



Description of a new species *Squalius* from Lake Hazar and Upper Tigris River drainages in Anatolia (Teleostei: Leuciscidae)*

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Abstract: In a study of the fishes of the Lake Hazar, and Tigris, Euphrates and Kueik rivers were recorded four species of *Squalius* belonging to the *Squalis cephalus*-group were found: The western drainage of Euphrates River (Tohma Stream) population was identified as *S. seyhanensis*, northern drainages of Euphrates as *S. semae*, and the Kueik populations as *S. berak*. The comparison of 28 metric, 9 meristic parameters and morphological characters showed that the populations of the Lake Hazar and the upper Tigris drainages are distinct and belong to a hitherto unnamed species. We describe it here as *Squalius verepi* sp. n.

Keywords: Freshwater fish, Türkiye, taxonomy, chub, morphology.

Hazar Gölü ve Dicle Nehri Yukarı Havzasında Yeni Bir *Squalis* Türünün Tanımlanması (Teleostei: Leuciscidae)

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Öz: Bu çalışmada, Hazar Gölü, Dicle, Fırat ve Kueik nehirlerinden *Squalius cephalus* grubuna ait 4 tür tespit edilmiştir. Fırat Nehri'nin batı drenajlarında *S. seyhanensis*, Kuzey drenajlarında *S. semae* ve Kueik Nehri'nden *S. berak* dağılım gösterdiği saptanmıştır. Hazar ve Dicle popülasyonları 28 metrik ve 9 meristik karakter bakımından Fırat ve Kueik nehirlerinden rapor edilen türler ile karşılaştırılmış ve bu popülasyonların henüz tanımlanmamış olduğu saptanmıştır. Burada, bu popülasyonları *S. verepi* adında yeni tür olarak tanımlanmaktadır.

Anahtar kelimeler: Tatlısu balıkları, Türkiye, taksonomi, tatlısu kefali, morfoloji.

INTRODUCTION

The genus *Squalius* Bonaparte, 1837 is distributed in Europe and Western Asia. The genus includes about 48 species widespread in the Western Palearctic (Özuluğ & Freyhof, 2011; Turan et al., 2013). In Turkey, the species of genus occur in almost all streams and rivers. Turkish *Squalius* species morphologically divided in two groups. First one, *Squalius cephalus* group, morphologically represented with 16 species: *S. orientalis* (Nordmann, 1840) from the rivers and streams of Caucasus; *S. berak* Heckel, 1843 from Kueik River; *S. turcicus* De Filippi, 1865 from Arax Rivers drainaegs; *S. agdamicus*

Kamensky, 1901 from Kura River drainages; *S. fellowesii* (Günther, 1868) from Madra south to Eşen River; *S. pursakensis* (Hanko, 1924) from Sakarya River; *Squalius cii* (Richardson, 1857) from Susurluk River; *S. kosswigi* (Karaman, 1972) from Tahtalı River; *S. aristotelis* Ozuluğ & Freyhof, 2011 from Tuzla drainage, *S. carinus* Ozuluğ & Freyhof, 2011 from Lake Işıklı basin; *S. cappadocicus* Ozuluğ & Freyhof, 2011 from Melendiz River in Lake Tuz basin; *Squalius cephalus* (Linnaeus, 1758) from western part of Turkish Black Sea coast; *S. recurvirostris* Ozuluğ & Freyhof, 2011 from Lake Eber, Akşehir, and Ilgın basins; *S. adanaensis* Turan, Kottelat & Doğan, 2013 from streams of the lower Seyhan River basin; *S. seyhanensis*

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Turan, Kottelat & Doğan, 2013 from streams of the upper Seyhan River basin; and *S. semae* Turan, Kottelat & Bayçelebi, 2016 from the northern drainages of Euphrates (Heckel, 1843; Hanko, 1924; Nordmann, 1840; De Filippi, 1865; Battalgil, 1942; Berg, 1949; Karaman, 1972; Bogutskaya, 1994; Özuluğ & Freyhof, 2011; Turan et al., 2009; Turan et al., 2013; Turan et al., 2016, Bayçelebi, 2019). The other, *Squalius lepidus* group, include 3 species: *S. lepidus* Heckel, 1843; *S. anatolicus* Bogutskaya, (1997); and *S. kottelati*, Turan, Yılmaz & Kaya, 2009.

This study identified one species from the Lake Hazar and two species from Tigris River (Persian Gulf basin) of *Squalius*. One is readily identifiable as *S. lepidus*, a species belonging to the *Squalius lepidus* group and it occurs in the Euphrates and Tigris drainages (Turan et al., 2009). The other species belongs to the *Squalius cephalus* group which is unnamed thus, the aim of the present study is to describe the species based on morphological characters.

MATERIAL AND METHOD

Fish were caught by pulsed DC electrofishing equipment and killed by over anaesthetization,

fixed and stored in formaldehyde. Material examined is deposited in Recep Tayyip Erdogan

University Zoology Museum of the Faculty of Fisheries, Rize (FFR). Measurements were taken with digital calipers (0.1 mm accuracy). Counts and measurements follow Kottelat & Freyhof (2007) except as follows. Head width1: distance between anterior margin of eyes; head width2: distance between posterior margin of eyes; head width3: at middle of opercle; head depth1: through eye; head depth2: at nape; width of mouth gape: between corners of mouth; length of mouth gape: from tip of upper lip to corner of mouth. The lateral-line scale count includes the scales on the base of the caudal fin. The last two branched dorsal and anal-fin rays articulating on a single pterygiophore are counted as 1½. The number in parentheses after a count indicates the frequency of that count. Asterisks indicate the values of the holotype. The map was created using the Qgis v. 3.8.3-Zanzibar software available at <http://diva-gis.org>. Occurrence data in the map (Fig. 2) are based on our own material.

Abbreviations used: SL, standard length, SD, standard deviation; HL, lateral head length. We follow Stout et al. (2016) and authors cited in this publication and treat the cyprinid subfamily Leuciscinae as an own family: Leuciscidae.

The morphometric and meristic data for *Squalius* species in eastern Turkey Turan et al. (2009; 2013, 2017), Bayçelebi (2019).

RESULTS

Squalius verepi, new species



Figure 1. *Squalius verepi*, FFR 6296, holotype, 175 mm SL; stream Behremas.



Figure 2. *Squalius verepi*, paratypes, from top, FFR 763, 180 mm SL, 161 mm SL; 155 mm SL, stream Behremas.



Figure 3. *Squalius verepi*, paratypes, from top, FFR 748, 169 mm SL, 165 mm SL; 157 mm SL, stream Akçapınar, Tigris River.

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Holotype: FFR06296, 1, 175 mm SL; Turkey: Elazığ prov.: stream Behremas at lake Hazar, 38.501N 39.508E.

Paratypes: FFR00763, 38, 87-176 mm SL; same data as holotype. -FFR00628, 52, 45-120 mm SL; Turkey:

Diyarbakır prov.: stream Batman at Malabadi bridge, 38.153N 41.205E. -FFR00630, 4, 80–103 mm SL; Turkey: Diyarbakır prov.: stream Akçayır at Sinanköprü bridge, 37.871N 40.989E. -FFR00678, 16, 32–158 mm SL; Turkey: Diyarbakır prov.: stream Akçayır at Sinanköprü bridge, 37.868N 40.988E. -FFR00679, 15, 65–98 mm SL; Turkey: Diyarbakır prov.: stream Batman at Malabadi bridge, 38.154N 41.203E. -FFR00748, 11, 117–166 mm SL; Turkey: Diyarbakır prov.: stream Akçayır at Sinanköprü bridge, 37.871N 40.990E. -FFR00751, 13, 86–138 mm SL; Turkey: Diyarbakır prov.: stream Batman at Malabadi bridge, 38.154N 41.203E.

Diagnosis: *Squalius verepi* is distinguished from the species in Tigris-Euphrates and adjacent basins as the following characters. *Squalius verepi* is distinguished from *S. berak* (Fig. 4) by having a smaller head (length 25–28% SL, vs. 29–31), a greater interorbital distance (interorbital width 36–41% HL, mean 38.2, vs. 30–37, mean 34.2), the mouth gape smaller than its width (vs. greater than its width), a deeper head (head depth at nape (62–68% HL, mean 64.8, vs. 56–64, mean 59.8), a deeper snout (snout depth at the nostril 32–38% HL, mean 34.0, vs. 24–33, mean 29.0), and fewer black pigments on posterior edge on flank scales and more black pigments on each flank scale pocket (Fig.5). *Squalius verepi* is distinguished from *S. semae* by the presence of orange pigments on anal-fin rays in live individuals (vs. anal-fin rays with black pigments in live individuals, fewer dark brownish or blackish pigments on posterior edge of each flank scales (vs. with dense dark brown pigments, and almost covered by the posterior margin of preceding scales (Fig. 5), fewer gill rakers the outer side of the first gill arch (8–11, vs. 11–12) and length of mouth gape is smaller than its width (vs. approximately equal). *Squalius verepi* is distinguished from *S. seyhanensis* by having a fewer dark grey or blackish pigments on posterior edge of each flank scale (a few, vs. numerous, [Fig. 5]), a narrower head (width at the posterior margin of eyes 50–55% HL, vs. 56–60) and a slenderer anal-fin (height 50–55% SL vs. 56–60). It is distinguished from *S. lepidus* by the lower jaw not projecting, having fewer branched anal-fin rays ($7\frac{1}{2}$ – $8\frac{1}{2}$, mode $8\frac{1}{2}$, vs. $8\frac{1}{2}$ – $10\frac{1}{2}$, mode 9), fewer lateral line scales (42–46, vs. 48–49) and fewer gill rakers the outer side of the first gill arch (8–11, vs. 11–13).

Description: The general appearance is shown in Figs. 1–3; morphometric and meristic data are given in Tables 1. Body moderately deep, slightly compressed laterally. Dorsal profile of body convex, ventral profile less convex than dorsal profile. Head short, its length 25–28 % SL, approximately 1.0–1.3 times body depth, its dorsal profile straight or slightly convex at the interorbital area and slightly convex on the snout. Mouth slightly subterminal, its corner not reaching vertical through

anterior margin of eye. Length of mouth gape slightly smaller than its width. Upper lip thick, anterior width approximately 1.7–2.0 times width at the corner of the mouth. Snout with a slightly rounded tip.



Figure 4. *Squalius Berak*, From Top, Ffr 3821, 169 Mm SL, 165 Mm SL; 157 Mm SL, Stream Kueik.

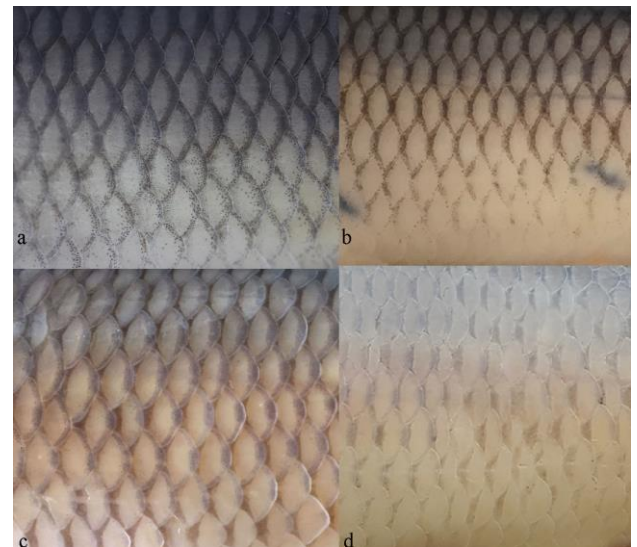


Figure 5. Pigments on flank scales: from the top of: a) *Squalius semae*, FFR 669, 174 mm SL; b) *S. berak*, FFR 775, 164 mm SL, Kueik River; (c) *S. seyhanensis*, FFR 729, 228 mm SL; d) *S. verepi*, FFR 763, 180 mm SL, 161 mm SL; 155 mm SL, stream Behremas.

Dorsal fin with 4 simple and $8\frac{1}{2}$ (19) and $9\frac{1}{2}$ (1) branched rays, its height approximately equal to the pectoral-fin length, outer margin straight or slightly convex. Pectoral fin short, its length 16.7–19.2% SL, outer margin convex, with 15 (2), 16 (5), 17 (8) and 18 (5) branched rays. Pelvic fin rounded, with 1 simple and 8 (3) or 9 (17) branched rays, outer margin convex. Anal fin with 3 simple and $7\frac{1}{2}$ (3) and $8\frac{1}{2}$ (17) branched rays, fleshy, outer margin convex. Caudal fin slightly forked, lobes slightly pointed. Lateral line with 42 (4), 43 (2), 44 (5), 45 (7) and 46 (2); 7 (6) and 8 (14) scale rows between lateral

line and dorsal-fin origin; 3(8) and 4 (12) scale rows between lateral line and anal-fin origin. Gill rakers 8-11 on the outer side of the first-gill arch. Pharyngeal teeth 2.5-F5.2, distinctly hooked, serrated.

Table 1. Morphometric data of *Squalius verepi* from stream Behremas and Akçapınar.

	holotype	range (mean)	SD
N=22			
Standard length (mm)	175	140–181	
In % SL			
Head length	26.9	25.3–28.2 (26.6)	0.7
Body depth at dorsal-fin origin	24.7	21.5–26.0 (24.4)	1.1
Predorsal length	54.8	52.6–56.0 (54.3)	0.8
Prepelvic length	51.4	48.7–51.4 (50.3)	0.7
Prealanal length	72.5	69.8–73.9 (71.8)	1.3
Pectoral-fin origin to anal fin	49.6	47.0–51.2 (48.9)	1.4
Pectoral-fin origin to pelvic fin	27.3	25.2–28.7 (26.6)	1.0
Pelvic-fin origin to anal fin	23.4	21.2–24.5 (23.0)	0.9
Dorsal-fin height	16.4	16.2–19.0 (17.3)	0.8
Anal-fin height	15.0	14.2–17.3 (15.5)	0.7
Pectoral-fin length	17.1	16.7–19.2 (17.9)	0.8
Pelvic-fin length	15.2	14.2–16.3 (15.3)	0.5
Length of upper caudal-fin lobe	21.5	20.6–23.7 (22.1)	0.9
Length of middle caudal-fin rays	13.7	12.3–14.1 (13.3)	0.5
Length of caudal peduncle	20.1	18.3–22.2 (20.4)	1.0
Depth of caudal peduncle	11.4	10.4–12.7 (11.5)	0.6
In % HL			
Snout length	29.0	29–32 (30.4)	0.9
Eye diameter	16.6	17–20 (18.3)	0.9
Interorbital width	39.3	36–41 (38.2)	1.2
Head width ₁ at anterior margin of eyes	42.6	40–45 (42.6)	1.2
Head width ₂ at posterior margin of eyes	50.6	50–55 (51.6)	1.5
Head width ₃ at middle of opercle	60.8	57–65 (60.4)	2.1
Head depth ₁ at through eye	45.9	45–51 (47.1)	1.5
Head depth ₂ at nape	62.9	62–68 (64.8)	1.7
Snout width at nostrils	38.1	36–40 (38.0)	1.1
Snout depth at nostrils	34.3	32–38 (34.0)	1.8
Width of mouth gape	31.8	27–38 (29.6)	1.3
Length of mouth gape	28.9	27–30 (28.1)	0.9

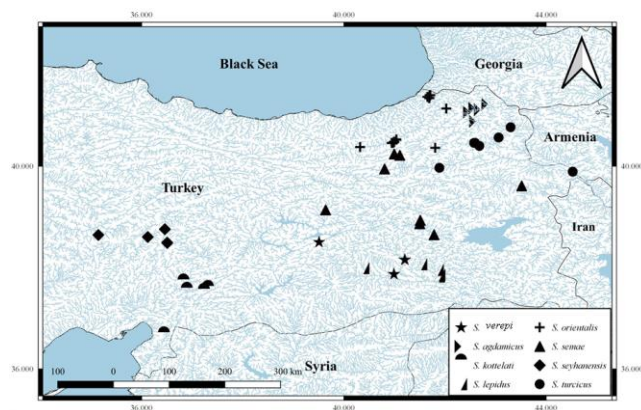


Figure 6. Distribution of *Squalius* species in eastern Turkey.

Sexual dimorphism: There are small tubercles on head in males.

Coloration: In life, general body color silvery, pelvic, anal and pectoral and anal fins yellowish, dorsal and caudal fins light greyish. There are a few orange pigments on anal fin rays. Dorsal fin with numerous black pigments on rays and membranes. A black bar behind the opercle. Formalin-fixed adults and juveniles grey on the back and upper part of flank, yellowish on the belly. Dorsal and caudal fins dark grey; pectoral, pelvic and anal fins yellowish. Scale pockets with dark grey or blackish spots, and not covered by the posterior margin of preceding scales (Fig. 7). There are a few dark grey or blackish pigments along the posterior margin of each flank scale. Anal, pelvic and pectoral fins hyaline. Dorsal fin with a few black pigments on rays and membrane (Fig. 3-5).

Etymology: This species is named in honor of Prof. Dr. Bülent Verep, who has always supported me throughout my research.

Distribution: *Squalius verepi* is presently known from Lake Hazar basin and Batman and Akçayır streams (Tigris River drainages) in southeast Turkey (Fig. 6). See Figure 7 for habitat of *S. verepi*. Its maximum known size is 181 mm SL. Larger individuals probably can be found in nature but most likely there is a propensity for smaller fish.



Figure 7. Turkey: Stream Behremas, type locality of *Squalius verepi*. Photo by BY.

DISCUSSION

In this study, species belonging to the genus *Squalius*, which are distributed in the Lake Hazar, and Kueik, Tigris and Euphrates rivers, were examined. As a result of this study, one species (*Squalius berak*) from the Kueik River, three species (*S. semae*, *S. seyhanensis*, *S. lepidus*) from the Euphrates River, two species (*S. verepi* and *S. lepidus*) from Tigris River and one species (*S. verepi*) from Lake Hazar were determined. In addition, in the distribution area of *S. berak* is restricted to the Queik River. The differences of *Squalus verepi* between the above species are given in the diagnosis section. *Squalius verepi* also differs from the species (*S. agdamicus* [Kura River], *S. turcicus* [Aras River] and *S. orientalis* [Coruh River]) found in adjacent waters. *Squalius verepi* is distinguished from *S. turcicus* and *S. agdamicus* by the presence orange pigments on anal-fin rays in live

individuals (vs. absent) and fewer dark grey or blackish pigments along posterior edge of each flank scale (a few, vs. numerous). *Squalius verepi* is further distinguished from *S. agdamicus* by having a smaller mouth gape (length of mouth gape 27–30% HL, vs. 28–36). *Squalius verepi* is further distinguished from *S. turcicus* by having a deeper body (depth at dorsal-fin origin 22–26% SL mean 24.4, vs. 20–23 mean 21.4) and a smaller mouth gape (length of mouth gape 27–30% HL, vs. 31–36). *Squalius verepi* is distinguished from *S. orientalis* by having a fewer dark grey or blackish pigments on the posterior edge of each flank scale (a few, vs. numerous), fewer branched anal-fin rays (7½-8½, mode 8, vs. 8½-9½, mode 9) and a smaller mouth gape (length of mouth gape 27-30% HL, vs. 31-36).

Comparative material: Materials of *Squalius* species examined other than those below are listed by Turan et al. (2009; 2013, 2017), Bayçelebi (2019).

Squalius agdamicus: FFR00595, 12, 100-186 mm SL; Turkey: Ardahan prov.: Kura River, 41.116N 42.701E. -FFR00637, 5, 107-137 mm SL; Turkey: Ardahan prov.: stream Ölçeksuyu at Ölçek village, 39.349N 30.038E. -FFR00638, 5, 95-115 mm SL; Turkey: Ardahan prov.: stream Açıkyazı at Açıkyazı village, 41.144N 42.591E. -FFR00639, 4, 166-222 mm SL; Turkey: Ardahan prov.: stream Hanak at Hanak, 41.225N 42.847E. -FFR00684, 9, 100–150 mm SL; Turkey: Ardahan prov.: stream Şimşilik at Göle, 40.885N 42.606E. -FFR00687, 12, 110–152 mm SL; Turkey: Ardahan prov.: Kura River, at Yalnızçam, 41.071N 42.485E. -FFR00754, 8, 46-158 mm SL; Turkey: Ardahan prov.: Kura River, 41.117N 42.701E.

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REFERENCES

- Battalgil, F. (1942).** Contribution à la connaissance des poissons des eaux douces de la Turquie. *Istanbul Üniversitesi Fen Fakültesi Mecmuası, Seri B, Tabii İlimler*, 7, 287-306.
- Bayçelebi, E. (2019).** Taxonomic Revision of Genus *Squalius* Distributing in Turkey. PhD Thesis. Recep Tayyip Erdogan University, Institute of Science and Technology, Rize, Turkey pp: 135.
- Berg, L.S. (1948-1849).** [Freshwater fishes of the U.S.S.R. and adjacent countries]. Izdatelstvo Akademii Nauk USSR, Moskva & Leningrad, vol. 1 (1948), vols. 2-3 (1949) [in Russian; translation: Israel Program for Scientific Translations, Jerusalem, 1965].
- Bogutskaya, N. G. (1994).** A description of *Leuciscus lepidus* (Heckel, 1843) with comments on *Leuciscus* and leuciscine-aspinine relationships. *Annalen des Naturhistorischen Museums in Wien*, 96, 599–620.
- Filippi, F de. (1865).** Note d'un voyage in Persia nel 1862. Milano, viii + 396 pp.
- Hanko, B. (1924).** Fische aus Klein-Asien. *Annales Historica-Naturales Musei Nationalis Hungarici*, 21, 137-158.
- Heckel, J.J. (1843).** Ichthyologie. In: J. von Russeger. Reisen in Europa, Asien und Africa, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder unternommen in den Jahren 1835 bis 1841. Erster Band. Reise in Griechenland, Unteregyp ten, im nördlichen Syrien und südöstlichen Kleinasien. Schweizerbart, Stuttgart, pp 225-1079.
- Karaman, M.S. (1972).** Süsswasserfische der Türkei. 9. Revision einiger kleinwüchsiger Cyprinidengattungen Phoxinellus, Leucaspius, Acanthobrama usw. aus Südeuropa, Kleinasien, Vorder Asien und Nordafrika. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 69, 115-155.
- Kottelat, M. & Freyhof, J. (2007).** *Handbook of European freshwater fishes*. Kottelat, Cornol & Freyhof, Berlin, xii+660 pp.
- Nordmann, A de. (1840).** Prodrome de l'ichthyologie pontique. Pp. 353–549, 32 pls. in: A. de Sainson, F. Le Play, A. Huot, J. H. Léveillé, D. A. M. Raffet, L. Rousseau, A. de Nordmann & A. du Ponceau, Voyage dans la Russie méridionale et la Crimée, par la Hongrie, la Vallachie et la Moldavie, exécuté en 1837, sous la direction de M. Anatole de Démidoff. Tome troisième. Observations sur la faune pontique. Bourdin, Paris, 756 pp
- Özuluğ, M. & Freyhof, J. (2011).** Revision of the genus *Squalius* in Western and Central Anatolia, with description of four new species (Teleostei: Cyprinidae). *Ichthyological Exploration of Freshwaters*, 22, 107-148.
- Turan, D., Yilmaz, B. & Kaya, C. (2009).** *Squalius kottelati*, a new cyprinid species (Teleostei: Cyprinidae) from Orontes River, Turkey. *Zootaxa*, 2270, 53-62.
- Turan, D., Kottelat, M. & Bayçelebi, E. (2013).** Two new species of *Squalius*, *S. adanaensis* and *S. seyhanensis* (Teleostei: Cyprinidae), from the Seyhan River in Turkey. *Zootaxa*, 3637, 308-324.
- Turan, D., Kottelat, M. & Bayçelebi, E. (2017).** *Squalius semae*, a new species of chub from the Euphrates River, Eastern Anatolia (Teleostei: Cyprinidae). *Zoology in the Middle East*, 63, 33-42.