

1-1-2007

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KÜÇÜK, FAHRETTİN (2007) "Pseudophoxinus alii (Teleostei: Cyprinidae), a New Fish Species from the Antalya Region, Turkey," *Turkish Journal of Zoology*: Vol. 31: No. 2, Article 1. Available at: <https://journals.tubitak.gov.tr/zoology/vol31/iss2/1>

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***Pseudophoxinus alii* (Teleostei: Cyprinidae), a New Fish Species from the Antalya Region, Turkey**

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Received: 29.03.2006

Abstract: *Pseudophoxinus alii* is a new species described from 3 water bodies (Aksu River, and Ilica and Kömürcüler streams) in the Antalya region, Turkey. This new species is distinguished from other large-scaled species of *Pseudophoxinus* in having 41-44 scales in lateral series, commonly 14 predorsal vertebrae, and large eye diameter (26%-32% HL).

Key Words: Taxonomy, Cyprinidae, Leuciscinae, Antalya region, Turkey

Türkiye'nin Antalya Havzası'ndan Yeni Bir Balık Türü, *Pseudophoxinus alii*

Özet: *Pseudophoxinus alii*, Türkiye'nin Antalya bölgesindeki Aksu Çayı ile Ilica ve Kömürcüler derelerinden tanımlandı. *Pseudophoxinus*'un bu yeni türü Anadolu'nun büyük pullu diğer türlerinden yanal sıradaki pul sayısı (41-44), daha fazla predorsal omur sayısı (çoğunlukla 14) ve göz çapının büyüklüğü (baş boyunun % 26-32'si) ile açık olarak farklılaşmıştır.

Anahtar Sözcükler: Taksonomi, Cyprinidae, Leuciscinae, Antalya Havzası, Türkiye

Introduction

The accumulation of knowledge about the Cyprinids of Asia Minor has been rather slow (Hanko, 1924; Pellegrin, 1928; Pietschmann, 1933; Battalgil, 1942, 1944). Material collected by C. Kosswig, F. Battalgazi (Battalgil) and W. Villwock between 1940 and 1967 has contributed greatly to this knowledge. Detailed studies by Ladiges (1960) and Karaman (1972) based on these collections published earlier contributed to our understanding of Cyprinids from Anatolia. Bogutskaya (1992, 1997a) described 10 *Pseudophoxinus* species from Anatolia based on the museum collections across Europe. In her studies, beside traditional morphological characters, Bogutskaya hypothesized on the phylogenetic relationships of Anatolian *Pseudophoxinus* species based on characters of the sensory canal system and cranial bones. These studies concluded that the Anatolian *Pseudophoxinus* species exhibit a large variability of the cephalic sensory canal structure and configuration of the

pharyngeal process. According to these studies, *Pseudophoxinus* species in Anatolia, except *P. fahirae*, may be grouped in 3 lineages. *P. fahirae* living near Tefenni-Burdur region is different from the other Anatolian species in having the preoperculo-mandibular canal (CPM) and infraorbital canal (CIO) interconnected. One of these 3 lineages includes *P. meandri* and *P. egridiri*, which share, in particular, a reduced type of cephalic sensory canal system and a reduced number of vertebrae. Three new species belonging to this group have been recently described (Bogutskaya et al., 2007): *P. elizavetae*, *P. zekayi*, and *P. firati*.

The second lineage is represented by *P. meandricus* and *P. antalyae*, both of which are characterized by a less reduced sensory canal system. Finally, the third lineage includes *P. handlirschi*, *P. anatolicus*, and *P. crassus*, which share such synapomorphies as small scales, high number of vertebrae, and increased number of sensory canal pores (Bogutskaya, 1992). The genus

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Pseudophoxinus is found in a wide range of habitats and often co-occurs with *Aphanius*. Based on molecular data, *Pseudophoxinus* in central Anatolia forms 4 large clades. These clades are reported as clade I, *P. cf. anatolicus* (Sultansazlığı, Develi); clade III, *P. anatolicus* (Tuzgözü basin); clade IV, *P. meandri* (Lakes district); and clade VI, *P. fahirae* (southwest Beydağları region). *P. antalyae* inhabits the Alanya region and forms a sister group to clades IV and VI (Hrbek et al., 2004).

The fish described herein as a new species was not reported in the Antalya region or in the Manavgat drainage in earlier publications (Ladiges, 1960; Balık, 1988; Küçük and İkiz, 1993, 2004; Bogutskaya et al., 2000) but was reported once as *Rutilus tricolor* from Ilıca Stream by Küçük (1997). It is described here as a new species, *P. alii*.

Materials and Methods

Specimens were collected from the Ilıca Stream with a portable electroshocker in May 1996 and April 2005, and from Aksu River in June 1995 and April 2005. Samples were preserved in 4% formaldehyde (v/v) and transported to the Fish Biology Laboratory at Eğirdir Fisheries Faculty for systematic analyses. Metric measurements were obtained with 0.01 mm sensitive calipers. The lateral line scale counts include the scales on the base of the caudal fin. A stereo drawing microscope was used for the pore counts and for the examination of the structure of the sensory canals. The number of vertebrae and fin rays of specimens was established using X-rays. The last 2 branched dorsal and anal fins are counted as “1^{1/2}” (Kottelat and Barbieri, 2004). The vertebrae counts include the 4 Weberian vertebrae and the hypural complex. Additional observations on elements such as the pharyngeal plates and highly diagnostic skull elements were performed under the microscope after dissection and immersion in a 3% KOH solution. The terminology used when dealing with the skull morphology, sensory canal system, vertebrae, and pore counts was according to Bogutskaya (1990, 1994, 1997b) and Naseka (1996). Comparative materials examined in this study were from SCFK-SDU (private collection of the author, Eğirdir Fisheries Faculty, Süleyman Demirel University) and ESFM-PISI (Inland-water Fish Collections of the Faculty of Fisheries, Ege University).

Abbreviations used: CIO infraorbital canal; CPM preoperculomandibular canal; CSO supraorbital canal; CST supratemporal canal.

Comparative material: *Acanthorutilus handlirschi*, 3 specimens in ESFM-PISI / 1950-006 December 25 1950, Eğirdir Lake; *P. fahirae*, 8 specimens in SCFK-SDU / 158 Karamusa village Tefenni, Burdur; *P. antalyae*, 5 specimens in SCFK-SDU / 159 Düden canal, Antalya; *P. anatolicus*, 4 specimens in SCFK-SDU / 160 Suğla Lake, Seydişehir; *P. battalgili*, 18 specimens in SCFK-SDU / 161 Oymapınar Dam Lake, Manavgat; *P. crassus*, 4 specimens in SCFK-SDU / 162 Sultanhanı, Aksaray; *Pseudophoxinus* sp., 24 specimens in SCFK-SDU / 163 Bağlıllı village, Eğirdir; *P. egridiri*, 13 specimens in SCFK-SDU / 164 Eğirdir Lake, Karaot; *P. meandri*, 7 specimens in SCFK-SDU / 165 Salda Lake, Burdur; *P. meandri*, 17 specimens in SCFK-SDU / 166 Düğer village, Burdur; *P. cf. meandri*, 4 specimens in SCFK-SDU / 167 Kırkpınar Spring, Korkuteli; *P. cf. meandricus*, 13 specimens in SCFK-SDU / 168 Tatlısuyu Kanalı, Ereğli; *P. elizavetae*, 6 specimens in SCFK-SDU / 174b Sultansazlığı, Kayseri; *P. firati*, 8 specimens in SCFK-SDU / 176,187a Yazıyurdu, Sivas; *P. zekayi*, 7 specimens in SCFK-SDU / 181a Çoçelli village, Pazarcık, Kahramanmaraş.

Pseudophoxinus alii, new species (Figure 1).

Rutilus tricolor Küçük, 1997; Ilıca Stream Manavgat, Antalya, Turkey

Holotype: (ESFM-PISI/2005-015) 66.32 mm SL, Ilıca Stream Manavgat, Antalya, Turkey, F. Küçük, May 1996.

Paratypes: SCFK-SDU/169(13), 53.33-98.48 mm SL, Ilıca Stream Manavgat, Antalya, Turkey, F. Küçük, May 1996.

Diagnosis

P. alii are distinguished from all other large-scaled species of *Pseudophoxinus* in Anatolian by the following combination: lateral line incomplete; 38-41 perforated scales; 41-44 scales in lateral series; commonly 9 (rarely 8) scales between anus and anal-fin origin, 17-19 circumpeduncular scales, dorsal fin with 3-4 simple and 7^{1/2} branched rays, anal fin with 3 simple 7-8^{1/2} branched rays; mouth terminal or slightly subterminal, snout rounded, eye large, its diameter 26%-32% HL, head



Figure 1. *Pseudophoxinus alii*, paratypes, SCFK-SDU/169; female 53.0 mm SL, male 69.55 mm SL. Ilica stream, Manavgat, Antalya, Turkey (a: female, b: male).

depth at nape 69%-89% HL; predorsal vertebrae 13-15, commonly 14, comprising 59%-63% of abdominal vertebrae count, pelvic fins origin in front of the dorsal fin origin. Sexual dimorphism is pronounced; spawning males are generally darker and possess nuptial tubercles on dorsal and lateral surface of the head and along rays of the pectoral fin.

Description

Morphometric data of the described species are given in Table 1. The body is compressed; the mouth is terminal or slightly subterminal, top of the mouth is on the level of the lower margin of the pupil (Figures 1 and 3). Snout is rounded. Body profile is convex between the head and the beginning of the dorsal fin. Predorsal distance is 53%-58% SL; postorbital length is 44%-53% HL (1.4-2.0 times of eye diameter); head length is 25%-28% SL (3.1-3.7 times of eye diameter); head depth at nape is 69%-89% HL (1.4-1.5 times of head width at nape). Caudal fin is deeply forked. The origin of the pelvic fins is always in front of dorsal fin origin. Dorsal fin with 3-4 simple and $7^{1/2}$ branched rays and its depth 3.96-4.89 times in the SL. Posterior margin of the dorsal fin is straight and near the center of the anal fin. Anal fin with 3 simple and (7) $8^{1/2}$ branched rays, posterior margin is straight. Gill rakers short, 8-11 on the first branchial arch. Pharyngeal teeth 5-5, markedly hooked and

smooth. Scales are regularly arranged and large, the anterior part of them is straight and the posterior part is rounded. Some of the posterior radii reach the focus. Anterior radii are extremely few and some of them reach the focus. There are 16-19 pores in CIO (interruption in infraorbital part is found in one specimen). CPM has 17-18 pores and does not communicate with CIO. CSO is complete and has 11-12 pores. There are 8-10 pores in CST.

Total vertebrae are 37(1), 38(7), 39(5), abdominal vertebrae 21(4), 22(7), 23(1), predorsal vertebrae 13(8), 14(3), 15(1), intermediate vertebrae 2-3, caudal vertebrae 16(7), 17(5). Vertebral formula is 21+16(1), 22+16(4), 22+17(3), 23+16(1); abdominal vertebrae 56%-58% of total vertebrae.

Coloration: The natural color of specimens is greenish brown at the dorsal side, and dark silvery at the ventral. There is a considerable band originating from behind the eye and continuing to the base of the caudal fin. This band is more considerable in the males. All fins are pale. Sexual dimorphism is pronounced; spawning males are generally darker and possess nuptial tubercles on the dorsal and lateral surface of the head and along the rays of the pectoral fin (Figure 1b).

Distribution and habitat: Ilica and Kömürçüler streams are fed with surface water, located 5-6 km west

Table 1. Morphometric data of holotype (ESFM-PISI/2005–015) and 13 paratypes (SCFK-SDU/169) of Ilica Stream.

	Holotype	Paratypes			
		Min.	Max.	Mean	SD
Standard length (mm)	63.3	53.3	98.5		
Percents of SL					
Head length	25.8	25.0	28.1	26.8	0.98
Body depth at dorsal fin origin	27.5	25.6	29.6	27.5	1.31
Predorsal distance	55.1	53.2	57.5	55.9	1.39
Prepectoral distance	26.5	23.1	27.9	26.3	1.30
Prepelvic distance	50.8	48.0	54.4	51.2	1.63
Preanal distance	69.2	66.0	72.7	70.2	1.84
Pectoral–pelvic-fin origin distance	26.4	23.6	28.5	25.8	1.46
Pelvic–anal-fin origin distance	19.4	18.3	22.5	20.0	1.16
Caudal peduncle depth	12.7	11.8	14.0	12.6	0.66
Caudal peduncle length	20.3	16.7	20.3	19.2	0.89
Dorsal fin depth	23.2	20.5	25.3	22.9	1.18
Dorsal fin base length	13.8	11.9	15.9	13.9	1.07
Anal fin depth	17.2	15.6	21.0	18.3	1.49
Anal fin base length	12.7	11.1	14.7	13.4	0.88
Pectoral fin length	19.7	19.3	22.8	20.5	1.12
Pelvic fin length	16.5	16.0	19.4	17.7	1.01
Percents of HL					
Eye diameter	28.7	25.8	31.9	28.5	2.03
Postorbital distance	50.5	43.5	52.6	49.0	2.56
Interorbital distance	39.7	32.8	42.8	37.2	2.70
Snout width at nostril	19.8	19.4	22.4	20.8	1.07
Head depth at nape	74.1	69.1	88.8	74.4	5.01
Head width at nape	50.2	48.7	53.7	51.3	1.66
Operculum depth	52.6	48.0	54.7	51.8	2.10
Dental length	35.4	33.5	39.3	36.7	1.81
Mouth width	22.8	22.5	28.0	25.4	2.00

of the town of Manavgat and drain into the Mediterranean Sea. The riparian vegetation of the 15- to 17-km-long stream includes emergent aquatic plants and other trees. The bottom of the stream is covered with sand, gravel and partly mud. Aksu River is about 140 km long and begins from Eğirdir and Kovada Lakes. The bottom of the Karaöz region of Aksu River is completely covered with gravel and sand, and its riparian vegetation also includes emergent aquatic plants (Figure 2). *P. alii* is

only caught from the Ilica and Kömürcüler streams and the Karaöz section of Aksu River, suggesting that the range of the species is very limited. Fish species found at the some localities (Aksu River) included *P. alii*, *Anguilla anguilla*, *Cyprinus carpio*, *Capoeta antalyensis*, *Vimba vimba*, *Clarias gariepinus*, and *Aphanius mento*. The species living in the Ilica and Kömürcüler streams are *A. anguilla*, *Capoeta angorae*, *Alburnus baliki*, and *Salaria fluviatilis*.

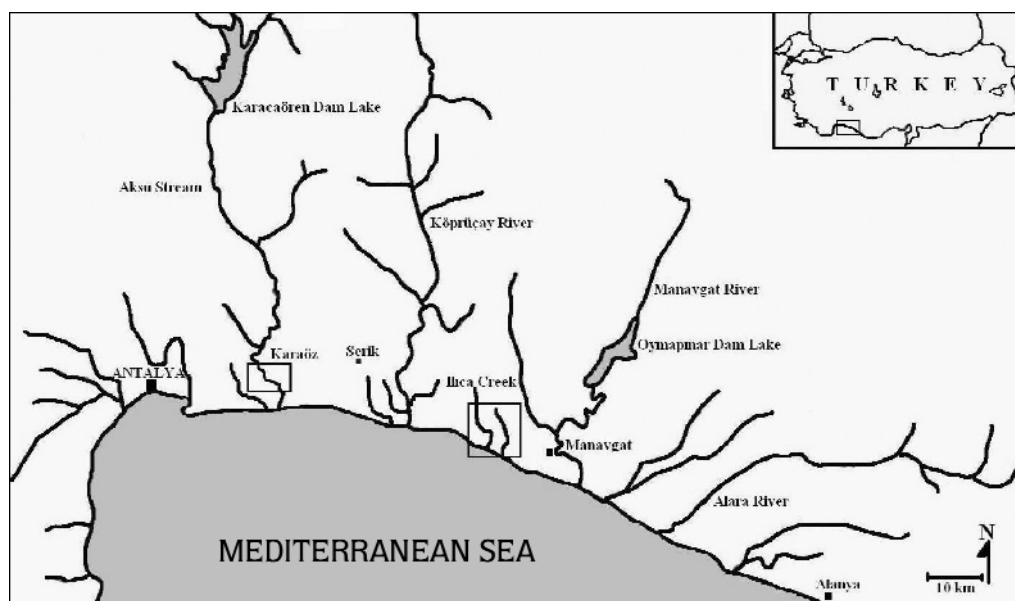


Figure 2. Distribution of *Pseudophoxinus alii* in the Antalya region, Turkey.

Table 2. Vertebrae, gill rakers, lateral line, dorsal and anal fin rays of large scales *Pseudophoxinus* species in Anatolia.

Species	Pred. vert.	Abd. vert.	Caudal vert.	Total vert.	Gill rakers	Lateral line	Dorsal fin	Anal fin
<i>P. antalyae</i>	12-13	20-22	17	37-39	9-12	52-56	III 7 ^{1/2}	III 7 ^{1/2}
<i>P. battalgili</i>	11-12	20-21	17-18	37-38	13-16	60-62	III 7 ^{1/2}	III 8-9 ^{1/2}
<i>P. elizavetae</i>	12-13	22	15-16	36-37	11-13	33-60	III 7 ^{1/2}	III 6-7 ^{1/2}
<i>P. firati</i>	12-14	21-22	16-17	37-39	6-8	15-44	III-IV 7 ^{1/2}	III 6 ^{1/2}
<i>P. egridiri</i>	12	18-19	16-18	35-36	9-10	0-3	III 6-7 ^{1/2}	III 6 ^{1/2}
<i>P. meandri</i> (Işıklı Lake)	12	21-22	15-17	37-38	7-9	19-23	III 7 ^{1/2}	III 6 ^{1/2}
<i>P. meandri</i> (Salda Lake)	13	21-22	15-17	36-38	7-9	19-32	III 7 ^{1/2}	III 6 ^{1/2}
<i>P. meandri</i> (Düğer village)	12-13	21-22	15-16	37	9	19-34	III 6-7 ^{1/2}	III 6 ^{1/2}
<i>P. cf. meandri</i> (Kırkpınar)	13	20-22	14-15	37-38	6-7	12-16	III 7 ^{1/2}	III 6 ^{1/2}
<i>P. ninae</i> (*)	?	?	?	?	9-10	7-30	III 7 ^{1/2}	III 6-7 ^{1/2}
<i>P. meandricus</i> (**)	?	20-22	?	37-38	11-13	45-63	III-IV 8	III 8
<i>P. zekayi</i>	12-13	21	15-16	36-37	8	37-42	III 7 ^{1/2}	III 7 ^{1/2}
<i>P. alii</i> , new species	13-15	21-22	16-17	37-39	8 - 11	38-41	III-IV 7 ^{1/2}	III 7-8 ^{1/2}

(*): from Freyhof and Özulug, 2006; (**): Bogutskaya, 1992

Etymology: The species is named after Ali, the author's father.

Discussion

The new species shares all diagnostic characters of the genus *Pseudophoxinus*. Total vertebrae are 37-39,

mostly 39, abdominal vertebrae 21-23, mostly 22, predorsal vertebrae 13-15, mostly 14, intermediate vertebrae 2 and 3 (Table 2); lateral line slightly incomplete. The origin of the pelvic fins is always in front of the dorsal fin origin. Gill rakers are lined up with wide intervals. Infraorbital canal and preoperculo-mandibular canal are disconnected (Figure 3).

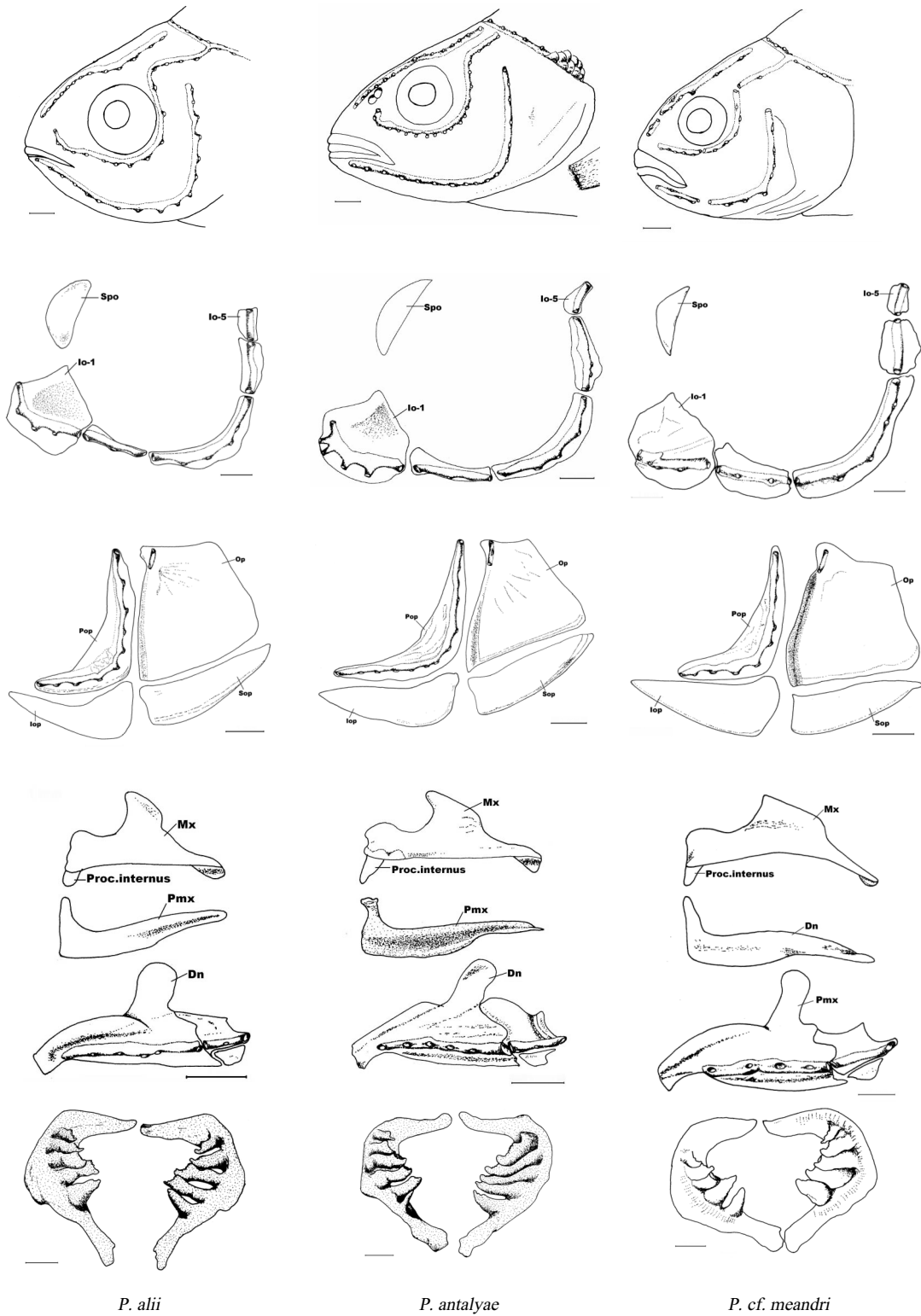


Figure 3. Head, supra and circumorbitals, bones of opercular, jaws and pharyngeal teeth of *P. alii* (Ilica, Manavgat), *P. antalyae* (Düden canal, Antalya) and *P. cf. meandri* (Kırkpınar, Korkuteli) (scale 1 mm).

Abbreviations: dn, dentary; mx, maxilla; pmx, premaxilla; lo, infraorbital; spo, supraorbital; op, operculum; pop, preoperculum; lop, interoperculum; sop, suboperculum; Proc. internus, Processus internus.

Comparison

P. alii differs from the other large-scaled *Pseudophoxinus* species found in Anatolia by the following combination of character states: large scales, 41-44 in lateral series; slightly incomplete lateral line, 39-41; large eye, its diameter 26%-32% HL; commonly 14 predorsal vertebrae; presence of a brown line along the lateral line.

P. alii is distinguished from *P. battalgili* (in Manavgat River specimens) by 9-11 gill rakers (vs. 13-16) and the absence of a keel between the posterior extremity of the pelvic-fin base and the anus (vs. presence).

P. alii is distinguished from *P. antalyae* by short preanal distance (mean 70.2% SL vs. 75% SL), deep anal fin (mean 18.3% SL vs. 14.0% SL); long anal fin (mean 13.4% SL vs. 9.6% SL); deep head (mean 74.4% HL vs. 70.2% HL); large eye (mean 28.5% HL vs. 24.4%); fewer scales in the lateral series (41-44 vs. 52-56); and

commonly 8^{1/2} branched anal-fin rays (vs. 7^{1/2}); short pharyngeal teeth (vs. long); short processus internus on the maxilla (vs. long) (Figure 3).

P. alii can be clearly differentiated from *P. meandri* (Salda Lake, Işıklı Lake, and Düger village) by 38-41 lateral line scales (vs. 5-36); anal fin with (7) 8^{1/2} branched rays (vs. 6^{1/2}); larger number of predorsal vertebrae (13-14 (15), vs. 12-13).

P. alii is distinguished from *P. cf. meandri* (Kırkpınar) by short pectoral–pelvic-fin origin distance (mean 25.8% SL, vs. 29.4%); larger number of caudal vertebrae (16-17, vs. 14-15); 38-41 lateral line scales (vs. 12-16); anal fin with (7) 8^{1/2} branched rays (vs. 6).

Acknowledgments

I would like to thank Dr. N. G. Bogutskaya for the methodology in the identification of a new species. I wish to thank Dr. İsmail İ. Turna and Salim Serkan Güçlü for drawing the figures, and many thanks to Dr. Hüseyin Küçüktaş for reading this manuscript and his constructive discussions.

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