslerii*, d) *R. vladykovi*.**

Table 2a. **Characterization of parts of spines in gudgeons of genus Gobio and Romanogobio from Ukrainian waters**

Part of spine	Species							
	R. uranoscopus (n = 18)		*R. kesslerii* (n = 18)		*R. vladykovi* (n = 9)		*G. carpathicus* (n = 17)	
	M ± m	lim	M ± m	lim	M ± m	lim	M ± m	lim
T	39,2 ± 0,32	37 – 42	39,7 ± 0,55	36 – 41	39,7 ± 0,55	36 – 41	38,4 ± 0,3	36 – 40
A	19,2 ± 0,31	18 – 22	19,1 ± 0,45	16 – 20	19,1 ± 0,45	16 – 20	19,4 ± 0,17	18 – 21
a1	9, 9 ± 0,21	8 – 11	10 ± 0,17	9 – 11	10 ± 0,17	9 – 11	9,5 ± 0,15	8 – 10
i	3,4 ± 0,16	2 – 5	3,7 ± 0,17	3 – 4	3,7 ± 0,17	3 – 4	3,2 ± 0,21	2 – 5
C	20,1 ± 0,25	18 – 22	20, 6 ± 0,29	19 – 22	20, 6 ± 0,29	19 – 22	19 ± 0,23	17 – 20
c1	1,4 ± 0,17	0 – 3	2,7 ± 0,37	1 – 4	2,7 ± 0,37	1 – 4	2,1 ± 0,16	1 – 3
c2	18,6 ± 0,16	17 – 20	17,8 ± 0,36	17 – 20	17,8 ± 0,36	17 – 20	16,9 ± 0,22	15 – 18

Our results are similar to data of previous revisions of this species [29]. Data on the number of vertebrae in different sections of the spinal column are included in the discriminant analysis.

Table 2b. **Characterization of parts of spines in gudgeons of the genera Gobio and Romanogobio from Ukrainian waters**

Part of spine	*t*					
	R. uranoscopus – R. kesslerii	*R. uranoscopus – R. vladykovi*	*R. uranoscopus – G. carpathicus*	*G. carpathicus – R. kesslerii*	*G. carpathicus – R. vladykovi*	*R. kesslerii – R. vladykovi*
T	0,23	0,85	1,87	1,91	**2,3**	0,59
A	**2,7**	0,1	0,52	**3,15**	0,6	1,93
a1	0	0,34	1,59	1,59	**2,19**	0,34
I	1,02	1,06	0,79	1,71	1,53	0,24
C	**3,33**	1,22	**3,12**	**6,27**	**4,11**	1,68
c1	**9,3**	**3,49**	**2,66**	**6,68**	1,76	**2,51**
c2	**2,58**	**2,42**	**6,16**	**3**	**2,1**	0,27

* values marked in bold *p*<0,05.

The cephalic sensory canal system of all species is similar by the number of pores (Table 4), but there are some differences in its structure.

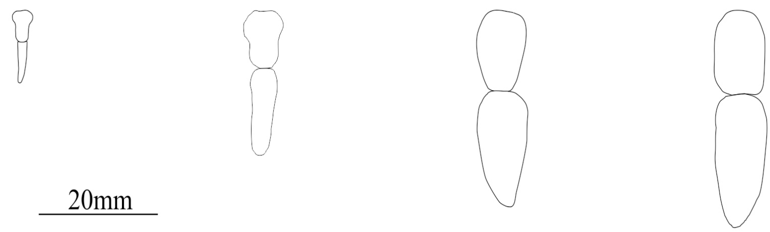
The most distinct this system is in *G. carpathicus*: CSO and CIO are separated but the pores of each canal are situated very closely. It is necessary to mention that two specimens of *R. uranoscopus* from the Rika River were found, in which these two canals were also disconnected.

In *R. kesslerii*, the last pore of CSO is situated on parietale near CST, whereas CSO in other species ends on frontale and in some specimens of *R. uranoscopus* the furthermost pore of CSO is situated above parietale. In several specimens of *R. kesslerii*, canals do not displayed in the bones and are situated on the bones surfaces, where they form deepening's, while the upper part of the canals is formed from the dermal tissue. In many gudgeon specimens, the central pore of CST is also situated above supraoccipitale

Table 4. **Characterization of the number of pores in the sensory canals of gudgeons from the genera *Gobio* and *Romanogobio* from Ukrainian waters**

Canal	Species							
	R. uranoscopus (n = 41)		*R. kesslerii* (n = 41)		*R. vladykovi* (n = 17)		*G. carpathicus* (n = 76)	
	M ± m	lim	M ± m	lim	M ± m	lim	M ± m	Lim
CSO	8,5 ± 0,16	6 – 11	7,5 ± 0,14	6 – 9	6,9 ± 0,17	6 – 8	7,9 ± 0,11	6 – 11
CST	6,2 ± 0,19	5 – 8	6,1 ± 0,16	4 – 8	6,3 ± 0,17	5 – 7	6 ± 0,11	5 – 8
CIO	18 ± 0,28	14 – 22	16,8 ± 0,24	13 – 20	17,5 ± 0,38	15 – 20	18,2 ± 0,15	14 – 21
CPM	13,6 ± 0,19	12 – 16	13,7 ± 0,31	10 – 17	13,5 ± 0,32	12 – 16	14,1 ± 0,11	12 – 16

The structure of the swimming bladder in all four species has a very specific structure. The swimming bladder of *G. carpathicus* and *R. vladykovi* has smilar shape and size that may be a result of their similar ethology (Fig. 8).



a) b) c) d)

Fig. 8. **The structure of the gas bladder of 4 gudgeon species: a) *R. uranoscopus*, b) *R. kesslerii*, c) *R. vladykovi*, d) *G. carpathicus***

These two species are similar by the size of the anterior part but have some differences in the length of the posterior part, which is larger in *G. carpathicus* that is reflected on its total length (Fig. 8, Table 3).

The structure of the swimming bladder in *R. uranoscopus* and *R. kesslerii* is similar and differs from other species.

The widening in the anterior part of the swimming bladder in these species unites them in some extent, but as for the size of the swimming bladder, *R. uranoscopus* is exceptional.

The average length of the swimming bladder is 10,62 % of SL in *R. uranoscopus,* whereas in other species it is much bigger — from 21,0 to 31,8 % of SL (Table 3).

Moreover, its anterior part in *R. uranoscopus* reaches 4,4 % of SL (mean average), while in the others it varies from 8,2 to 12,3 %, and the posterior part reaches 6,2 % of SL (mean average) compared to 12,8 – 19,2 % in other gudgeons.

Table 3. Main features **of gas bladder and its sections in four gudgeon species from Ukrainian waters**

Feature	Species							
	R. uranoscopus (n = 25)		*R. kesslerii* (n = 25)		*R. vladykovi* (n = 25)		*G. carpathicus* (n = 25)	
	M ± m	lim	M ± m	lim	M ± m	lim	M ± m	lim
l, mm	80,1 ± 1,69	66,1 – 105	73,54 ± 1,211	62,4 – 82,4	87,7 ± 1,27	74,6 – 98,9	99,2 ± 3,02	67,8 – 128,1
				% l				
Length anterior part	4,4 ± 0,17	2,5 – 6,6	8,2 ± 0,17	6,8 – 10,1	12,2 ± 0,36	8,9 – 16,3	12,3 ± 0,28	8,5 – 14,7
Length of posterior	6,2 ± 0,22	4,1 – 8,9	12,8 ± 0,26	10,3 – 15,4	16,6 ± 0,21	15,1 – 19,8	19,4 ± 0,22	17,4 – 21,5
The total length of the swim bladder	10,6 ± 0,33	6,6 – 14,2	21 ± 0,39	17,4 – 24,9	28,8 ± 0,49	25,6 – 34,4	31,8 ± 0,39	26,5 – 34,4

The main examined features of neirocranium and individual bones are shown in Table 1. It can be seen that *R. uranoscopus* significantly differs from the genera *Gobio* and *Romanogobio* by following features: scl, Sfr, Ssp, Io3, pop, Wpop, pm. All these features in *R. uranoscopus* are smaller than in other species except the length of praemaxillare, which is smaller only in *R. vladykovi.*

No any unique feature, which is different in all four species, was found. But there are several features, which are different in more than two species: scl, Sfr, Ssp, Op, pop, iop, pm, HpD. Our data (Table 1) show that main features, which are useful for gudgeon comparisons, are width of neirocranium in its different parts and relative size of operculum bones, praemaxillare and supracleithrum, maximum height of dentale relative to its length.

Sexual dimorphism was not observed in *R. uranoscopus* and *R. vladykovi.* Sexual dimorphism in *G. carpathicus* is manifested by smaller Sfr (p = 0,03, t = 2,39) in females, which characterizes interorbital distance. Sexual dimorphism in *R. kesslerii* is manifested by different Lscl (p = 0,01, t = 2,85) and WOp (p = 0,02, t = 2,6): these features are larger in males. Taking into consideration such small differences, indexes: Sfr, Lscl, WOp were excluded from discriminant analysis for comparing populations without separating them into sex groups.

An analysis of numerical data of the Mahalanobis distance shows that we cannot say definitely about genus belonging of one or another species (Table 6), because there is no clear boundary between different *Romanogobio* species. When comparing this distance between different species, one can only say unambiguously that *R. kesslerii* and *G. carpathicus* are the most distinctly separated species; *R. vladykovi* has intermediate osteological descriptions, which allow determining the belonging to the genus *Romanogobio* based only on examination of the specificity of the structure of individual skeletal components (without indicating general morphological data). *R. uranoscopus* is distinct from all studied species (Fig. 9).

Results of the discriminant analysis are shown in Fig. 9 and in Tables 5 and 6. Fig. 9 demonstrates that all species are well distinguished from each other by osteological features. The most variable are features in *R. vladykovi*, which by the totality of osteological data takes an intermediate position between *R. kesslerii* and *G. carpathicus*.

Table 5. **Factor load of first three principal components when comparing the genera *Gobio Romanogobio* from Ukrainian waters**

Feature	canonical variable		
	1	2	3
cl	0,108	- 0,029	- 0,345
scl	0,232	- 0,423	0,200
Hsoc	- 0,263	0,410	0,488
WBoc	0,441	0,180	0,741
Lsent	0,366	0,194	- 0,603
Io5	0,785	- 0,138	1,060
Io3	0,410	- 0,540	0,984
op	- 0,349	0,027	- 0,592
pop	0,151	- 0,945	0,871
iop	- 1,595	0,371	- 0,791
pm	0,662	0,473	- 1,110
dn	-0,038	- 1,110	0,065
qu	0,610	0,167	0,095
WIn1	- 0,151	0,289	0,322
WIn3	- 0,233	- 0,111	- 0,208
Wpop	- 0,108	- 0,676	- 0,920
Hiop	- 1,143	- 0,102	0,205
HPm	- 0,599	0,952	0,032
HpPm	1,260	- 0,548	0,405
HD	- 1,279	- 0,171	- 0,435
HpD	0,614	- 0,763	0,553
HQ	- 0,301	0,598	0,429
T	0,195	1,062	- 0,059
A	0,021	- 0,187	0,227
a1	- 0,376	0,163	0,110
i	0,030	- 0,481	- 0,343
C	- 0,369	- 0,156	0,592
c1	1,202	- 0,982	- 1,496
c2	0,616	- 0,577	- 0,835
Factor contribution to total variance	57,05%	26,62%	16,33%

Table 6. **Value of the Mehalanobis distance of osteologycal data of species of the genera *Gobio* and *Romanogobio* from Ukrainian waters**

Species	*R. uranoscopus*	*R. kesslerii*	*R. vladykovi*	*G. carpathicus*
R. uranoscopus	–	92,69	106,07	143,96
R. kesslerii	92,69	–	104,3	203,58
R. vladykovi	106,07	104,3	–	98,48
G. carpathicus	144,14	203,58	98,48	–

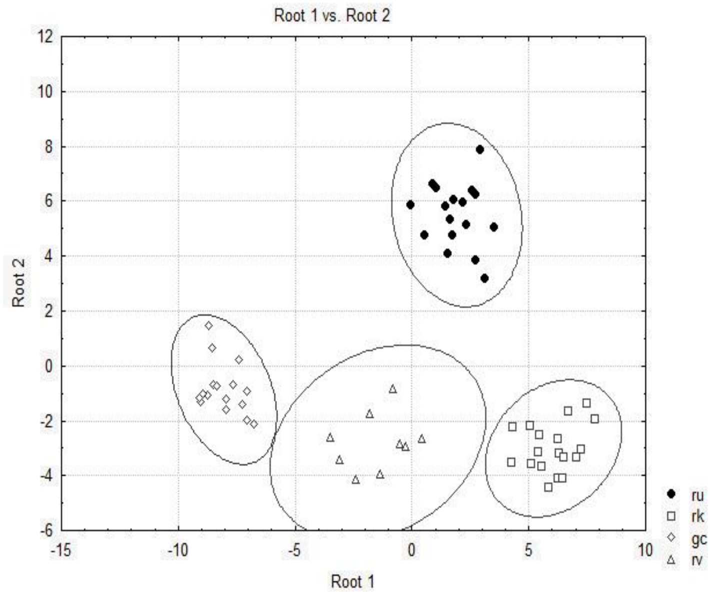


Fig. 9. **The distribution of four species of gudgeon individuals in the value space of the 1st and 2-nd canonical variables. ru — *R. uranoscopus*, rk — *R. kesslerii*, rv — *R. vladykovi*, gc — *G. carpathicus***

The most significant feature, which accounts for 56,05 % of general variance is Hiop = − 1,595, which characterizes the length of interoperculum in % of ccl. HD (− 1,279), HpPm (1,26), c1 (1,202) and Hiop (− 1,143) have great contribution to the first canonical variance. As for the second canonical variance (26,62 %), following features: D (− 1,11), T (1,062), c1 (− 0,982), Hpm (0,952), and pop (− 0,945) have the greatest (almost identical) weight. The third canonical variance (16,33 %) is characterized by the greatest contributions of following features: c1 (− 1,496), Pm (− 1,110), ln1 (1,06), ln3 (0,982), and pop (− 0,920). The biggest contributions in all three canonical variances make c1 as a feature, which characterizes the number of preanal vertebrae.

Bănărescu published a description of the subgenus *Rheogobio* in 1961 and he mentioned a small difference of this subgenus from the subgenus *Romanogobio*. One of main feature, which is typical for *Romanogobio*, is the presence of epithelial crests on the dorsal part of the body, which are absent in *Rheogobio.* Classification of gudgeons based on the presence or absence of epithelial crests is not universal, because several gudgeon species without such structures were described but they were placed in the *Romanogobio* group: *R. pentatrichus*, Naseka, Bogutskaya, 1998 and *R. benacensis* (Pollini, 1816) [18]. It is necessary to mention one peculiarity which gave the name to the subgenus *Rheogobio,* rheo — which literally means current.

It is known that species, which prefer current, are called rheophils. I.e., for the subgenus characterization, Bănărescu included an important but rarely used ethological feature for characterization of superspecies taxa [21]. Therefore, in our opinion, this ethological feature of *Rheogobio*, which expressed in its rheophilic stenobionticity, is an important reason to consider this group of species as a separate taxon. This peculiarity of *Rheogobio* is useless because it cannot be determined on the preserved material. The shape and size of the swimming bladder is one of the elements of the body structure, which closely correlates with fish behavior and directly with abovementioned ethological peculiarities. As it can be seen from the shape and size of the swimming bladder (Fig. 8, Table 3), *R. uranoscopus* is a specific species, swimming bladder of which reduced as a result of occupying sites with high water velocity, therefore the role of swimming bladder decreased and its size is on average 10,6 % of SL, while in other gudgeons it reaches 21,0 to 31,8 % of SL. The swimming bladder structure in *R. uranoscopus* is more similar to that of *R. kesslerii*, but *R. kesslerii* is a relatively eurybiotic species because it occurs in a considerably more various habitats irrespective of the water current velocity that can seen from the relative size of its swimming bladder. To note, ecological peculiarities were already used earlier as one of additional criterion for separation of genera from some subgenera of *Gobioninae* [12].

Osteological data are one of main arguments for separation of *R. uranoscopus* from other species of the genus *Romanogobio*. Significant differences were found for 7 indexes, they have smaller values (except larger value of praemaxillare compared to that of *R. vladykovi*): scl, Sfr, Ssp, Io3, pop, Wpop, pm. Mahalanobis distance distinctly shows the difference of *R. uranoscopus* from other investigated species, the maximum close species to *R. uranoscopus* by a complex of osteological data is *R. kesslerii* SqMD = 92,69, in lower degree *R. vladykovi* SqMD = 106,07, the furthermost species is *G. carpathicus* SqMD = 144,14. According to discriminant analysis, results of which are shown on Fig. 9, it can be concluded that *R. uranoscopus* is distinctly different from the genera *Romanogobio* and *Gobio*.

Value of spine, data on which are included in the previous analysis, allows finding that *R. uranoscopus* is the species with the specific average number of abdominal vertebrae — 1,4 and relatively large number of postanal vertebrae — 18,6, that in our opinion is a result of dislocation of anal fin closer to the head that correspondingly results in elongation of the tail stem that in its turn is related to narrow specialization of this species to the rapid flow of the river.

As a final reason for the necessity for separation of *R. uranoscopus* in a superspecies taxon is the structure of individual elements of cranium and pectoral girdle bones. *R. uranoscopus* is different from the genera *Romanogobio* and *Gobio* by following features: lateral branch of sphenoticum is orientated to the anterior part of neirocranuim; supraehtmoideum is elongated and narrow in the zone of connection with frontale and is widened (by 1,5 times) in the anterior part, which is ensured by widened processus lateralis anterior supraethmoidei; openings of the trigeminal-facial canal are large with an elongated form of the back opening, are narrowly situated that is expressed as a thin bony arch; the posterior part, epioticum, is relatively flat and does not exceed the margins of other bones of this zone; vomer has sharp spines at its distal side; pointed ethmoidale laterale are orientated to the axis praeethmoideum; twice as big than in other species; there are apertures in mesethmoideum; masticatory surface of processus pharyngealis is large and has a composite structure; processus pharyngealis is orthogonal; io1 is rounded at its posterior part; io2 has curved towards anterior part; is elongated and somewhat curved in the anterior part; interoperculum has a specific uncinate outgrowth in the middle; suboperculum is elongated with a clearly seen process in the anterior part; cleithrum is developed; anguloarticulare has a deep hollow in its lower part.

From the genus *Gobio*, *R. uranoscopus* is different by following features: lateral branch of sphenoticum is narrow; articulation zone of vomer and parasphenoideum has a triangular shape; processus medialis anterior supraehmoidei is slightly developed; io4 has only one canal segment; bones of the upper and lower jaws are massive; there is a hollow in the anterior part of anguloarticulare; supracleithrum is wide; the form of the notch in urohyale is rounded; CSO and CIO are connected in majority of studied fished.

From the genus *Romanogobio*, *R. uranoscopus* is different by following features: a foramen between orbitosphenoideum and ethmoidale laterale; io3 without thickening at it ends and is not narrowed in the center; upper part of urohyale (from the lateral view) is without hollow in the posterior upper part. According to data of previous investigators, the condition for separation of superspecies taxa is usually a complex of individual features, which one way or another separate an individual taxon [12, 33].

Taking in the consideration data of previous investigators [2, 3, 5, 6, 7, 28, 29], it can be concluded that eventual necessity for separation of *Rheogobio* was reduced by a wide range of features in species, which were placed in this subgenera. Modification of a taxon in such a way forced the majority of scientists to ignore ethological peculiarities of the type species *R. uranoscopus* and the next step for merging in synonymy with *Romanogobio* [29] became necessary that was confirmed by including species with no epithelial crests in dorsal part of the body in the genus *Romanogobio* [18, 30], based on which the subgenus *Rheogobio* was described earlier. On the other hand, data of genetic investigation only confirm the considerable likeness of *R. uranoscopus* with other representatives of the genus *Romanogobio* [22, 23, 37]. Thus, recovering taxonomic status of *Rheogobio* to the level of a genus (parallel with *Romanogobio*) is not reasonable and advisable will be its resumption to the level of a subgenus with its inclusion into the genus *Romanogobio.* Such a scheme of classification is the most reasonable because it raises the level of *Rheogobio* species in the genus *Romanogobio* and minimizes modifications in classification of gudgeons.

As for other species, which can be included in the recovered subgenus *Rheogobio* of the genus *Romanogobio*, in our opinion reasonable is inclusion of *R. elimeius,* which was earlier examined as a subspecies of *R. uranoscopus.*Validity of division *R. uranoscopus* into two species *frici* and *uranoscopus*, according to the recent rise of the subspecies status of these fishes to the level of species, requires additional investigations in this field. If *frici* is described as a separate species, it will be included into the subgenus *Rheogobio*. Genetic data shows that there is a great probability for including in this subgenera *R. macropterus* (Kamensky, 1901) [37], but it requires additional analyses.

Final renewal of the status of the subgenus *Rheogobio* should involve more osteological data for determination of structural peculiarities, which are common for species to be included in the genus *Rheogobio* and similarity of which to *R. uranoscopus* was determined earlier, namely *R. macropterus* and *R. elimeius.* In addition, it is necessary to determine the stability of manifestation of those peculiarities of the body structure, based on the comparison with other species of the generous, which were determinate both for the type species of *Romanogobio* — *R. kesslerii*, and for *G. carpathicus* of the genus *Gobio.*

CONCLUSIONS AND PERSPECTIVES OF FURTHER DEVELOPMENT

As a result of investigation of the internal structure of four gudgeon species with the use of osteological data, structure of cephalic sensory canals of the head and structure of the swimming bladder, we demonstrated considerable differences among species in the subgenus *Romanogobio*, namely a singularity of one species of this genera, *R. uranoscopus*, that is a prerequisite for renewal of the status of the genus *Rheogobio* to the level of a subgenus in the genus *Romanogobio*, however, more comparative materials are required for final separation.

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ОСТЕОЛОГІЧНА ХАРАКТЕРИСТИКА ЧОТИРЬОХ ВИДІВ РОДУ *GOBIO* І *ROMANOGOBIO* З ДЕЯКИМИ ЗАУВАЖЕННЯМИ ЩОДО СТАТУСУ КОЛИШНЬОГО ПІДРОДУ *RHEOGOBIO*

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Мета. *Метою даної роботи є з’ясувати доцільність використання у сучасній систематиці Gobioninae назви Rheogobio як синоніму Romanogobio, чи як окремого таксону, при порівнянні чотирьох видів родів Gobio і Romanogobio на основі остеологічних даних та будови плавального міхура.*

Методика*. Досліджено структуру осьового скелета і черепа чотирьох видів пічкурів. Всі екземпляри були попередньо опрацьовані за допомогою методики зафарбовування алізариновим червоним С. Вимірювання проводилися за допомогою програмного забезпечення ScopePhoto з допомогою цифрової фотокамери DCM 500. Розрахунки проводилися за допомогою програмного забезпечення Statistica 8.0. Для визначення відмінності між видами було використано t-критерій Сть’юдента та дискримінантний аналіз. Кінцеве опрацювання малюнків здійснювали за допомогою графічного редактора CorelDRAW X5 і Photoshop CS5.*

Результати. *R. uranoscopus є специфічним видом, у якого в результаті зосередження у місцях зі швидкою течією з часом зменшувалась роль гідростатичного апарату і він редукувався до середніх розмірів 10,6 % довжини тіла, тоді як у решти вона складає від 21 до 31,8 %. Дистанція Махаланобіса чітко вказує на відмінність R. uranoscopus від решти досліджуваних риб. Максимально близьким видом до R. uranoscopus за комплексом остеологічних показників є R. Kesslerii, найвіддаленішим — G. carpathicus. Структура окремих елементів черепа, кількість хребців і кістки грудного пояса також вказують на значну відмінність R. uranoscopus від інших видів.*

Наукова новизна. *Новизна даної роботи є в новому погляді на систематичний статус підроду Rheogobio на базі остеологічних та інших даних.*

Практична значимість. *Практична цінність даної роботи полягає у роз'ясненні систематичного статусу підроду Rheogobio для узгодження природоохоронної документації та уникнення різної інтерпретації систематичного статусу видів з цього підроду.*

Ключові слова: *остеологія, систематика, таксономія, Romanogobio, Gobio, Rheogobio.*

ОСТЕОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА ЧЕТЫРЕХ ВИДОВ РОДА *GOBIO* И *ROMANOGOBIO* С НЕКОТОРЫМИ ЗАМЕЧАНИЯМИ ОТНОСИТЕЛЬНО СТАТУСА БЫВШЕГО ПОДРОДА *RHEOGOBIO*

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Цель. *Целью данной работы является выяснение целесообразности использования в современной систематике Gobioninae названия Rheogobio как синонима Romanogobio, или как отдельного таксона, при сравнении четырех видов родов Gobio и Romanogobio на основе остеологических данных и строения плавательного пузыря.*

Методика. *Исследована структура осевого скелета и черепа четырех видов пескарей. Все экземпляры были предварительно обработаны с помощью методики окрашивания ализариновым красным С. Измерения проводились с помощью программного обеспечения ScopePhoto с помощью цифровой фотокамеры DCM 500. Расчеты проводились с помощью программного обеспечения Statistica 8.0. Для определения различия между видами было использовано t-критерий Стьюдента и дискриминантный анализ. Конечную обработку рисунков осуществляли с помощью графического редактора CorelDRAW X5 и Photoshop CS5.*

Результаты. *R. uranoscopis является специфическим видом, у которого в результате сосредоточения в местах с быстрым течением со временем уменьшалась роль гидростатического аппарата и он редуцировался до средних размеров 10,6 % длины тела, тогда как у остальных она составляет от 21 до 31,8 %. Дистанция Махаланобиса четко указывает на отличие R. uranoscopis от остальных исследуемых рыб. Максимально близким видом к R. uranoscopis по комплексу остеологических показателей является R. Kesslerii, отдаленным — G. carpathicus. Структура отдельных элементов черепа, количество позвонков и костей грудного пояса также указывают на значительное отличие R. uranoscopis от других видов.*

Научная новизна. *Новизна данной работы состоит в новом взгляде на систематический статус подрода Rheogobio на базе остеологических и других данных.*

Практическая значимость. *Практическая ценность данной работы заключается в разъяснении систематического статуса подрода Rheogobio для согласования природоохранной документации и избегания различной интерпретации систематического статуса вида из этого подрода.*

Ключевые слова: *остеология, систематика, таксономия, Romanogobio, Gobio, Rheogobio.*