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A new *Chondrostoma* species from the Büyük Menderes River Basin, Turkey (Teleostei: Cyprinidae)

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In a study of the fishes of the Büyük Menderes River Basin, Aegean region of Turkey, two populations of *Chondrostoma* were found which showed clearly distinctive characters: the population from the Upper B. Menderes (Işıklı Lake) was attributed to *C. meandrense* Elvira, 1987, while the population from the Çine Stream in the Lower B. Menderes River basin proved to be a hitherto undescribed species: *Chondrostoma turnai* sp. n. Altogether 24 metric and 7 meristic parameters were compared. The new species is distinguished from *C. meandrense* and all other congeners by a combination of the number of lateral line scales, the number of scale rows between the lateral line and the dorsal-fin origin, the number of scale rows of the lateral line and pelvic-fin origin, and the number of gill rakers on the first gill arch.

<http://www.zoobank.org/urn:lsid:zoobank.org:pub:811C213D-BEDD-4C8C-AE57-BFFA7964781A>

Keywords: *Chondrostoma*; taxonomy; freshwater fish; Turkey

Introduction

The genus *Chondrostoma* Agassiz, 1832, is widespread and extends from the northern Mediterranean drainages across Europe, the Balkan Peninsula, Anatolia, Caucasia and southwestern Iran. Six species of *Chondrostoma* were found in the Balkan Peninsula and the Adriatic basin, four species were found in the Caucasian basin, Volga, Don and Kuban rivers including the Kura and Aras rivers, and three species were found in Iran (Eagderi, Jouladeh-Roudbar, Sungur Birecikligil, Çiçek, & Coad, 2017). In Turkey, *Chondrostoma* is found in most rivers and streams. Twelve species have been identified so far: *Chondrostoma angorense* Elvira, 1987 (Sakarya and Kızılırmak rivers), *C. beysehirense* Bogutskaya, 1997 (Lake Beyşehir), *C. ceyhanensis* Küçük et al., 2017 (Seyhan, Ceyhan and Berdan rivers), *C. colchicum* Derjugin, 1899 (Çoruh River), *C. cyri* Kessler, 1877 (Kura and Aras rivers), *C. fahirae* (Ladiges, 1960) (Tefenni Spring, Dalaman River basin), *C. holmwoodii* (Boulenger, 1896) (Gediz River), *C. meandrense* Elvira, 1987 (Büyük Menderes River), *C. kinzelbachi* Krupp, 1985 (Orontes River), *C. regium* (Heckel, 1843) (Tigris and Euphrates rivers), *C. toros* Küçük et al., 2017 (Göksu River), and *C. vardarense* Karaman, 1928 (Meriç River) (Elvira, 1987, 1997; Bogutskaya, 1997; Freyhof & Özuluğ, 2009; Küçük, Turan, Güçlü, Mutlu, & Çiftçi, 2017).

Geiger et al. (2014) studied the cytochrome oxidase gene (COI) of Anatolian *Chondrostoma* species and found that the samples (8 specimens) from the Büyük Menderes

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drainage had a distinct genetic composition. The intraspecific genetic distance between all samples of the different species (Dxy) ranged from 0.02% to 12.5%. The phylogenetic tree constructed using the neighbour-joining method (Kimura 2-parameter estimation of genetic distance) showed two clades for *Chondrostoma*, namely *Chondrostoma meandrense* (Elvira, 1997) and a hitherto unnamed clade *Chondrostoma* sp.

In a study of the fishes of the Büyük Menderes River drainage in SW Turkey, we found two species of *Chondrostoma*. While one was readily identified as *C. meandrense*, the second species remained unidentified. The present study aims to identify this species.

Material and Methods

The material was collected using the pulsed DC electrofishing technique and the fish specimens were sacrificed by over-anaesthetization and were immediately fixed in 5 % formalin. The samples are deposited in the Inland Fishes Collection, Eğirdir Fisheries Faculty of Isparta University of Applied Sciences, Turkey (IFC-ESUF). The counts and measurements were performed as described by Kottelat and Freyhof (2007). All point-to-point measurements were made with a dial caliper and recorded at 0.1 mm precision. Head width 1 is the distance between the anterior eye margins, and head width 2 is the head width at the nape; head depth 1 is the head depth through the eye, and head depth 2 is the head depth at the nape. Scales along the lateral line are counted from the first one next to the pectoral girdle to the last one on the caudal-fin base. The last two branched dorsal and anal fin rays articulating on a single pterygiophore were counted as 1½.

Abbreviations

HL = Head length; SL = Standard length.

Results

Chondrostoma turnai sp. n. (Figure 1)

Material. Holotype. IFC-ESUF 03-1557, 191.8 mm SL; Turkey: Aydın Prov.: Çine Stream, Büyük Menderes River, 37°45'47"N, 27°50'03"E, S. S. Güçlü & Y. U. Güçlü leg., 13.v.2016. – Paratypes. IFC-ESUF 03-1558, 43, 108.3-174.8 mm SL; same data as holotype; S. S. Güçlü, & Y. U. Güçlü leg., 24.iv.2016.

Diagnosis. *Chondrostoma turnai* sp. n. is distinguished from *C. meandrense* from the Upper Büyük Menderes Watershed (Küfi Stream near Işıklı spring, Karasandıklı Stream near Sandıklı, Büyük Menderes River at Çal) by having fewer lateral line scales (44–51 vs. 56–60), fewer branched dorsal-fin rays (8 vs. 8–9), a wider head (head width between the anterior eye margins 50–57 % HL, vs. 38–48) and general body colour silvery with very few dark brownish pigments on dorsal side (vs. numerous dark brownish pigments on dorsal side forming a dark brownish background) (see Figures 1–2). *Chondrostoma turnai* sp. n. is distinguished from *C. holmwoodii* from Gediz River by having fewer lateral line scales (44–51, vs. 60–66), fewer scale rows between the lateral line and dorsal-fin origin (8–9 vs. 9–11), fewer scale rows between the lateral line and pelvic-fin origin (3–5 vs. 5–7) and a wider head (head width between the anterior eye margins 50–57% HL vs. 41–48) (Tables 1, 4). It differs from *C. fahirae* from Dalaman River by a shorter head (21–23% SL vs. 23–25), a greater distance between the pectoral-fin origin and pelvic-fin origin (29–34% SL vs. 25–30), a greater distance between the pelvic-fin origin and anal-fin origin (21–23% SL vs. 18–20), a shorter caudal peduncle length (15–19% SL vs. 18–21) and a wider head (head width between the anterior eye margins 50–57% HL vs. 39–48).



Figure 1. *Chondrostoma turnai* sp. n. Above holotype (ESUF 03-1557), below paratype (ESUF 03-1558), both from Çine Stream in the Lower Büyük Menderes Watershed, Turkey.



Figure 2. *Chondrostoma meandrense* (ESUF 03-1519), from Işıklı Spring in the Upper Büyük Menderes Watershed, Turkey.

Chondrostoma turnai sp. n. is also distinguished from the other species of *Chondrostoma* in Anatolia and adjacent waters by having a lower number of total lateral line scales (44–51 vs. 54–73, except *C. fahirae*), fewer scale rows between the lateral line and dorsal-fin origin (8–9 [mode 8], vs. 9–11, except *C. cyri*). *Chondrostoma turnai* sp. n. has fewer branched anal-fin rays than *C. kinzelbachi* and *C. regium* (9–10 [mode 9], vs. 10–12) and fewer gill rakers on first gill arch than *C. beysehirense*, *C. kinzelbachi* and *C. vardarense* (22–27, vs. 28–39) (see Tables 2–5).

Description. The habitus is shown in Figure 1 and morphometric and meristic data are given in Tables 1–5. Body slightly deep, depth at dorsal-fin origin 23–27% SL and slightly compressed laterally. Upper profile of body convex, ventral profile more convex than dorsal profile and showing a slight hump at nape. Head short, and dorsal profile convex at interorbital area, slightly concave at level of nostrils, and its length 21–23% SL. Snout short, its length 27–34% HL, with slightly rounded tip. The mouth inferior and slightly arched. The upper jaw covered with rostral cap. The lateral line

Table 1. Morphometry of *Chondrostoma turnai* sp. n. (holotype and n=43 paratypes [all paratypes with a SL >120 mm measured]), *C. meandrense* (IFC-ESUF 03-1519, n=24), *C. fahirae* (IFC-ESUF 03-1512, n=36), and *C. holmwoodii* (IFC -ESUF 03-1513, n=19).

	<i>C. turnai</i> sp. n. Çine Stream		<i>C. meandrense</i> B. Menderes R.	<i>C. holmwoodii</i> Gediz R.	<i>C. fahirae</i> Tefenni S.
	Holotype	Paratype			
SL (mm)	191.8	132.0-174.8	120.6-200.9	88.8-161.3	82.8-96.8
In percent of standard length					
Head length	20.8	21.9 (20.7-23.4)	22.6 (21.9-23.6)	23.1 (21.5-24.0)	24.1 (23.3-25.1)
Body depth	23.8	24.6 (22.9-27.0)	23.9 (21.8-25.5)	23.6 (22.0-24.8)	24.0 (21.9-25.3)
Predorsal distance	50.5	51.5 (50.0-54.5)	51.3 (49.6-52.6)	52.2 (50.7-54.0)	53.5 (51.8-55.0)
Prepelvic distance	51.5	52.7 (50.1-53.8)	52.4 (50.7-54.0)	52.7 (50.6-54.2)	52.5 (49.8-53.8)
Preanal distance	72.3	73.4 (71.8-75.1)	72.1 (69.4-74.8)	72.2 (70.4-73.4)	70.3 (67.3-72.9)
Pectoral-fin origin to anal fin	52.4	52.9 (48.7-54.3)	49.9 (46.1-52.4)	49.9 (48.2-51.1)	47.1 (45.7-49.9)
Pectoral-fin origin to pelvic fin	31.1	31.4 (29.0-34.3)	29.2 (26.5-31.5)	28.9 (28.2-29.4)	28.0 (25.4-30.3)
Pelvic-fin origin to anal fin	21.6	22.0 (20.5-23.0)	20.9 (19.5-23.5)	20.9 (19.8-21.6)	19.4 (18.2-20.4)
Dorsal fin depth	19.5	19.2 (17.5-21.4)	18.3 (16.2-20.2)	19.5 (17.2-20.9)	21.0 (20.0-22.4)
Anal fin depth	15.3	15.3 (13.5-16.4)	14.9 (13.4-16.8)	16.2 (14.8-17.1)	16.6 (15.0-18.8)
Pectoral fin length	17.4	18.0 (16.0-20.1)	17.5 (15.4-19.1)	18.4 (18.0-19.4)	20.5 (18.7-21.9)
Pelvic fin length	15.3	15.6 (14.1-17.5)	15.4 (13.8-17.5)	15.4 (14.6-16.2)	17.3 (14.1-19.0)
Caudal peduncle length	17.4	17.4 (14.5-18.5)	18.2 (16.7-20.3)	17.8 (16.2-19.4)	19.4 (18.2-20.9)
Caudal peduncle depth	10.6	10.5 (9.7-11.7)	10.5 (9.9-11.2)	10.2 (9.4-10.9)	10.8 (9.9-11.9)
In percent of head length					
Snout length	32.5	30.6 (27.2-33.8)	32.5 (29.1-34.8)	31.4 (26.9-33.3)	31.2 (28.0-32.6)
Eye diameter	20.9	22.2 (20.1-24.7)	21.9 (19.7-26.3)	20.6 (17.6-22.4)	25.7 (23.2-29.1)
Interorbital distance	40.6	38.2 (33.1-41.9)	36.4 (33.7-38.7)	36.1 (32.7-39.0)	37.8 (35.1-39.6)
Head width ₁	56.6	54.4 (49.8-57.0)	43.4 (37.6-48.2)	44.0 (40.5-47.7)	42.6 (38.9-48.1)
Head width ₂	59.0	55.7 (53.5-57.6)	53.9 (48.8-59.0)	55.5 (53.0-59.4)	53.9 (51.7-56.5)
Head depth ₁	48.0	50.6 (47.1-56.1)	50.1 (47.6-54.8)	50.1 (47.3-52.5)	56.8 (51.1-62.4)
Head depth ₂	75.9	74.3 (70.6-78.9)	73.6 (69.8-79.4)	72.7 (71.2-75.4)	75.0 (72.2-76.8)
Mouth width	27.4	26.1 (23.1-27.7)	25.8 (23.8-28.3)	27.4 (25.3-29.3)	25.4 (24.4-27.8)

Table 4. Frequency distribution of the number of rows of scales between lateral line and origin of dorsal fin and pelvic fin of *Chondrostoma* species distributed in Turkey.

	N	Number of rows of scales between lateral line and origin of dorsal fin						Number of rows of scales between lateral line and origin of pelvic fin								
		8	8½	9	9½	10	11	Mean	3½	4	4½	5	5½	6	7	Mean
<i>C. turnai</i> sp. n.	15	8	2	4	1			8.4	1	10	1	3				4.2
<i>C. angorense</i>	20			12		8		9.4				13				5.0
<i>C. beysehirense</i>	11					10	1	10.1				8		3		5.2
<i>C. ceyhanensis</i>	42			8		27	7	9.9		6		33		3		4.9
<i>C. colchicum</i>	20			14		6		9.3		6		14				4.7
<i>C. cyri</i>	28	8		17		3		8.8		8		20				4.7
<i>C. fahirae</i>	10	5		5				8.5		7		3				4.3
<i>C. holmwoodii</i>	20			2		13	5	10.2				5		13	2	5.8
<i>C. kinzelbachi</i>	19					5	14	10.2				17		2		4.9
<i>C. meandrense</i>	14	1		11		2		9.0				14				5.0
<i>C. regium</i>	33			3		24	6	10.1		8		18		7		5.0
<i>C. toros</i>	22					16	6	10.3		8		5		9		5.1
<i>C. vardarense</i>	16	3		11		2		8.9		1		13		2		5.1

Table 5. Frequency distribution of the number of branched dorsal fin rays and branched anal fin rays of *Chondrostoma* species distributed in Turkey.

	N	Branched dorsal fin rays					Branched anal fin rays					
		7	8	9	10	Mean	8	9	10	11	12	Mean
<i>C. turnai</i> sp. n.	18		18			8.0		11	7			9.4
<i>C. angorense</i>	25		4	21		8.8		4	16	5		10.0
<i>C. beysehirense</i>	5		5			8.0	1	3	1			9.0
<i>C. ceyhanensis</i>	24		11	13		8.5		6	16	2		9.8
<i>C. colchicum</i>	12		5	7		8.6		4	8			9.7
<i>C. cyri</i>	17		14	3		8.2	1	12	4			9.2
<i>C. fahirae</i>	10	10				7.0	3	7				8.7
<i>C. holmwoodii</i>	16		16			8.0		14	2			9.1
<i>C. kinzelbachi</i>	9		1	8		8.9			3	6		10.7
<i>C. meandrense</i>	14		12	2		8.1		8	6			9.4
<i>C. regium</i>	12		1	10	1	9.0			4	7	1	10.8
<i>C. toros</i>	18		1	16	1	9.0		5	12	1		9.8
<i>C. vardarense</i>	14		14			8.0		12	2			9.1

with 44 (1), 45 (4), 46 (1), 47 (3), 48 (3), 49 (2), 50 (2) and 51 (1); 8 (10) and 9 (5) scale rows between lateral line and dorsal-fin origin; 3 (1), 4 (11) and 5 (3) scale rows between lateral line and pelvic-fin origin (Tables 2, 4). 22–27 gill rakers on outer side of first gill arch (Table 3). The dorsal fin with 3 simple, 8½ branched rays and the outer margin straight or slightly concave. The anal fin with 3 simple, 9½ and 10½ branched rays; outer margin concave. The caudal fin deeply forked, lobes with pointed tip. Outer margin of the pectoral fin slightly convex. Outer margin of the pelvic fin clearly rounded. The pharyngeal teeth formula 5–5 or 6–6, markedly large-tipped and knife-shaped.

Colouration. In live individuals, body silvery on back and flanks, yellowish on belly. In formalin-preserved specimens, body light greyish on back and upper flank, yellowish on belly and lower flank. Pectoral, pelvic and anal fins yellowish, dorsal and caudal fins greyish. The outer margin of caudal fin with a blackish band.

Sexual dimorphism: Males with tubercles on the head, pectoral girdle and dorsal scales during the reproductive period (March to May).

Distribution. *Chondrostoma turnai* sp. n. is known from the lower and middle tributaries of the Büyük Menderes River (the Çine Stream, Akçay Stream near Nazilli, Yenicekent near Sarayköy). The Büyük Menderes River is located in the Aegean Region of

Turkey and is about 548 km long. While *Chondrostoma meandrense* is present in the upper tributaries of Büyük Menderes, *C. turnai* sp. n. is found in the middle and lower tributaries. They show a clear allopatric distribution pattern.

Biology. Fish species found at the same localities include: *Alburnus demiri* Özuluğ & Freyhof, 2008; *Barbus pergamonensis* Karaman, 1971; *Capoeta aydinensis* Turan et al., 2017; *Cyprinus carpio* Linnaeus, 1758; *Luciobarbus kottelati* Turan et al., 2008; *Petroleuciscus ninae* Turan et al., 2018; *Pseudorasbora parva* (Temminck & Schlegel, 1846); *Rhodeus amarus* (Bloch, 1782); *Squalius fellowesii* (Günther, 1868); *Vimba mirabilis* (Ladiges, 1960); *Lepomis gibbosus* (Linnaeus, 1758), and *Gambusia holbrooki* Girard, 1859.

Etymology. The species is named after İsmail İbrahim Turna (Süleyman Demirel University, Isparta, Turkey), who has made a great contribution to hydrobiology in Turkey.

Remarks. Twelve species of *Chondrostoma* have been found in Turkey and adjacent waters and they are clearly separated by their geographic occurrence in the various watersheds. Our surveys show that two species of *Chondrostoma* occur in the Büyük Menderes watershed. They have an allopatric distribution with *C. meandrense* in the upper Büyük Menderes River and its upper tributaries, while *C. turnai* sp. n. is found in the lower and middle tributaries.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

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