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DESCRIPTION OF A NEW SPECIES, *PHOXINELLUS DALMATICUS* (CYPRINIDAE: LEUCISCINAE), FROM THE ČIKOLA RIVER IN THE KRKA RIVER SYSTEM, ADRIATIC BASIN (CROATIA)

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Zupančič, P. & Bogutskaya, N. G.: Description of a new species, *Phoxinellus dalmaticus* (Cyprinidae: Leuciscinae), from the Čikola River in the Krka River system, Adriatic basin (Croatia). Nat. Croat., Vol. 9, No. 2., 67–81, 2000, Zagreb.

Phoxinellus dalmaticus, new species, is described from the Čikola River in the Krka River system in Croatia. It is distinguished from congeners by a suite of characters which includes a naked body with scales only in a relatively short, often interrupted, lateral line series (sq. l. 18–44) formed from both pored (l. l. 16–29) and unpored scales, a low number of vertebrae (37 or 38 total) with 21 vertebrae in the abdominal and 16 or 17 in the caudal region, a shallowly forked caudal fin with considerably rounded lobes and the lack of a foramen between the cleithrum and coracoid.

Key words: *Phoxinellus dalmaticus*, new species, Leuciscinae, Cyprinidae, systematics

Zupančič, P. & Bogutskaya, N. G.: Opis nove vrste, *Phoxinellus dalmaticus* (Cyprinidae: Leuciscinae), iz rijeke Čikole u slivu rijeke Krke, Jadranski bazen (Hrvatska). Nat. Croat., Vol. 9, No. 2., 67–81, 2000, Zagreb.

Nova vrsta *Phoxinellus dalmaticus* opisana je iz rijeke Čikole u slivu rijeke Krke u Hrvatskoj. Razlikuje se od srodnih vrsta nizom osobina koje uključuju golo tijelo s ljuskama samo u relativno kratkoj, često isprekidanoj lateralnoj seriji linija (sq. l. 18–44), koje čine ljuske s porama (l. l. 16–29) i bez njih, mali broj kralježaka (ukupno 37 ili 38) s 21 kralješkom u abdominalnom i 16 ili 17 u kaudalnom dijelu, plitko urezana repna peraja sa znatno zaobljenim režnjevima i nepostojanje otvora između kleitruma i korakoidne kosti.

Ključne riječi: *Phoxinellus dalmaticus*, nova vrsta, Leuciscinae, Cyprinidae, sistematika

INTRODUCTION

The taxonomy of small circum-Mediterranean leuciscins usually classified under the generic names *Phoxinellus*, *Paraphoxinus* and *Pseudophoxinus* is still unsettled. The main question is the limits and definition of *Phoxinellus* Heckel, 1843 (type-species *Phoxinellus alepidotus* Heckel, 1843; synonym *Paraphoxinus* Bleeker, 1863 – for details see TREWAVAS, 1971) and *Pseudophoxinus* Bleeker, 1860 (type-species *Phoxinellus zeregi* Heckel, 1843). About 8–14 species are commonly referred to the genus *Phoxinellus*. In most cases the species are poorly described and specific boundaries are in doubt.

Phoxinellus alepidotus was originally described by HECKEL (1843) who gave a short diagnosis that included the most characteristic feature, the absence of scales on most of the body. Later, HECKEL & KNER (1858) gave a detailed description and a drawing of a specimen (Fig. 121, p. 215). Unfortunately, neither HECKEL (1843) nor HECKEL & KNER (1858), presented the number of scales in the lateral line.

Other authors followed HECKEL & KNER (1858) identifying specimens with a naked body and the scales only in the lateral line as *Phoxinellus alepidotus.* VUKOVIĆ & IVANOVIĆ (1971), presented a drawing taken from HECKEL & KNER (1858) and a very short diagnosis and VUKOVIĆ (1977a) presented some morphometric characters and biological data including a drawing from HECKEL & KNER (1858).

KARAMAN (1972), considering *Ph. alepidotus* as the subspecies *Phoxinellus adspersus alepidotus*, examined 9 specimens from Glamočko polje, 8 specimens from Resanovci stream in the Struga basin at Knin (which actually belongs to SW Bosnia and not to Knin in Croatia) and 11 specimens from Livno and found 4–40 scales in the lateral line (interrupted, judging from Fig. 9 in the mentioned publication, representing a specimen from Livno). Later MARIĆ (1980, 1983) analyzed some morphometric and meristic characters of *Ph. alepidotus* from the Struga and Korana rivers by Bosansko Grahovo (SW Bosnia and Herzegovina) and finally ŠORIĆ (1992) studied osteological characters of *Phoxinellus*-like species from Dalmatia and Bosnia and Herzegovina.

A revision of *Ph. alepidotus* is not the goal of this paper but it is necessary to emphasize a point of confusion before comparing other taxa with this species. The type-locality for *Phoxinellus alepidotus* is the waters around Livno (HECKEL, 1843: 1040 – »aus den Gewassern um Livno in Bosnien«). However, the known syntypes include only two specimens labeled as from Livno: MHNN 1018 (1) Dalmatien: Livno; SMF 802 (1) Livno, while five others are from Sinj (Cetina River basin): NMW 51061 (3) Sign [Cettina, N.V. Split] 1843.II.20 (pt.) [Heckel]; NMW 51106 (2) Sign [N.S. Split; Cettina] 1843.II.20 (pt a) [Heckel-Reise, 1840]. According to KOTTELAT (1984), all type specimens of species described by Heckel deposited in MHNN possess labels personally handwritten by Heckel. The SMF specimen was most probably also sent there by Heckel as is evident from the date on the label. Thus, in total, there are 7 specimens known as syntypes at present, which corresponds well with the number of specimens given in the NMW aquisition book: »1843.II.pt: 1 Ex, Sign« and »1843.II.pt a: 6 Ex, Livno«. However, it is not clear why HECKEL (1843) did not include Sinj in the list of type localities for *Ph. alepidotus* and what is the

true locality for four other NMW syntypes. Until the question is better investigated, we use all of the specimens labeled as syntypes as a type-series for the name *Phoxinellus alepidotus*.

No reliable data exist in the literature on any *Phoxinellus or Paraphoxinus* species from the Čikola tributary of the Krka River in Croatia. MRAKOVČIĆ & MIŠETIĆ (1989) and MRAKOVČIĆ *et al*. (1995) reported *Phoxinellus pstrossii* (Steindachner, 1882) from the Krka river in Dalmatia but according to VUKOVIĆ & IVANOVIĆ (1971), VUKOVIĆ (1977 b) and MIKAVICA (1998) this species inhabits Eastern Herzegovina only. The range of *Ph. alepidotus* according to HECKEL & KNER (1858), GUNTHER (1868), STEINDACHNER (1882), KATURIĆ (1883), KOLOMBATOVIĆ (1886), SEELEY (1886), KIŠPATIĆ (1893), TRGOVČEVIĆ (1905), TALER (1953 a,b), SKET (1967), SABIONCELLO (1967), VUKOVIĆ & IVANOVIĆ (1971), KARAMAN (1972), VUKOVIĆ (1963, 1977 a, b, 1982), KAĆANSKI *et al*. (1978), POVŽ *et al.* (1990) is as follows: Bosnia and Herzegovina (Korana and Struga rivers, Glamočko and Livanjsko karst fields, Buško and Blidinje lakes, Duvanjsko karst field, Mostarsko blato and Cetina basin in Croatia as well as the Neretva river in both states. KARAMAN (1972) mentions the range Kninsko polje, which means the region around Knin in Croatia. No field observations have been carried out in this region to verify Karaman's record. Primož Zupančič (PZ) was the first to collect *Phoxinellus alepidotus*-like specimens here. A comparison with a wide range of material, including syntypes, of *Phoxinellus* species from many localities in Bosnia and Herzegovina and Croatia revealed that they belong to a new species described here as *Phoxinellus dalmaticus*.

MATERIAL AND METHODS

Collection acronyms: CNHM, Croatian Natural History Museum; MHNN, Musee d'Histoire Naturele de Neuchatel; NMW, Naturhistorisches Museum, Wien; PZC, personal collection of the first author; SMF, Senckenberg Museum, Frankfurt a. Main; ZISP, Zoological Institute, Russian Academy of Sciences, St. Petersburg; and ZMH, Zoologisches Museum und Institut Universitat Hamburg. C&S indicates specimens cleared and stained with alizarin red S.

Comparative material: syntypes of *Phoxinellus alepidotus* – NMW 51061 (3) Sign; NMW 51106 (2) Sign; SMF 802 (1) Livno; non-type material – NMW 51047 (3) Sign; NMW 51107 (3) Sign; NMW 51048 (3) Livno; NMW 51049 (4) Livno; NMW 51050 (4) Livno; NMW 51059 (6) Livno; NMW 51087 (20), 51097 (13), 51098 (7), 51102 (3), 51104 (10), 51105 (15, 1C&S) – all from Mostarsko blato; NMW 51112 (1) Narenta; ZISP 6855 (3) Dalmatia; ZISP 39490 (2) Livanjsko Polje; ZMH 15136 (5) Livno; PZC (6, 1 C&S) Glamočko Polje; PZC (1) Čikola. The syntypes of the following species were also examined: *Phoxinellus croaticus* Steindachner, 1896: NMW 51063 (5, Ottucha Fluss bei Grachacz), 51064 (9, Richicza Fluss bei Stikada), 51115–16 (3, Novchicza Fluss bei Gospic), 51167 (45, Licca bei Gospic), *Paraphoxinus epiroticus* Steindachner, 1896: NMW 12982–12990, 51123, 51133–34, 51146–49, 51152 (78, See v. Janina), *Paraphoxinus ghetaldii* Steindachner, 1882: NMW 51158–59, 51161–62, 51164–65 (11, Hohlen v. Popovo), *Paraphoxinus metohiensis* Steindachner, 1901: NMW 12972–75 (4,

Musica bei Smolski), 51171, 51173 (4, Ljutafluss bei Griuda), 51172, 51174–76 (10, Musica), 9368–72, 51088–094 (55, Zalomska Nevesinsko polje, "*Paraphoxinus affinis* Steindachner nomen mus."; *Paraphoxinus pstrosii* Steindachner, 1882: NMW 51177 (2, Trebinschitzafluss bei Trebinje); as well as specimens from the type-locality of *Leucos adspersus* Heckel, 1843: Imotski, NMW 51073 (6), 51075 (8), 51076 (6), 51079–81 (14), 51095 (16), and those of *Phoxinellus adspersus fontinalis* Karaman, 1972: Krbavsko Polje, PZC (2, Ribničko jezero; 3, Močilo source).

Most specimens were radiographed. The two last branched dorsal and anal fin rays were counted as one. Methods of counting vertebrae and sensory pores as well as terminology of vertebral regions and sub-regions follow those given in BOGUTSKAYA (1997).

Phoxinellus dalmaticus, new species

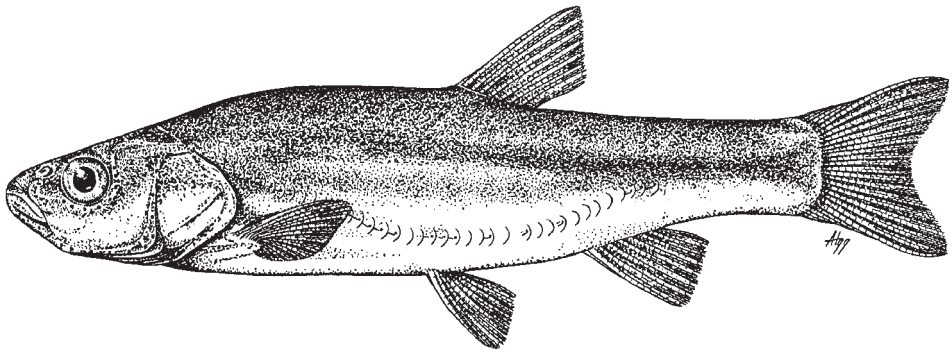

Fig. 1. *Phoxinellus dalmaticus,* holotype, CNHM No. 5387 female SL 58.3 mm, Čikola River at Kljake. Scale bar 2 mm. Drawn by A.M. Naseka.

Holotype: CNHM No. 5387 female, Čikola River at Kljake, Croatia; coll. P. Zupančič, 21.08.1998

Paratypes: PZC, 5, Čikola River at Kljake, Croatia; coll. P. Zupančič, 21.08.1998; PZC, 3 Vrba creek at Kljake, Croatia; coll. P. Zupančič 21.8.1998; PZC, 1, Čikola River at Kljake, Croatia; coll. P. Zupančič, 13.06.1999; PZC, 2, Čikola River at Ružič, Croatia; coll. P. Zupančič, 23.08.1996. One specimen (Standard length=SL 52.3 mm) is C&S and dissected.

Data for the holotype: SL 58.3 mm; D III 7, A III 7, l. l. 25 (interrupted, 9+7+ 3+1+1+1+3, terminating above the anal fin base), sp. br. 9, vert. 37, abd. vert. 21, caud. vert. 16, preD vert. 13.

Data for the paratypes: 11, SL 42.0–57.5 mm; D III 7, A III 7, l. l. 16–29 (often interrupted), sp. br. 9, 10, vert. 37, 38, abd. vert. 21, caud. vert. 16, 17, preD vert. 13, 14.

Diagnosis

Phoxinellus dalmaticus is clearly distinguished from the other species of the »*Phoxinellus alepidotus* group« in having a relatively short, often interrupted, lateral line series (sq.l. 18–36) which is formed from both pored (l. l. 16–29) and unpored scales, a low number of vertebrae (37 or 38 total) with 21 vertebrae in the abdominal and 16 or 17 in the caudal region, a shallowly forked caudal fin with considerably rounded lobes and the complete absence of a foramen between the cleithrum and coracoid.

Description. Morphometric data (for specimens 50 mm SL and larger) are given in Tab. 1. The body is elongated, slightly compressed. The head is relatively long, its length, 28–30% SL, considerably exceeds the maximum body depth, 22–24% SL. The eye is small, its diameter, 20–23% lc, is markedly less than the snout length, 27–29% lc. The snout is moderately stout, markedly rounded at the very tip. The mouth is terminal. The uppermost point of the mouth cleft is about level with the lower margin of the pupil. The lower jaw-quadrate junction is about level with the vertical through the anterior margin of the eye. The postorbital region is elongated,

Tab. 1. Morphometric data of *Phoxinellus dalmaticus* sp. n.

	Holotype	Paratypes				
SL (mm)	58.3	59.2	57.5	52.3	51.5	49.7
Percents of SL						
Head length	29.8	28.0	29.0	28.4	30.1	28.4
Maximum body depth	24.0	22.3	21.7	22.8	23.7	21.7
Minimum body depth	11.7	11.0	11.5	10.9	11.7	11.3
Predorsal distance	58.7	57.4	57.9	58.3	57.1	56.9
Postdorsal distance	35.7	32.1	32.3	31.7	32.8	33.2
Caudal peduncle length	19.6	16.0	18.4	19.1	16.3	18.7
Dorsal fin length	8.9	9.6	11.3	9.9	11.7	12.1
Dorsal fin depth	19.2	19.9	21.0	18.2	21.2	19.1
Anal fin length	10.3	11.8	10.8	8.8	10.1	9.7
Anal fin depth	13.4	14.0	16.9	15.5	16.3	14.1
Pectoral fin length	17.3	15.9	17.9	15.3	15.5	16.1
Pelvic fin length	14.1	13.3	14.6	13.8	13.7	13.7
P-V distance	26.1	26.5	27.1	27.3	27.2	23.1
V-A distance	19.6	19.4	17.7	19.1	18.6	18.7
Percents of head length						
Snout length	29.3	28.9	28.7	27.3	27.1	27.0
Eye diameter	20.1	21.1	22.8	21.3	19.9	19.9
Postorbital distance	52.3	54.2	53.1	54.7	52.9	53.8
Head depth at nape	59.8	66.3	64.7	62.0	67.9	63.8
Head width at nape	48.8	51.2	52.7	48.0	48.4	48.9
Interorbital distance	33.3	34.9	34.7	28.7	31.6	31.9
Lower jaw length	34.5	31.3	35.0	32.0	31.6	31.9
Operculum depth	31.6	31.3	32.9	32.0	31.0	31.9

Fig. 2. *Ph. dalmaticus*, PZC paratype, male SL 44,8 mm, Čikola River at Kljake 13.6.1999. Photo: P. Zupančič

its length being 52–55% lc. The head is shallow, its depth at nape being 60–66% lc, and the operculum depth 31–33% lc. Length of the lower jaw, 31–35% lc, is larger than or equal to the operculum depth.

The dorsal fin has 3 simple and 7 branched rays. Its outer margin is slightly to markedly convex. The dorsal fin origin is slightly behind the vertical through the posterior end of the pelvic fin base. The anal fin has 3 simple and 7 branched rays. Its outer margin is slightly convex or almost straight. The anal fin origin is markedly behind the vertical through the posterior end of the dorsal fin base. The caudal fin is shallowly forked, with its lobes markedly rounded.

Number of gill rakers 9 (9) or 10 (3) in total on the outer side of the first left gill arch. Pharyngeal teeth 5–4, hooked, smooth (unserrated).

The entire body is scaleless except for the lateral series and, in some specimens, 1 to 3 scales above the very beginning of the latter. The lateral series includes pored (the lateral line scales) and unpored scales, which are present mostly in the posterior section of the lateral series. The lateral series terminates from above the pelvic fin base to almost the end of the caudal peduncle, being interrupted in the posterior half. The number of lateral line scales is 16 to 29, and the number of scales in the entire lateral series is 18–38(44). The scales are quite large, overlapping along the anterior section or the major part of the lateral series. The number of scales in front of the vertical through the end of the pectoral fin is 12 to 14(15). The scales are poorly ossified (except for the walls of the sensory canal which is the only

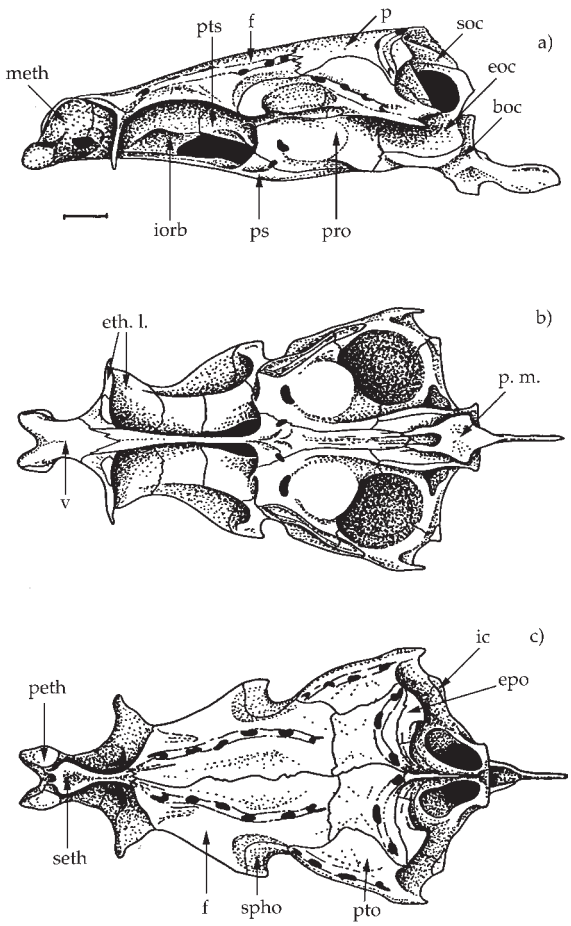

Fig. 3. Neurocranium of *Ph. dalmaticus*, PZC, Čikola River at Kljake, paratype SL 52.3 mm, lateral (a), ventral (b) and dorsal (c) views. Scale bar 1 mm.boc – basioccipital, eoc – exoccipital, epo – epiotic, eth.l. – lateral ethmoid, f – frontal, ic – intercalar, iorb – interorbital septum of orbitosphenoid, meth – mesethmoid, orbs – orbitosphenoid, p – parietal, p. m. – masticatory plate of pharyngeal process, peth – preethmoid, pro – prootic, ps – parasphenoid, pto – pterotic, pts – pterosphenoid, seth – supraethmoid, soc – supraoccipital; spho – sphenotic, v – vomer.

structure being stained with alizarin red S), and most of them are completely embedded in the skin.

The supraorbital canal (CSO) is interrupted between the nasal (3 pores) and frontal (5 or 6 pores) or, in three specimens, complete with 8 or 9 pores. The parietal supraorbital canal segment is missing in all specimens. The infraorbital canal (CIO) is complete in only one specimen; in the others, it is interrupted in one (between the last infraorbital and the pterotic) or two or three (between infraorbitals

and the last infraorbital and the pterotic) places. There are 14–17(19) CIO pores with 4(5) openings on the 1st infraorbital. The preopercular-mandibular canal (CPM) does not communicate with CIO, terminating just above the upper margin of the opercular antedorsal process or, in 5 canals, at the upper end of the preoperculum. CPM is interrupted between the anguloarticular and preoperculum (19 canals), between the dentary and preoperculum (2 canals) or does not have an interruption (3 canals). In most canals, there are 5 pores on the lower jaw (in the first fragment of the canal) with 4 openings on the dentary. The supraorbital canal (CST) is narrowly interrupted in the middle, 3+3 or 4+4 pores.

Total number of vertebrae 37 (8 specimens) or 38 (4). Number of abdominal vertebrae 21. Predorsal vertebrae 13 (8) or 14 (4). Intermediate vertebrae 4. Number of caudal vertebrae 16 (8) or 17 (4). Vertebral formulae 21+16 (8) or 21+17 (4).

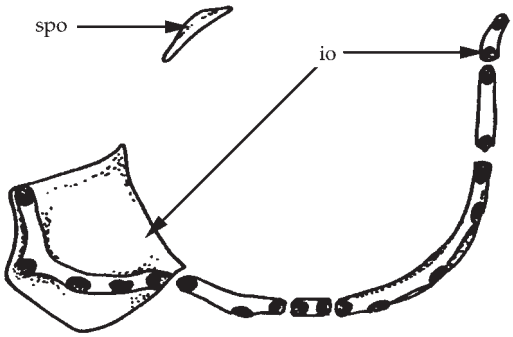

Fig. 4. Circum-orbitals of *Ph. dalmaticus* (the same specimen). Scale bar 1 mm.
io – infraorbitals, spo – supraorbital.

The neurocranium (Fig. 3) is moderately narrow and shallow in the sphenoid and occipital regions. Neurocranium measurements (% L. bas. n.) in one dissected specimen are as follows: H eth 13%, H soc 30%, Lt eth 30%, Lt spho 45% and Lt pto 52%. In undissected specimens, maximum depth (Lt pto) is 65–73% L cr. r., width of the supraethmoid 12–16% Lt pto.

The preethmoid is mostly ossified. The supraethmoid is relatively small, considerably elongated and dorsally concave, very narrow in its posterior part. The vomer is relatively long, with a pointed posterior end. The orbital region is markedly depressed but the interorbital septum is well pronounced though shallow. The pterosphenoid bears an extensive postero-lateral process that contacts the anterior margin of the same bone markedly above the upper border of the parasphenoid ascending process. The paired pterosphenoids do not contact each other being widely separated, and the entire anterior margin of the orbital-hypophyseal foramen is formed by the orbitosphenoid. The dilatator fossa is small and shallow, lacking any roof from either frontal or pterotic. The pharyngeal process is quite delicate, with a small masticatory plate bearing narrow lateral extensions.

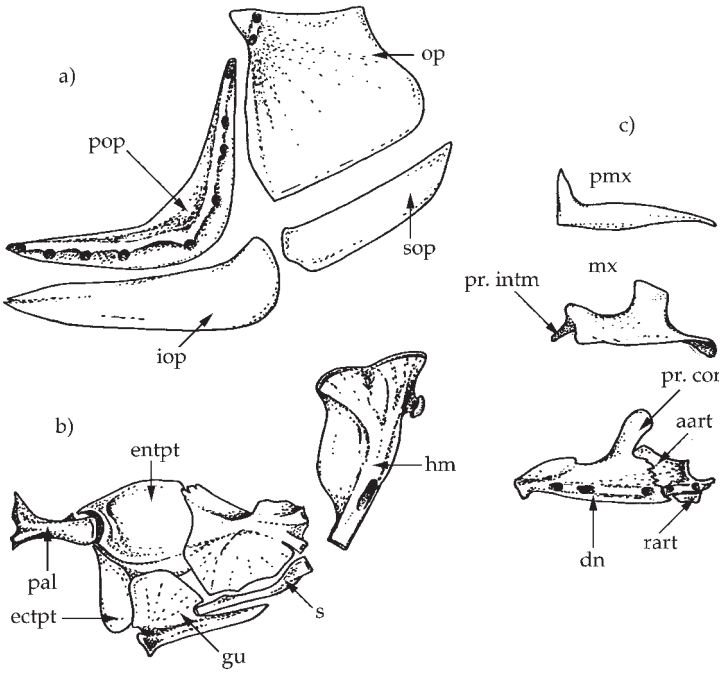

Fig. 5. Opercular bones (a), palato-quadrate complex and hyomandibular (b) and jaws (c) of *Ph. dalmaticus* (the same specimen). Scale bar 1 mm. aart – anguloarticular, dn – dentary; ectpt – ectopterygoid, entpt – entopterygoid, hm – hyomandibular, iop – interoperculum, mtpt – metapterygoid, mx – maxilla, op – operculum,pal-palatine, pmx – premaxilla, pop – preoperculum, pr.intm.-intermaxillary process of maxilla, pr. cor. – coronoid process, qu – quadrate, s – symplectic, sop – suboperculum, rart – retroarticular.

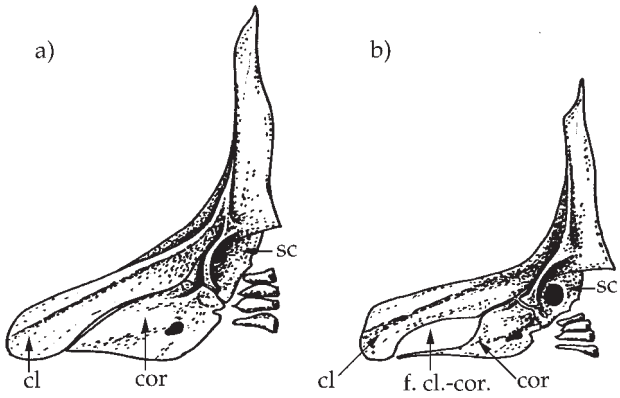

Fig. 6. Pectoral girdle of *Ph. dalmaticus* (the same specimen) (a) and *Ph. alepidotus*, SL 52.1 mm, Glamočko Polje. cl – cleithrum, cor – coracoid, f. cl.-cor. – foramen between the cleithrum and coracoid, sc – scapula,

The infraorbitals (Fig. 4) except for the first one are poorly ossified and narrow, their lamellate parts being considerably or completely reduced. The 2nd or 3rd infraorbital is often fragmented and the total number of infraorbitals is 6, rarely 7. The last infraorbital and pterotic are always widely disconnected. The supraorbital is minute.

Opercular bones, palato-quadrate complex and bones of the jaws are shown in Fig. 5. The most distinguishing features are as follows: the operculum with a long horizontal branch which is clearly longer than the ascending branch; the symplectic is narrow and long accordingly, with a relatively long lower margin of the metapterygoid; the ectopterygoid is relatively extensive, well ossified; all jaw bones elongated, especially the maxillary, which possesses an anteriorly attenuated intermaxillary, and the anterior part of the dentary.

The postcleithrum is often absent or, rarely, present but extremely minute. The most peculiar character of the species is the lack of a foramen between the cleithrum and coracoid (Fig. 6a), or a foramen that is quite small (found in two specimens). This is the only example of such a structure of the pectoral girdle among the leuciscins examined.

Coloration. Live specimens dorsally greenish grey, sides brownish and spotted with small black dots spread above the lateral line. The belly yellowish. The base of pectoral, ventral and anal fins slightly reddish; otherwise all the fins colorless. Alcohol/preserved specimens have a dark blackish back and head and creamy belly.

Biology and habitat. The specimens described are only caught in places with slow and stagnant waters. They are sympatric with endemic *Leuciscus turskyi* (HECKEL, 1843), *Aulopyge huegelii* HECKEL, 1842 and the introduced *Gambusia affinis* (BAIRD & GIRARD, 1853). The only specimen, a ripe male SL 44.8, caught during the spawning season (June), has well-developed conical nuptial tubercles which are almost equal in size, being relatively large and located along the margin ray of the pectoral fin, along the two longest anal fin rays, on most scales both pored and unpored (one pair on a scale); on the head, rare tubercles are only located on the operculum.

Size. The maximum recorded size is 59.2 mm SL.

Distribution: Found only in the upper reaches of the Čikola River and the Vrba creek in the Krka river basin, Dalmatia, Croatia. Probably endemic to the Čikola River basin.

Etymology. Named for Dalmatia, the region in southern Croatia.

Comparative remarks and discussion

Phoxinellus dalmaticus is clearly distinct from all the other species of the genus by the lack of a foramen between the cleithrum and the coracoid. It may be assigned to the »*Ph. alepidotus* group« being characterized by the same apomorphies: a lack of scales outside the lateral line and an absence (rarely extreme reduction in size) of the postcleithrum.

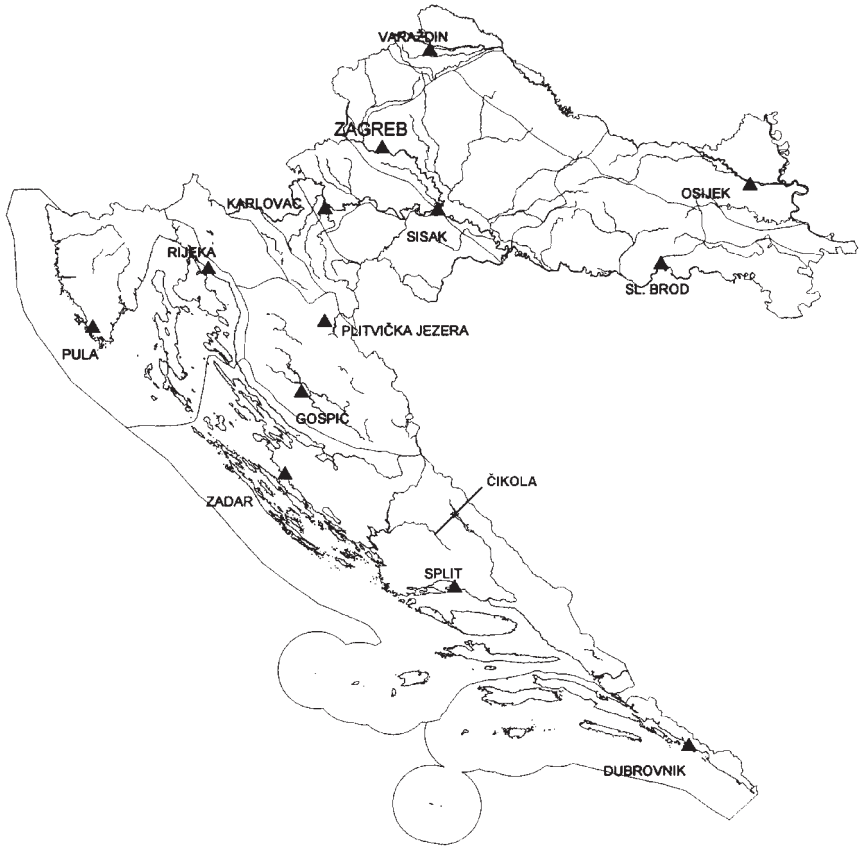

Fig 7. Map of Croatia with the position of the Čikola River.

A short comment must be made here to clarify the taxonomic situation with respect to the so-called »*Phoxinelus alepidotus*« from different localities. A preliminary study undertaken by the authors of this paper has already revealed that *Ph. alepidotus* auctorum (the only characteristic feature usually used for its identification is a lack of scales except for the lateral line) is most probably presented by a complex of forms, probably distinct species, which include at least two besides *Ph. dalmaticus*.

The syntypes of *Ph. alepidotus* were examined (NMW 51061, 51106 and SMF 802). They are characterized by the following diagnostic features: 7 branched rays in both the dorsal and anal fin, the head is relatively short (its length about 25% SL), the eye is small, the snout is moderately rounded, the body is scaleless except for the lateral line which has 28–40 pored scales (the scales normally overlap each other) and terminates above the anal fin base or in front of it, CSO and CIO are complete (without interruptions), and CPM, which does not communicate with CIO, is always interrupted between the anguloarticular and preoperculum.

Fig 8. The Čikola at Kljake – type locality of *Phoxinellus dalmaticus*. Photo: P. Zupančič

The following specimens are also identified as *Ph. alepidotus* since they possess the above mentioned character states: NMW 51047 (3) Sign; NMW 51107 (3) Sign; NMW 51048 (3) Livno; NMW 51049 (4) Livno; NMW 51050 (4) Livno; NMW 51059 (5 specimens from 6) Livno; ZISP 6855 (2 specimens from 3) Dalmatia; ZISP 39490 (2) Livanjsko Polje; ZMH 15136 (5) Livno; PZC (7) Glamočko Polje. They are characterized by 20–39 scales in the lateral line (only one specimen from ZISP 39490, Livno, has 42 scales on the left side and 45 on the right side of the body). The lateral line is usually interrupted in its posterior section and terminates in the area above the ventral fin base, sometimes above the anal fin base. All the scales contain the canal (sq.l.=l.l.). There are 12 to 14 scales in front of the vertical through the end of the pectoral fin.

It should be mentioned that the canals on the scales and the head attain their definitive developmental state in specimens of about 48–50 mm SL, so only the specimens from 49–50 mm SL are taken into consideration as to the structure of the lateral line and cephalic canals.

Besides these specimens, there were found among the museum collections specimens earlier identified as *Ph. alepidotus*, but characterized by a much longer lateral line and more numerous scales. They are: NMW 51087 (20), 51097 (13), 51098 (7), 51102 (3), 51104 (10), 51105 (16) – all from Mostarsko blato; NMW 51112 (1) Narenta; NMW 51059 (1 from 6) Livno; ZISP 6855 (1 from 3) Dalmatia; PZC (1) Čikola. They are characterized by 53–77 scales in the lateral line (only one specimen from NMW 51105, Mostarsko blato, has 40 scales on the left side and 47 on the right side of the body). The lateral line, which is usually slightly interrupted in its posterior section, commonly terminates posterior to the end of the anal fin base, often almost at the very end of the caudal peduncle. All the scales contain the canal (sq.l.=l.l.). There are 15 to 17 scales in front of the vertical through the end of the pectoral fin.

Judging from these data, there are two forms within the »*Ph. alepidotus* group«, the first being characterized by a low number of lateral line scales, 20–39 (*Ph. alepidotus)*, and the second by a high number of scales, 53–77 (probably a new species). However, there are rare specimens as seen from the above data with an intermediate number of scales, 40–47.

Both forms have the foramen between the cleithrum and coracoid well-developed and relatively large (Fig. 5b). They also have a similar sensory canal structure and very close vertebral counts. In *Ph. alepidotus* with l.l. 20–39 (n=22;) we found: total number of vertebrae 39 (15 specimens) or 40 (7); number of abdominal vertebrae 22 (10) or 23 (12); predorsal vertebrae 14 (11) or 15 (11); intermediate vertebrae 4 (13) or 5 (9); number of caudal vertebrae 16 (6), 17 (15) or 18 (1); vertebral formulae 22+17 (9), 23+16 (6), 23+17 (6) or 22+18 (1). In 13 specimens with l.l. 53–77 we found: total number of vertebrae 38 (3), 39 (7) or 40 (3); number of abdominal vertebrae 22 (9) or 23 (4); predorsal vertebrae 13 (2), 14 (7) or 15 (4); intermediate vertebrae 4 (8) or 5 (5); number of caudal vertebrae 16 (5), 17 (7) or 18 (1); vertebral formulae 22+16 (3), 22+17 (5), 23+16 (2), 23+17 (2) or 22+18 (1). Other osteological characters have not yet been studied.

Phoxinellus dalmaticus is clearly distinguished from both forms of the »*Ph. alepidotus* group« in having an often interrupted lateral line series which is commonly relatively short, with 18–38 scales (it is formed from both pored, l. l. 16–29, and unpored scales) and a common presence of rare scales above the lateral line just behind the head. The new species also differs by the low number of vertebrae (37 or 38 total with 21 vertebrae in the abdominal region and commonly 13 predorsal vertebrae *vs.* 39 or 40, 22 or 23, and 14 or 15, respectively, in *Ph. alepidotus*), and a shallowly forked caudal fin with considerably rounded lobes.

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REFERENCES

BOGUTSKAYA, N. G., 1997: *Chondrostoma beysehirense*, a new cyprinid fish from Beysehir Lake, Central Turkey. – Ichthyol. Explor. Freshwaters, Vol. **8**, No. 2, 151–158.

GUNTHER, A., 1859–1870: A catalogue of the fishes in the British Museum. London 8 vols.

HECKEL, J., 1843: Ichthyologie. – In: RUSSEGGER, J. VON: Reisen in Europe, Asien und Africa, mit besonderer Rucksicht auf die naturwissenschaftlichen Verhaltnisse der betreffenden Landerunternommen in den Jahren 1835 bis 1841. 1. Band. Reise in Greichenland, Unteregypten, ... etc. Schweizerbart, Stuttgart, 991–1099.

HECKEL, J. & R. KNER, 1858: Die Süsswasserfische der Österreichischen Monarchie mit Rucksicht auf der angrenzen Lander – 388 S. – Leipzig (W. Engelmann).

KAĆANSKI, D., L. JERKOVIĆ, D. HAFNER & M. AGANOVIĆ, 1978: O ishrani nekih vrsta riba iz Buškog Blata – On nutrition of some fish species in the Buško Blato inundation area. – Ichthyologia Vol. **10**, NO.1, 67–75.

KARAMAN, M. S., 1972: Süsswasserfische der Turkei. 9 Teil. Revision einiger kleinwuchsiger Cyprinidengattungen *Phoxinellus, Leucaspius, Acanthobrama* usw aus Südeuropa, Kleinasien, Vorder-Asien und Nordafrica. – Mitt. hamb. Zool. Mus. Inst., **69**, 115–155.

KATURIĆ, M., 1883: Notizie Zoologiche. – Estratto dal Bollettino della Societa Adriatica di scienze naturali in Trieste,Vol. VIII, fasc.1, 1–9.

KIŠPATIĆ, M., 1893: Ribe Zagreb. Tisak Karla Albrechta, 1–455.

KOLOMBATOVIĆ, J., 1886: Imenik kralješnjaka Dalmacije II Dio: Dvoživci, Gmazovi i Ribe. – Godišnje izvješće c. k. velike realke. Split, 1–32.

KOTTELAT, M., 1984: Catalogue des types du Musee d'Histoire Naturelle de Neuchatel. I. Pisces. – Bull. Soc. Neuchatel. Sci. Nat. 107, 143–153.

KOTTELAT, M., 1997: European freshwater fishes. An heuristic checklist of the freshwater fishes of Europe (exclusive of former USSR), with an introduction for non-systematists and comments on nomenclature and conservation.- Biologia Vol. **52** / Suppl. 5, 1–271.

MARIĆ, D., 1980: Prilog poznavanju rasprostranjenja *Paraphoxinus alepidotus* (Heckel, 1843) u vodama Jugoslavije – The contribution to the knowledge of *Paraphoxinus alepidotus* (Heckel, 1843) in waters of Yugoslavia. – Glas. Republ. Zavoda Zašt. Prirode-Prirodnjačkog Muzeja Titograd, **13**, 101–105.

MARIĆ, D., 1983: Morfološke karakteristike *Phoxinellus alepidotus* (Heckel, 1843) (Cyprinidae) iz ponornice Korane kod Bosanskog Grahova (Jugoslavija). – Glas. Republ. Zavoda Zašt. Prirode-Prirodnjačkog Muzeja Titograd, **16**, 65–73.

MIKAVICA, D., 1998: The specific freshwater ichthyofauna, of the hidrographic region of Bosnia and Herzegovina. – Ichthyologia, Vol **30**, No. 1, 31–38.

MRAKOVČIĆ, M. & S. MIŠETIĆ, 1989: Značaj i karakteristike ihtiofaune rijeke Krke. – In: KEROVEC, M. (ed.): Zbornik radova – Simpozij Problemi zaštite Nacionalnog parka Krka, Šibenik, 271–282.

MRAKOVČIĆ, M., MIŠETIĆ, S. & M. POVŽ, 1995: Status of freshwater fish in Croatian Adriatic river systems.- In: DUFFEY, E. (editor in chief): Endemic Freshwater fishes of the Northern Mediterranean region. – Biological Conservation Vol. **72,** No. 2 , 179–185.

POVŽ, M., LEINER, S., MRAKOVČIĆ, M. & J. POPOVIĆ, 1990: Rare and endangered fishes from Yugoslavian Adriatic rivers. – Journal of Fish Biology **37** (Supplement A), 247–249

SABIONCELLO, I., 1967: Sistematika slatkovodnih riba.- In: LIVOJEVIĆ, Z. & C. BOJČIĆ (eds.): Priručnik za slatkovodno ribarstvo. Posebna izdanja »Agronomskog glasnika«, 21–90.

SEELEY, H. G., 1886: The freshwater fishes of Europe. Cassell & Company Limited, London, 1–444.

SKET, B., 1967: Ključi za določevanje živali I. Sladkovodne ribe. Pisces. Inštitut za biologijo Univerze v Ljubljani. Ljubljana, 1–89.

STEINDACHNER, F., 1882: Beitrage zur Kenntniss der Fische Afrikas (II.) und Beschreibung einer neuen *Paraphoxinus*. – Art aus der Herzegowina.- Denkschr. Akad. Wiss. Wien, Math.-Naturwiss. Cl., 45, 1–18. Pls. 1–6.

ŠORIĆ, V., 1992: Osteological characteristics in six species of the genus *Phoxinellus* Heck., 1843. – Ichthyologia Vol. **24**, No. 1, 43–56.

TALER, Z., 1953a: Znamenite i osobite ribe u Bosni i Hecegovini. – Ribarski list (4) XXVIII, Sarajevo, 56–57.

TALER, Z., 1953b: Rasprostranjenje i popis slatkovodnih riba Jugoslavije. – Glasnik Prirod. muz. Srpske zem., Ser. B, knj. 5–6, Beograd, 423–455.

TREWAVAS, E., 1971: The type-species of the genera *Phoxinellus*, *Pseudophoxinus* and *Paraphoxinus* (Pisces, Cyprinidae). – Bull. Brit. Mus. Nat. Hist., Zool. **21**, 359–361.

TRGOVČEVIĆ, L., 1905: *Paraphoxinus* Blkr. i *Telestes* Bonap. u vodama Like i Krbave.- Nastavni vjesnik,XIV, Zagreb, 1–23.

VUKOVIĆ, T., 1963: Ribe Bosne i Herzegovine (Ključ za određivanje). Zavod za izdavanje udžbenika, Sarajevo, 1–127.

VUKOVIĆ, T., 1977a: *Paraphoxinus alepidotus* (Heckel, 1843) Novi podaci o rasprostranjenju u vodama Jugoslavije.- Ribarstvo Jugoslavije (1) XXXII, 3–4.

VUKOVIĆ, T., 1977b: Ribe Bosne i Herzegovine – Svjetlost, Sarajevo, 1–205.

VUKOVIĆ, T., 1982: Sistematika riba.- In: BOJČIĆ, C. *et al.*: Slatkovodno Ribarstvo, Poslovna zajednica slatkovodnog ribarstva Jugoslavije Ribozajednica, Zagreb, Jugoslavenska medicinska naklada, Zagreb, 99–168.

VUKOVIĆ, T. & B. IVANOVIĆ, 1971: Slatkovodne ribe Jugoslavije. Zemaljski muzej BiH, Sarajevo, 1–268.