

Seminemacheilus ahmeti, a new species of Nemacheilid from Sultan Marshes, Turkey

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Abstract

Seminemacheilus ahmeti, new species, is described from Sultan Marshes, Kızılırmak Basin, Kayseri Province, Turkey. This species is distinguished from the other members of the genus by a combination of the following characters: irregular dark brown spots on the dorsal and lateral faces of the head, longer head with blunt snout, reduced and separated orbitosphenoids, and wider and larger actinosts and connection of the coracoid to the cleithrum in pectoral girdle. It is also diagnosed from *S. ispartensis* and *S. lendlii* by seven fixed, diagnostic nucleotide substitutions in the mtDNA COI barcode region, and a K2P nearest-neighbour distance of 5.5% and 2.1%, respectively.

Keywords: Loaches, Inland water, Kayseri, Osteology.

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Introduction

Banarescu and Nalbant (1995) described monotypic genus *Seminemacheilus* by transferring *Nemacheilus lendlii* Hanko, 1925. Later they described *S. tongiorgii* from the Kul river basin, Iran (Banarescu and Nalbant 1995). This species differs from Anatolian species, *S. lendlii*, mostly by colour pattern and possession of scales, therefore Freyhof et al. (2011) transferred it to the genus *Oxyneomacheilus*. A second species, of the genus *Seminemacheilus* described by Erk'akan et al. (2007). Therefore, this endemic genus of Turkish inland water has two species, including *S. ispartensis* Erk'akan, Nalbant & Özeren, 2007 and *S. lendlii* (Hankó, 1925) described from the Isparta Creek, Isparta (Western Mediterranean Basin) and Eskişehir (Sakarya Basin), respectively (Kuru 2004; Erk'akan et al. 2007; Fricke et al. 2007; Kottelat 2012).

Geiger et al. (2014) suggested that species diversity of the genus *Seminemacheilus* in Turkey is underestimated and introduced the population of Sultan Marshes (Kızılırmak Basin, Kayseri Province) as an unrecognized species. Therefore, we compared DNA data (mtDNA COI gene) of our collected specimens from the Sultan Marshes with sequences from NCBI GenBank (KJ554757 and KJ554681) and the results revealed both share the same COI. Consequently, based on morphological differences found with the two other species of this genus, we describe the population of the Sultan Marshes as a new species.

Material and Methods by

Sampling and morphological study: The specimens were collected by electrofishing device. After anaesthesia, fishes were fixed in 5% buffered formaldehyde. Measurements were made using a digital caliper to the nearest 0.1 mm. All measurements were made point to point, never projections. Methods for counts and measurements follow Kottelat and Freyhof (2007). Standard length (SL) is measured from the tip of the snout to the end of the hypural complex. The length of the caudal peduncle is measured from behind the base of the last anal-fin ray to the end of the hypural complex, at mid-height of the caudal-fin base. The last two branched rays articulating on a single pterygiophore in the dorsal and anal fins are counted as "1½".

Osteological study: For osteological examination, 8 specimens (42.2-45.1 mm SL) from the Yeşilova (Sultan March, Kızılırmak Basin) and 8 specimens of *S. lendlii* (44.7-48.2 mm SL) from the Cihanbeyli (Konya closed



Figure 1. *Seminemacheilus ahmeti* n. sp., NHVUIC 2017-06-17, holotype, 53.0 mm SL, Turkey: Kayseri prov.: Sultan Marshes.

Basin) were cleared and stained with alizarin red S and alcian blue according to Taylor and Van Dyke (1985). Then, the cleared and stained specimens were studied using a stereomicroscope (Leica MC5) and their skeletal elements were scanned by a scanner equipped with a glycerol bath (Epson V600). The images were illustrated by CorelDrawX6 software. Nomenclature and abbreviation of skeletal elements follow Jalili et al. (2015a, b, c). **Abbreviations used:** SL, standard length; HL, lateral head length; IMNRFI-UT, Ichthyological Museum of Natural Resources Faculty - University of Tehran; NHVUIC, Ichthyology Collections of Nevsehir Haci Bektas Veli University, Nevşehir, Turkey.

Results

Seminemacheilus ahmeti new species

(Figs. 1-4, Table 1)

Holotype: NHVUIC 2017-06-17, 53.0 mm SL; Turkey: Kayseri prov.: Sultan Marshes near Yeşilova Village, Kızılırmak Basin, 38°12'05.26"N 35°13'19.76"E; S. Sungur, E. Çiçek and S. Eagderi, 12 March 2017.

Paratypes: NHVUIC 1990-01-16, 21, 40.1-53.2 mm SL; data same as holotype. IMNRFI-UT-3016, 5, 43.0-51.2 mm SL; data same as holotype.

Diagnosis: *Seminemacheilus ahmeti* n. sp. is distinguished from *S. ispartensis* by having longer head (25.1-28.6 vs. 21.3-23.6 %SL), blunt snout (vs. pointed snout), upper lip without furrows (vs. densely furrowed), lower caudal peduncle depth (12.5-14.8 vs. 19.1-25.9 %SL), seven fixed, diagnostic nucleotide substitutions in the mtDNA COI barcode region, and a K2P genetic distance of 5.5%.

Seminemacheilus ahmeti n. sp. is distinguished from *S. lendlii* by having slimer upper lip (vs. thick and fleshy), irregular dark brown spots on the dorsal and lateral faces of the head (vs. lacking spots or having few spots in some specimens), wider (vs. narrower) anterior part of the parasphenoid (Fig. 5), reduced and separated (vs. well-developed and connected) ventral margin of the orbitosphenoids (Fig. 5), wider and larger (vs. narrower and smaller) actinosts of the pectoral girdle (Fig. 6), connection of the anterior and posterior parts of the coracoid to the cleithrum (vs. connection along the whole length of the coracoid to the cleithrum) (Fig. 6),



Figure 2. *Seminemacheilus ahmeti* n. sp., paratypes; Turkey: Kayseri Prov.: Sultan Marshes; (A) NHVUIC 1990-01-1, 51.4 mm SL; (B) NHVUIC 1990-01-2, 47.7 mm SL; (C) NHVUIC 1990-01-3, 42.5 mm SL.

absent of a fossa in the medial part of the pelvic bone (vs. presence) (Fig. 7), seven fixed, diagnostic nucleotide substitutions in the mtDNA COI barcode region, and a K2P genetic distance of 2.1% (Table 2).

Description: See Figures 1-4 for general appearance and Table 1 for morphometric and meristic data. Body stout, deep and short with broad head and blunt snout in dorsal and lateral views and a hump at nape in some specimens; deepest part of body at midline between nape and dorsal-fin origin and widest part at pectoral-fin base or behind operculum; eye relatively large; mouth arched, processus dentiformis absent, thick lower lip markedly furrowed with a deep median incision; barbels long, outer rostral barbel reaching to middle of maxillary barbel or vertical to posterior edge of eye, inner one reaching to anterior margin of eye, maxillary barbel reaching behind vertical of posterior margin of eye.

Pectoral fin pointed reaching approximately 0.6-0.9% of distance between pectoral and pelvic fins' origins; pelvic-fin origin below 3th or 4th branched rays of dorsal fin, usually not reaching to anus, slightly pointed without an axillary lobe (sometimes with a tiny axillary lobe at its antero-lateral corner fully attached to body); anus about 0.3-1.2 eye diameter in front of anal-fin origin; anal-fin base at middle or front middle between posterior ray of dorsal fin and caudal fin base and not reaching caudal fin origin; margin of dorsal and anal fins moderately straight to convex; caudal-fin rounded; dorsal fin with 3-4 unbranched and 6½-8½ branched rays, anal fin with 4 unbranched and 5½ branched rays, pectoral fin with 1 unbranched and 10-12 branched and pelvic-fin with 1 unbranched and 4-6 branched rays, caudal fin with 8+8 rays.

Caudal peduncle length 1.1 times of its depth with moderate dorsal and ventral adipose crest; dorsal crest reaching to vertical anterior anal-fin origin; males with a longer pectoral fin and a shallow suborbital depression

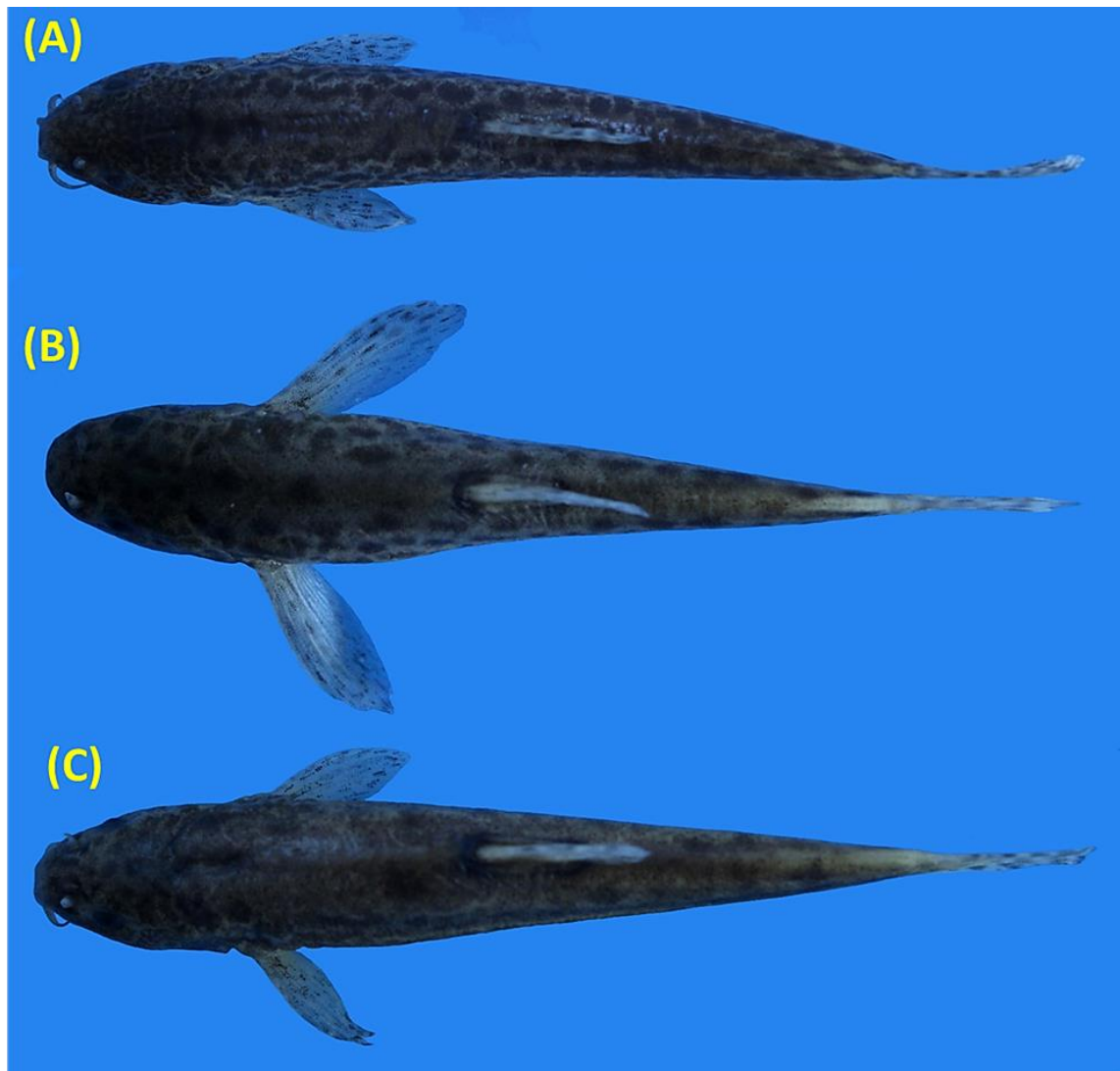


Figure 3. *Seminemacheilus ahmeti* n. sp., paratypes; Turkey: Kayseri Prov.: Sultan Marshes; (A) NHVUIC 1990-01-1, 51.4 mm SL; (B) NHVUIC 1990-01-2, 47.7 mm SL; (C) NHVUIC 1990-01-3, 42.5 mm SL.

in some specimens; tiny breeding tubercles in anterior part of body (in front of dorsal fin and head) during spawning season; lateral line not complete, reaching to posterior part of pectoral origin (with 5-6 pores); 4 lateral and 4 central pores in supratemporal canal; body scaleless with tiny tubercles in some specimens.

Coloration: Body whitish grey in live and yellowish or yellowish brown in preserved individuals. Plain brown head with tiny spots or mottling on top, cheeks with dark brown mottled spots, without color pattern ventrally. Dorsum brown with one or two dark brown ellipsoid saddles in front of dorsal fin in some specimens. Irregular dark brown blotches and spots on flanks (sometimes fused as strips) arranged as two or three longitudinal rows, reducing its number posteriorly, a dark-brown strip on lateral line, belly white or yellowish without color pattern or with scattered tiny spots particularly around anal fin base. Dorsal fin with 3 or 4 dark brown bands on rays, caudal fin with 4-6 bands on rays (with darker proximal one), pelvic fins usually hyaline without color pattern. Pectoral and anal fins with small or large spots (sometimes without pigmentation) on rays.

Sexual dimorphism: Males bear longer pectoral fin and shallow suborbital depression in some specimens.

Distribution and Habitat: *Seminemacheilus ahmeti* n. sp. is known from the small streams flow to the Sultan Marshes, Kızılırmak Basin, Kayseri Province, Central Anatolia in Turkey. It inhabits in small ponds and streams of the Sultan Marshes with gravel to sandy bottoms covered by dense periphytonic vegetation (Fig. 8).

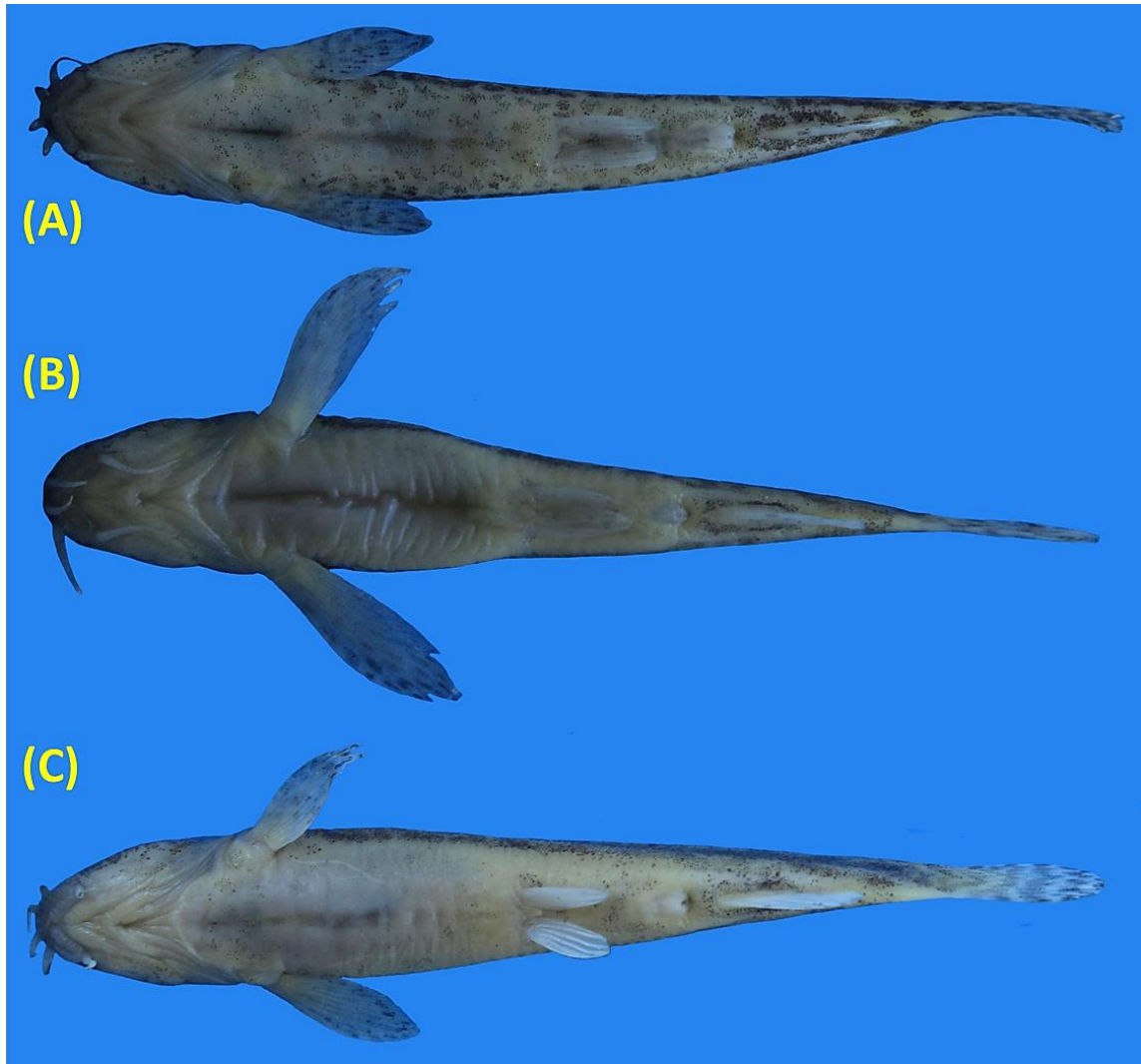


Figure 4. *Seminemacheilus ahmeti* n. sp., paratypes; Turkey: Kayseri Prov.: Sultan Marshes; (A) NHVUIC 1990-01-1, 51.4 mm SL; (B) NHVUIC 1990-01-2, 47.7 mm SL; (C) NHVUIC 1990-01-3, 42.5 mm SL.

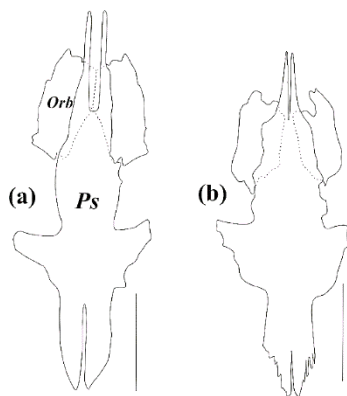


Figure 5. Ventral view of the parasphenoid (Ps) and orbitosphenoid (Orb) in (a) *Seminemacheilus lendlii* and (b) *Seminemacheilus ahmeti* n. sp. (Scale bar = 2 mm).

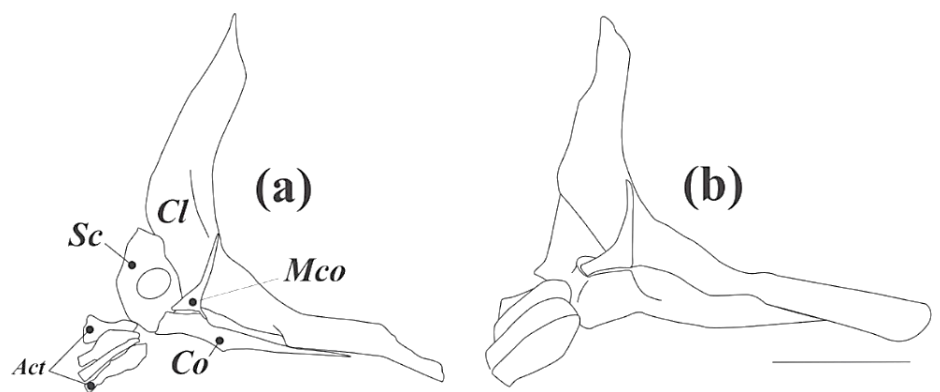


Figure 6. Lateral view of the pectoral girdle in (a) *Seminemacheilus ahmeti* n. sp. (Act: actinost; Sc: scapula; Cl: cleithrum; Co: coracoid; Mco: mesocoracoid; scale bar = 2 mm).

Table 1. Morphometric and meristic data of *Seminemacheilus ahmeti* n. sp. (Holotype, NHVUIC 2017-06-17; paratypes, NHVUIC 1990-01-16, 21 specimens).

	<i>Seminemacheilus ahmeti</i> n. sp. (with holotype, n=22)			
	Holotype	range	mean	SD
Morphometric characters				
Standard length (mm)	53.0	40.1-53.2	46.80	3.13
In percent of SL				
Body depth maximal	18.4	17.0-19.4	18.09	1.15
Caudal peduncle depth	13.6	12.5-14.8	13.52	0.70
Predorsal length	50.4	47.6-59.4	52.51	1.13
Postdorsal length	38.9	33.4-41.3	36.72	1.15
Prepelvic length	57.8	51.3-65.3	56.95	1.26
Preanal length	76.2	69.6-87.1	78.08	1.59
Caudal peduncle length	17.1	11.5-17.7	15.34	1.54
Dorsal fin base length	11.1	9.6-13.4	11.62	0.93
Dorsal fin depth	22.6	19.7-23.0	21.25	1.25
Anal fin base length	9.7	7.6-11.1	9.47	1.09
Anal fin depth	19.5	16.1-20.3	18.10	1.35
Pectoral fin length	28.4	18.7-28.8	24.61	3.76
Pelvic fin length	15.1	10.5-15.1	12.79	1.42
Pectoral-pelvic fin origin distance	32.0	24.3-35.6	29.71	2.37
Pelvic-anal fin origin distance	20.7	16.2-26.0	20.70	1.84
Caudal fin length	23.2	19.4-24.1	22.13	1.37
Body width	13.0	11.0-15.9	12.69	1.05
Caudal peduncle width	2.8	2.2-4.3	3.29	0.56
Head length	25.6	25.1-28.6	26.90	1.07
Head length (mm)	12.5	11.4-13.8	12.57	0.65
In percent of HL				
Snout length	39.9	33.9-42.9	36.57	6.34
Eye diameter	13.6	13.6-19.3	15.94	1.29
Postorbital distance	54.0	45.4-54.6	50.89	2.25
Head depth at nape	59.2	52.4-60.4	57.30	2.01
Head width	67.2	59.6-67.3	64.00	1.94
Inter orbital	41.1	32.9-44.3	39.02	2.37
Inter nasal	26.0	20.0-29.7	23.97	2.62
Mouth width	38.2	33.1-40.6	36.63	2.15
Inner rostral barble	27.5	22.5-37.3	29.47	4.08
Outer rostral barble	38.2	34.0-50.0	39.50	4.41
Maxillary barble	39.2	33.1-46.7	39.43	3.44
Meristic characters				
		range	mode	
Branched dorsal fin rays	8	6-8	8	
Branched anal fin rays	5	5	5	
Pectoral fin rays	12	10-12	11	
Pelvic fin rays	6	4-6	6	
Caudal fin rays	16	16	16	

Table 2. Estimates of evolutionary divergence over sequence pairs between *Seminemacheilus ahmeti* n. sp. and other *Seminemacheilus* species.

Species 1	Species 2	Distance	SE
<i>Seminemacheilus lendii</i>	<i>Seminemacheilus ispartensis</i>	4.3%	0.8
<i>Seminemacheilus lendii</i>	<i>Seminemacheilus ahmeti</i> n. sp.	2.1%	0.6
<i>Seminemacheilus ispartensis</i>	<i>Seminemacheilus ahmeti</i> n. sp.	5.5%	0.9

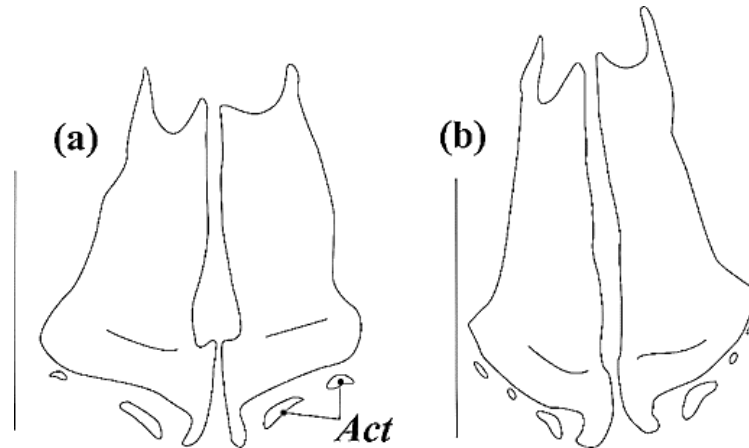


Figure 7. Pelvic girdle of (a) *Seminemacheilus lendlii* and (b) *Seminemacheilus ahmeti* n. sp. (scale bar = 2 mm).



Figure 8. Type locality and natural habitat of *Seminemacheilus ahmeti* n. sp., Turkey: Kayseri prov.: Sultan Marshes.

Etymology: The new species is named to Ahmet Sungur, who is brother of first author, passed away in an accident at age 27 in 17 June 2017.

Comparative materials used in the morphological analyses: All from Turkey.

Seminemacheilus lendlii: NHVUIC 2017-08-01, 13, 40.2-66.0 mm SL; Turkey: Konya prov.: Kozanlı, 20 km nearest to Kulu, Konya Closed Basin, 39°02'13"N 032°48'36"E; E. Çiçek, 19 August 2017.

Seminemacheilus ispartensis: Data from Erkakan et al. (2007)

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