

SPIXIANA	44	2	203–208	München, December 2021	ISSN 0341-8391
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***Schizothorax prophyllax* (Pietschmann, 1933)  
and *Capoeta mauricii* Küçük, Turan, Şahin & Gülle, 2009,  
junior synonyms of *Capoeta pestai* (Pietschmann, 1933)**

(Teleostei, Cyprinidae)

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Çiçek, E., Eagderi, S. & Sungur, S. 2021. *Schizothorax prophyllax* (Pietschmann, 1933) and *Capoeta mauricii* Küçük, Turan, Şahin & Gülle, 2009, junior synonyms of *Capoeta pestai* (Pietschmann, 1933) (Teleostei, Cyprinidae). Spixiana 44 (2): 203–208.

*Schizothorax prophyllax* (Pietschmann, 1933) and *Capoeta pestai* (Pietschmann, 1933) were described from the Egirdir Lake, western Mediterranean basin and *C. mauricii* Küçük, Turan, Şahin & Gülle, 2009 from the Beyşehir Lake, the Konya endorheic basin. This study aimed to test the synonymy hypothesis of *C. mauricii* and *C. pestai* as suggested based on previous studies and to clarify the taxonomic status of *S. prophyllax*. According to the results, *S. prophyllax* has been erroneously described based on large size specimens of *C. pestai* and actually the genus *Schizothorax* never exists in Turkey. Moreover, we were unable to find any differences between *S. prophyllax*, *C. mauricii* and *C. pestai*, therefore, we conclude all three names define the same species, and treat *S. prophyllax* and *C. mauricii* as junior synonyms of *C. pestai*.

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### Introduction

*Schizothorax prophyllax* (Pietschmann, 1933) and *Capoeta pestai* (Pietschmann, 1933) were described from the Egirdir Lake, western Mediterranean basin, Turkey by Pietschmann (1933). *Capoeta pestai* is also found in other Turkish inland water basins, including the Konya (e. g. Lake Beyşehir and Yeşildere Stream) and Tuz Lake (e. g. Melendiz River) (Sivrikaya 2007, Küçük et al. 2007, 2009a, Turan 2008, Özcan & Turan 2009, Özdemir & Erk'akan 2012, Özdemir 2013). Later, those populations of *C. pestai* from the Beyşehir Lake, the Konya endorheic basin were described as *C. mauricii* Küçük, Turan, Şahin &

Gülle, 2009 based on some morphological characters (Küçük et al. 2009a). However, the used diagnostic characters to discriminate *C. mauricii* from *C. pestai* were reported not taxonomically reliable to discriminate the members of the genus *Capoeta* Valenciennes, 1842 and are considered to be intraspecific variable characters (Özdemir 2013, Bektaş et al. 2019). In addition, Özdemir (2013), Geiger et al. (2014), and Bektaş et al. (2017, 2019) showed that the mitochondrial COI and Cyt b gene sequences of *C. mauricii* and *C. pestai* are identical, suggesting synonymy of *C. mauricii* and *C. pestai*.

*Schizothorax* Heckel, 1838 is a genus of cyprinid distributing in Central and East Asia. This genus

consists of the medium-sized species known as snow-trout inhabiting clean, well-oxygenised waters as those of trout (Coad 2019). Despite many fieldworks conducted on the lake Eğirdir and other water bodies of the Konya endorheic basin, no success reported catching of any specimens of this genus (Kosswig & Geldiay 1952, Balık et al. 2006, Çubuk et al. 2007, Küçük et al. 2009b). In addition, the closest reported population of the genus *Schizothorax* is from the Dasht-e Kavir basin of Iran, very far from the Eğirdir Lake (Jouladeh Roudbar et al. 2015, Esmaili et al. 2018). Based on the above-mentioned background, this study aimed to compare the original description of *S. prophyllax* given by Pietschmann (1933) with those of *C. pestai*, and morphological characteristics of *C. pestai* and *C. mauricii* to test the hypothesis that all three names define the same species.

### Material and methods

A total of 30 specimens of *C. pestai* (n=15) and *C. mauricii* (n=15) were collected from the Eğirdir and Beyşehir Lakes i. e. their type localities, respectively. After anesthesia, fishes were fixed in 10 % buffered formaldehyde. Measurements were made with a dial caliper to the nearest 0.1 mm. All measurements were made a point to point and never by projections. Methods for counts and measurements followed Kottelat & Freyhof (2007) as same as Küçük et al. (2009a). Standard length (SL) was measured from the tip of the snout to the base of the hypural complex. The length of the caudal peduncle was measured from behind the base of the posterior anal fin ray to the base of the hypural complex, at mid-height of the caudal fin base. Scales along the lateral line were counted from immediately in front of the pectoral girdle to the caudal fin base (total lateral line scales). The last two branched rays articulating on a single pterygiophore in the dorsal and anal fins are counted as one ray versus 1<sup>1</sup>/<sub>2</sub> rays in Küçük et al. (2009a). Therefore, the 5<sup>1</sup>/<sub>2</sub> dorsal fin rays quoted in Küçük et al. (2009a) corresponds to 5 in this study. Gill rakers were counted on the outer margin of the anterior gill arch. We also used the morphometric and meristic data of *S. prophyllax*, *C. pestai* and *C. mauricii* from their original descriptions

(Pietschmann 1933, Küçük et al. 2009). Since, no type materials are available for *S. prophyllax*, therefore we measured the collected *C. pestai* based on Pietschmann (1933) to compare it with *S. prophyllax*.

**Abbreviations used:** HL, lateral head length; SL, standard length; SnL, Snout length; NUIC, Ichthyology Collections of Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey; IMNRF, Ichthyological Museum of the Faculty of Natural Resources – University of Tehran; FFR, Zoology Museum of the Faculty of Fisheries, Rize University, Turkey.

**Material examined.** *Capoeta mauricii*: FFR 3800, 138 mm SL, Turkey, Konya Prov.: Sariöz Stream, 1 km west of Beyşehir, Lake Beyşehir drainage. – UIC-1901, 15, 90.2–268.0 mm SL, Turkey, Konya Prov.: Sariöz Stream, Beyşehir Lake drainage. – NUIC-1503, 7, 44.3–62.1 mm SL, Turkey, Aksaray Prov.: Melendiz River, Lake Tuz drainage.

*Capoeta pestai*: NUIC-1902, 15, 84.2–234.0 mm SL, Turkey, Isparta Prov.: Eğirdir Lake, western Mediterranean basin.

*Schizothorax pelzami*: IMNRF-1078, 10, 48.6–141.2 mm SL; Iran, Semnan Prov.: Cheshmeh-Ali Spring, Dasht-e Kavir basin, 36°16'15" N 54°06'30" E.

### Results

The meristic counts of the collected specimens of *C. pestai* and *C. mauricii*, and those of *S. prophyllax* and *C. mauricii* from their original descriptions (Pietschmann 1933, Küçük et al. 2009) are given in Table 1. The body proportions of the collected specimens of *C. pestai* and *C. mauricii* and those from Küçük et al. (2009) are shown in Table 2.

Description of *S. prophyllax* is based on four syntypes ranging 273–588 mm in TL without any picture or drawing (Pietschmann 1933). Eğirdir snow-trout, *S. prophyllax*, was described by having 3 unbranched and 8 branched rays in dorsal fin (3 and 8 in *C. pestai*, respectively), 3 unbranched and 5 branched rays in anal fin (3 and 5 in *C. pestai*, respectively), complete lateral line with 88 scales (78–92 in *C. pestai*), head length of 4.1–4.9 (4.1–4.6 in *C. pestai*) times in TL,

**Table 1.** Meristic data of *Schizothorax prophyllax*, *Capoeta pestai* and *C. mauricii* based on their original description given by Pietschmann (1933) and Küçük et al. (2009a) and the examined specimens (NUIC-1902, n=15, and NUIC-1901, n=15; \* = Küçük et al. 2009b; \*\* = Pietschmann, 1933).

Parameters	<i>C. pestai</i> Lake Eğirdir basin NUIC-1902	<i>C. mauricii</i> Lake Beyşehir basin NUIC-1901	<i>C. pestai</i> *	<i>C. mauricii</i> *	<i>C. pestai</i> **	<i>S. prophyllax</i> **
Dorsal fin rays	III/8	III/8–9	III/8	III/8	III/8	III/8
Anal fin rays	III/5	III/5	III/5	III/5	III/5	III/5
Scales on lateral line	78–92	78–90	78–91	80–87	88	88
Gill rakers	16–17	15–18	16–18	16–18	–	–

caudal of 1.0–1.4 (1.1–1.4 in *C. pestai*) times in HL, pectoral-length of 1.5–1.8 (1.3–1.7 in *C. pestai*) times in HL, greatest body depth, slightly before the dorsal fin origin, 1.1–1.3 (1.0–1.3 in *C. pestai*) times in HL, head width of 5.6–6.3 (5.3–6.4 in *C. pestai*), smallest interorbital width 3.2 (3.1 in *C. pestai*), snout length of 2.5–2.8 (2.7–3.5 in *C. pestai*), and horizontal eye diameter of 7.0–9.4 (5.8–7.8 in *C. pestai*) times in HL. Eye diameter of 2.8–3.4 (1.6–3.0 in *C. pestai*) times in SnL, and two developed lobes on each side of the mouth (fleshy and well-developed in *C. pestai*) similar to *Schizothorax dipogon* Regan (now as *Ptychobarbus dipogon* (Regan, 1905)).

**Colouration.** Head and body flanks dark brown without any pattern with light bluish shine, lighter

toward the belly with white colouration (Fig. 1d).

We failed to find any non-overlapping differences between *C. pestai* and *C. mauricii* in the characters given by Küçük et al. (2019) to discriminate *C. mauricii* from *C. pestai*, or any other characters studied here (Tables 1–2). All morphometric and meristic characters of *C. mauricii* largely overlap with those of *C. pestai*. In addition, there are no differences in colour patterns (Fig. 1). The colouration of *C. pestai* from the Melendiz River, Tuz Lake basin showed a similar pattern with those of *C. mauricii* from the Beyşehir Lake. In addition, all morphometric and meristic data of *S. prophyllax* overlap with those of *C. pestai* and *C. mauricii* (Küçük et al. 2009a).

**Table 2.** Morphometric measurements of *Capoeta pestai* and *C. mauricii* based on the examined specimens (NUIC-1902, n=15, and NUIC-1901, n=15, respectively) and Küçük et al. (2009b); \* = Küçük et al. (2009b).

	<i>C. pestai</i> *	<i>C. mauricii</i> *	<i>C. pestai</i> Lake Eğirdir NUIC-1902	<i>C. mauricii</i> Lake Beyşehir NUIC-1901
Standard length (mm)	105.0–218.0	109.0–234.0	84.2–234.0	90.2–268.0
<b>In percentages of SL</b>				
Head length	25.0–29.0 (26.9)	24.8–28.4 (26.8)	24.6–28.8 (26.2)	24.9–28.7 (26.1)
Body depth of dorsal fin origin	21.7–26.0 (23.8)	24.1–27.1 (25.8)	22.1–26.5 (24.2)	21.7–26.1 (24.5)
Predorsal length	52.7–56.0 (54.5)	51.8–54.8 (53.2)	49.4–54.0 (52.8)	52.3–55.5 (54.0)
Prepelvic length	53.5–57.3 (55.1)	53.4–57.3 (54.9)	52.1–56.8 (53.8)	51.7–56.9 (53.6)
Preanal length	74.8–78.0 (76.4)	74.4–79.0 (76.4)	70.4–78.3 (75.3)	72.3–76.8 (74.5)
Dist. from pectoral fin origin to anal fin	50.1–53.4 (51.8)	48.8–54.3 (51.1)	47.8–54.1 (49.8)	48.3–54.8 (50.5)
Dist. from pectoral fin origin to pelvic fin	26.7–32.0 (30.2)	28.4–31.8 (29.5)	27.6–31.7 (29.3)	27.8–30.3 (29.8)
Dist. from pelvic fin origin to anal fin	19.7–23.0 (21.5)	20.6–24.5 (22.0)	19.7–23.6 (21.5)	19.9–22.8 (21.6)
Dorsal fin height	15.6–23.2 (20.4)	18.3–23.2 (20.7)	16.8–22.5 (19.7)	15.9–23.0 (19.8)
Anal fin length	14.3–21.6 (17.7)	12.9–22.5 (16.1)	14.8–21.5 (17.6)	13.9–20.8 (18.8)
Pectoral fin length	16.3–20.7 (18.8)	16.3–18.8 (17.4)	16.8–20.3 (18.3)	17.1–19.7 (17.8)
Pelvic fin length	13.3–16.7 (15.1)	13.7–15.2 (14.6)	14.1–16.8 (15.1)	13.4–16.3 (14.8)
Upper caudal-fin lobe	18.7–24.6 (22.1)	19.5–23.8 (21.6)	18.6–24.1 (21.7)	18.1–23.6 (20.8)
Length of caudal peduncle	15.9–18.3 (17.1)	17.4–19.8 (18.3)	16.1–20.0 (18.4)	15.9–19.9 (18.1)
<b>In percentages of HL</b>				
Snout length	34.0–38.8 (36.8)	35.2–37.4 (36.4)	35.1–37.8 (35.9)	34.3–38.1 (36.1)
Eye diameter	13.2–19.9 (16.5)	14.0–17.6 (15.8)	13.8–18.7 (16.2)	13.6–18.7 (16.3)
Interorbital distance	30.2–34.6 (32.1)	31.7–35.3 (33.3)	31.3–35.7 (32.9)	31.2–35.6 (33.6)
Head width (at ant. margin of eyes)	34.7–42.3 (38.3)	34.8–40.6 (38.4)	35.1–41.9 (38.1)	34.5–41.7 (37.3)
Head width (at post. margin of eyes)	44.5–56.3 (50.8)	49.7–52.7 (51.6)	47.1–53.9 (50.6)	45.4–54.6 (49.6)
Head width (at operculum)	53.6–64.6 (58.3)	54.9–62.8 (58.1)	53.4–59.8 (57.5)	53.1–61.2 (56.6)
Head depth (at interorbital region)	44.4–48.8 (46.9)	43.7–48.6 (46.2)	44.9–50.8 (48.9)	44.8–49.5 (47.4)
Head depth (at occiput)	62.1–71.3 (66.4)	63.1–68.0 (65.0)	62.5–69.3 (66.1)	62.0–69.7 (65.4)
Snout width (at nostrils)	30.2–37.7 (33.8)	32.0–35.9 (34.0)	31.2–36.8 (33.4)	31.7–35.9 (33.4)
Snout depth (at nostrils)	30.1–37.1 (33.3)	29.2–33.7 (31.4)	32.3–35.9 (34.1)	29.2–33.7 (32.3)
Distance between barbels	24.7–31.0 (26.8)	22.7–27.7 (25.6)	23.9–28.6 (25.7)	23.7–29.8 (25.4)
Length of barbels	13.4–19.3 (15.7)	11.8–14.9 (13.4)	13.1–17.3 (14.9)	12.3–18.8 (14.6)
<b>In percentages of postorbital distance</b>				
Snout length	1.30–1.41 (1.36)	1.45–1.56 (1.50)	1.39–1.51 (1.39)	1.40–1.49 (1.44)

## Discussion

*Schizothorax prophyllax* has not been reported from the Eğirdir Lake after its description. Kosswig & Geldiay (1952) listed the fish fauna of the Eğirdir Lake pointing out *S. prophyllax* has not been caught in any excursion and also never known by local fishermen; therefore, they called its occurrence a mystery. In addition, many studies on the Eğirdir Lake ichthyofauna had no success to catch this species or any other congener (Kesici & Kesici 2006, Balık et al. 2006, 2007, Çubuk 2007, Küçük et al. 2009b). Furthermore, Küçük et al. (2009b) and Yerli et al. (2013) mentioned that *S. prophyllax* may be a synonym of *C. pestai* however, without providing any evidence. The closest reported population of the genus *Schizothorax* is from the center of Iran with more than 2000 km distance from the Eğirdir Lake (Jouladeh Roudbar et al. 2015, Esmaeili et al. 2018) with many geographical barriers and no reported *Schizothorax* species in basins between them. Based on the above-mentioned background, *S. prophyllax* does not exist in the lake Eğirdir of Turkey; but it needs to be clarified which species was identified erroneously as *S. prophyllax*.

The members of the genus *Schizothorax* are found from Iran eastward up to China, favouring mountainous streams, but occasionally found in lowlands. This genus is characterised by having an elongate and almost cylindrical body, very small scales, over 100 in the series next to the lateral line, the vent and anal fin base are sheathed with enlarged scales and edge of the gill opening, four barbels (rostral and maxillary), mouth inferior or subterminal, lower jaw may have a horny sheath, and 6 branched anal fin rays (not 5 as in related genera such as *Capoeta*) (Coad 2019) (Fig. 1a). We found all meristic characters of *S. prophyllax* and *C. pestai* to be overlapped. In addition, *S. prophyllax* has 88 scales in the lateral line with 5 branched rays of the anal fin that are not in agreement with characterised traits of the genus *Schizothorax*. In terms of morphometric characters, based on the calculation of similar characters to those of original descriptions of *S. prophyllax*, we also found all data overlapping with those of *C. pestai*. As conclusion, *S. prophyllax* does not exist in Lake Eğirdir and was erroneously described based on large size specimens of *C. pestai*.

Küçük et al. (2009b) pointed out that both *C. mauricii* and *C. pestai* are similar in general body shape and that *C. mauricii* is distinguished from *C. pestai* by (1) having plain brown head in adult *C. mauricii* vs. numerous black spots on head of *C. pestai*; a few black spots on body of *C. mauricii* (<170 mm SL) vs. numerous in *C. pestai*; plain body in *C. mauricii* (>200 mm SL) vs. very few black spots on back of

*C. pestai*, but numerous in larger *C. pestai*, (2) shape of anal fin in females, (3) elevated predorsal keel in males, (4) scale number between dorsal fin origin and lateral line (18–22 in *C. mauricii* vs. 16–19 in *C. pestai*), (5) postdorsal distance, (6) some cephalic skeletal structures, and (7) scale number between anal fin origin and lateral line (11–14 in *C. mauricii* vs. 9–12 in *C. pestai*). Some of the used characters, e.g. colour pattern to discriminate *C. mauricii* from *C. pestai*, are not taxonomically reliable and intraspecific in the members of the genus *Capoeta* (Özdemir 2013, Bektaş et al. 2019) and all morphometric and meristic characters of *C. mauricii* largely overlap with those of *C. pestai* (Table 1 and 2). Similar results reported by Özdemir (2013) suggesting *C. mauricii* as a junior synonym of *C. pestai*. Different colour pattern between population of *C. pestai* in Eğirdir and Beyşehir lakes may be associated with their adaptation to their environmental features. However, those of *C. mauricii* from the Beyşehir Lake and *C. pestai* of the Tuz Lake have similar colour patterns. *Capoeta pestai* is a widespread species distributed in the western Mediterranean, Konya and Tuz Lake basins of Turkish inland water and in a species with such a wide distribution area, we expect morphological differences between populations found in different environmental conditions (Marcil et al. 2006). In addition, those discriminative head skeletal elements of *C. mauricii* from *C. pestai* namely infraorbital bones, preopercle, dentary and ascending dorsal process of maxilla in both species are similar in shape as presented in Küçük et al. (2009a) (figs 6–8). The used terms to compare these skeletal elements are short, wide, narrow and long without providing any quantitative data. These criteria are size-dependent as Küçük et al. (2009a,b) used different sized specimens (figs 6–8), therefore they cannot be considered reliable characters since they can be intraspecific and even different in various ontogenic stages.

Based on mtDNA COI gene sequence (Özdemir 2013), K2P genetic distance between *C. pestai* from the Eğirdir and Taşkale (Gödet Dam) Lakes and the Melendiz River, and *C. mauricii* from the Beyşehir Lake ranged 0.0–0.2 %. In addition, based on Gieger et al. (2014), the genetic distance between *C. mauricii* from the Beyşehir Lake and *C. pestai* from the Eğirdir Lake has been estimated as 0.7 %. Bektaş et al. (2017, 2019) also showed similar results based on the mitochondrial COI and Cyt b genes suggesting synonymy of *C. mauricii* and *C. pestai*.

As we were unable to find any differences between *S. prophyllax*, *C. mauricii* and *C. pestai*, we conclude these three nominal species represent one species and therefore, *S. prophyllax* and *C. mauricii* are treated as junior synonyms of *C. pestai*.



Fig. 1. Lateral view of **a.** *Schizothorax pelzami*, IMNRF-1078-7, 141.2 mm SL, Iran, Semnan Prov.: Cheshmeh-Ali Spring, Dasht-e Kavir basin; **b.** *Capoeta mauricii*, NUIC-1901, 94.8 mm SL, Turkey, Konya Prov.: Sariöz Stream, Beyşehir Lake drainage; **c.** *C. pestai*, NUIC-1503, 62.1 mm SL, Turkey, Aksaray Prov.: Melendiz River, Lake Tuz basin; and **d.** *C. pestai*, Turkey, Isparta Prov.: Eğirdir Lake, western Mediterranean basin (not catalogued).

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