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Capoeta kosswigi Karaman, 1969 a junior synonym of *Capoeta damascina* (Valenciennes, 1842) (Teleostei: Cyprinidae)

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Abstract: *Capoeta kosswigi* was described from Lake Van basin, Turkey, being close to C. *damascina* and *C. umbla*. It is distinguished from them by a pointed snout and a small horseshoe-shaped mouth, and differing from *C. damascina* by having smaller scales, and from the *C. umbla* by processing larger scales. In this study, we tested the suggested synonymy hypothesis of *C. kosswigi* and *C. damascina* by comparing the morphometric and meristic data. The results revealed that all morphometric and meristic characters of *C. kosswigi* overlap with those of *C. damascina*. In line with previous molecular studies that COI, cyt*b* and 16S rDNA genes of *C. kosswigi* and *C. damascina* are identical, therefore, without having any diagnostic characters, we treat *C. kosswigi* as a junior synonym of *C. damascina*.

Key words: Lake Van basin, *Capoeta umbla*, interspecific variation, taxonomy

1. Introduction

Capoeta kosswigi was described from Lake Van, an endorheic basin between the Euphrates and Tigris drainages in eastern Anatolia (Karaman, 1971). It was described as a subspecies of *Capoeta capoeta* by having narrow head; smaller, horseshoe-shaped mouth; 19–24 gill rakers, well-ossified last dorsal-fin spine with 2/3–3/4 of its posterior margined with serra, straight or slightly concaved outer margin of dorsal-fin; small scales with 70–88 lateral line scales (Karaman, 1971). It is mentioned to be close to *C. c. damascina* and *C.c. umbla*; but distinguished by having a pointed snout (vs. rounded snout) and a small horseshoe-shaped mouth (vs. straight mouth), and differing from *C. c. damascina* by having smaller scales, and from *C. c. umbla* by having larger scales (Karaman, 1971). Later all three abovementioned subspecies were elevated to the species rank, however, some recent studies suggested the synonymy of these three species based on their low genetic divergences (Turan, 2008; Levin et al., 2012; Ghanavi et al., 2016; Zareian and Esmaeili, 2017; Bektaş et al., 2017, 2019; Zareian et al., 2018; Kaya, 2019). Therefore, this study aims to test this synonymy hypothesis by comparing the morphometric and meristic data of *C. kosswigi* and *C. damascina*.

2. Materials and methods

The specimens of *C. kosswigi* were sampled from Lake Van basin and, those of *C. damascina* from Sürgü Stream, Merzimen Stream and Atatürk Dam Lake (Euphrates River drainages) and Sapkanlı Pond (Orontes basin) using electrofishing device and benthic-pelagic gillnets.. Fishes were anesthetized with ethyl 3-aminobenzoate methanesulfonate (MS-222), and fixed into 10% buffered formaldehyde and then stored in 70% ethanol after two weeks. Morphometric characters were measured using a dial calliper to the nearest 0.1 mm based on Armbruster (2012). Standard length (SL) was measured from the tip of the snout to the base of the hypural complex. The pierced scales along the lateral line were counted from immediately behind the operculum to the posterior most one at the base of the caudal-fin rays (i.e. posterior margin of the hypurals), including 2 or 3 scales located on the bases of the caudal-fin rays. Gill rakers were counted on the outer margin of the anterior gill arch. The last pair of the branched rays articulating on a single pterygiophore in the dorsal and anal fins were recorded as "1½".

3. Results

See Figure for general appearances of *C. kosswigi* and *C. damascina* and Tables 1 and 2 for their morphometric measurements and meristic counts, respectively. We could not find any nonoverlapping differences between *C. kosswigi* and *C. damascina* (Tables 1 and 2) i.e. all morphometric and meristic characters as well as other examined morphological features particularly those

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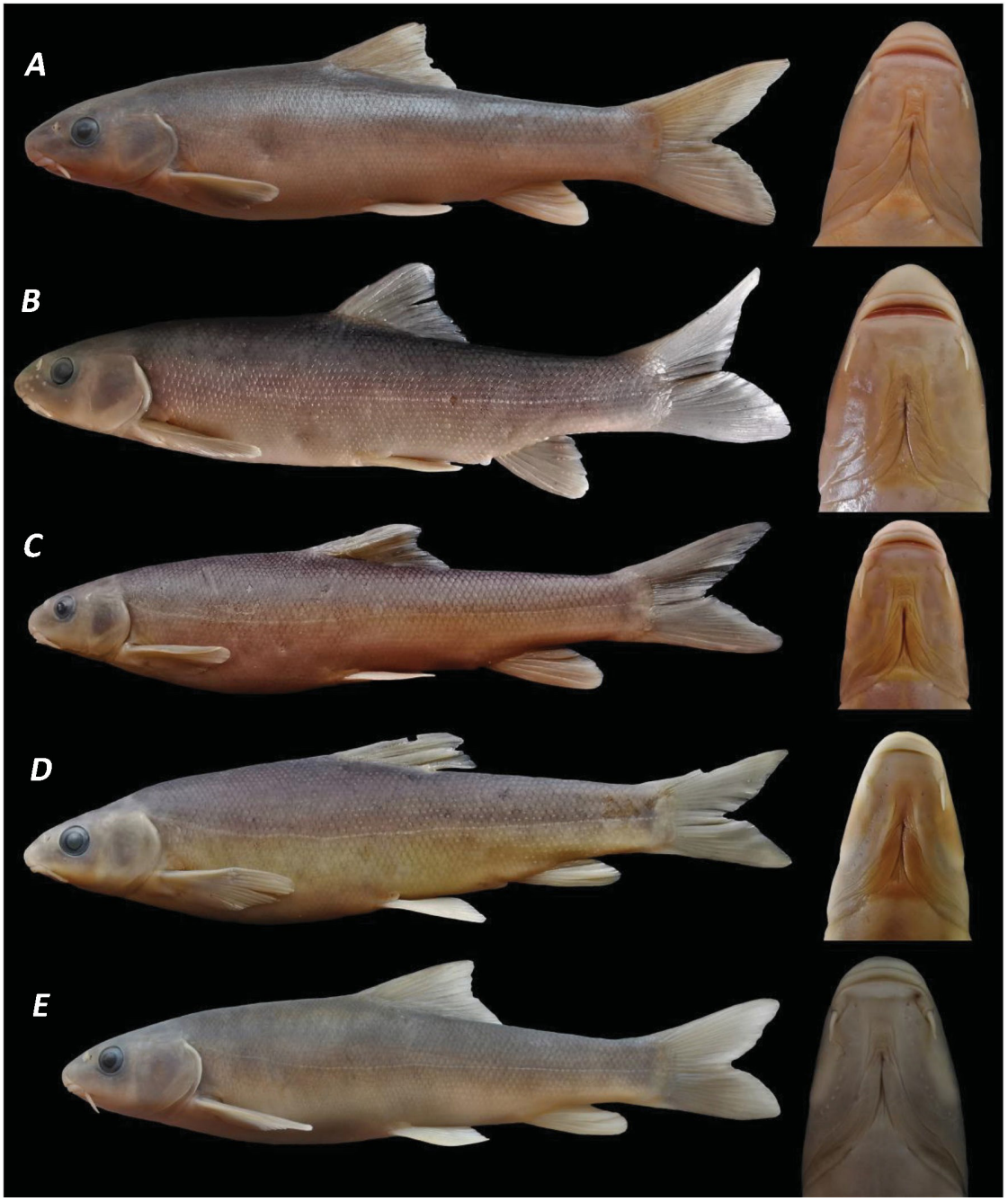

Figure. Lateral view and mouth shape of (A) *Capoeta damascina,* NUIC-1519, 158.9 mm SL; Malatya prov.: Sürgü Stream. Tigris-Euphrates basin (B) *C. damascina*, NUIC-1520, 163.5 mm SL; Gaziantep prov.: Merzimen Stream, Tigris-Euphrates basin (C) *C. damascina*, NUIC-1521, 152.3 mm SL; Adıyaman prov.: Input of Atatürk Dam Lake, Tigris-Euphrates basin (D) *C. damascina*, NUIC-1817, 127.3 mm SL; Kilis prov.: Sapkanlı Pond, Orontes basin (E) *C. kosswigi*, NUIC-1907, 179.3 mm SL; Van prov.: Karasu Stream, Lake Van basin (All from Turkey).

snout and mouth shapes (as discriminative characters of *C. kosswigi* from *C. damascina*), which show high intraspecific variation (Figure). In addition, the colour patterns of *C. kosswigi* are completely overlapped with those of *C. damascina*.

4. Discussion

Alwan (2011) reported two lineages (western and eastern) within the *C. damascina* species complex, that the western one is comprised of *C. caelestis*, *C. damascina, C. kosswigi,* and probably *C. umbla*. However, some molecular works

Table 1. Morphometric data of *Capoeta kosswigi* and *Capoeta damascina*.

	C. kosswigi (NUIC-1907)		*C. damascina* (NUIC-1519)		*C. damascina* (NUIC-1520)		*C. damascina* (NUIC-1817)		*C. damascina* (NUIC-1521)	
Morphometric characters	min-max	mean ± SD	min-max	mean ± SD	min-max	mean ± SD	min-max	mean ± SD	min-max	mean ± SD
Standard length (mm)	115.4–195.7	137.8 ± 26.2	104.8–218.1	151.5 ± 31.8	112.9–201.7	165.2 ± 27.7	89.0–150.8	120.8 ± 17.8	133.4–188.1	148.5 ± 16.3
In percent of standard length										
Head length	23.4–26.9	24.9 ± 1.1	21.2–25.2	23.6 ± 1.4	22.6–25.9	24.1 ± 1.2	23.1–25.5	24.1 ± 0.9	22.4–25.2	23.9 ± 1.0
Body depth at dorsal fin origin	20.9–25.2	23.3 ± 1.4	20.9–24.7	22.9 ± 1.1	21.6–24.6	23.2 ± 0.9	22.9–26.9	24.5 ± 1.3	20.6–26.9	23.2 ± 1.7
Predorsal length	46.2–51.0	48.8 ± 1.3	43.5–50.5	47.8 ± 2.4	45.1–50.5	47.1 ± 1.5	46.5–53.0	49.9 ± 2.0	45.8–51.3	47.9 ± 1.7
Prepelvic length	47.6–55.4	52.6 ± 2.4	48.6–53.9	51.6 ± 1.5	48.9–54.5	52.0 ± 1.9	49.9–54.8	53.3 ± 1.5	50.9–54.8	52.4 ± 1.1
Preanal length	69.4–77.2	74.2 ± 2.5	69.6–76.6	72.9 ± 2.2	70.3–76.7	73.4 ± 2.1	72.8–77.1	74.5 ± 1.4	71.7–75.4	73.7 ±1.3
Distance between pectoral-fin origin to anal fin	50.2–54.9	52.3 ± 1.8	51.3–54.9	52.8 ± 1.1	52.6–54.3	53.3 ± 0.7	51.7–56.0	54.1 ± 1.3	51.3–54.9	53.1 ±1.1
Distance between pectoral-fin origin to pelvic fin	27.6–33.3	30.7 ± 1.9	29.2–32.2	30.8 ± 0.9	30.2–32.1	31.4 ± 0.7	30.3–34.1	32.1 ± 1.3	30.1–34.1	31.1 ± 1.2
Distance between pelvic-fin origin to anal fin	19.6–23.6	21.6 ± 1.2	21.5–23.5	22.4 ± 0.7	21.5–23.4	22.4 ± 0.6	20.2–23.9	22.1 ± 1.2	20.5–23.5	22.2 ± 1.1
Dorsal-fin height	18.8–22.6	20.9 ± 1.3	18.1–23.5	19.9 ± 1.8	16.6–21.3	19.2 ± 1.4	18.6–22.9	20.8 ± 1.4	18.0–22.0	19.8 ± 1.3
Anal-fin length	14.5–20.4	17.3 ± 2.1	14.5–18.9	17.2 ± 1.3	14.1–18.8	16.0 ± 1.4	15.4–17.5	16.3 ± 0.6	16.0–18.9	17.5 ± 1.0
Pectoral-fin length	17.3–22.9	19.3 ± 1.6	17.2–20.4	18.9 ± 1.0	16.9–20.3	17.9 ± 1.1	18.0–19.9	18.9 ± 0.7	16.9–20.3	18.5 ± 1.1
Pelvic-fin length	14.7–20.8	16.5 ± 1.7	15.0–17.1	15.9 ± 0.8	14.9–17.6	15.8 ± 0.9	15.1–17.3	16.1 ± 0.8	14.1–17.6	16.1 ± 1.1
Upper caudal-fin lobe	18.3–24.9	21.7 ± 1.9	16.5–22.8	20.5 ± 2.1	21.2–26.3	23.1 ± 1.7	21.4–25.9	23.6 ± 1.2	19.9–26.3	22.5 ± 2.2
Length of caudal peduncle	16.8–20.2	18.7 ± 1.1	18.1–22.5	20.3 ± 1.5	18.1–21.4	19.4 ± 0.9	18.2–22.5	19.7 ± 1.2	18.7–22.5	20.1 ± 1.1
Depth of caudal peduncle	10.6–12.9	11.8 ± 0.7	10.9–13.1	12.0 ± 0.6	11.0–12.7	11.7 ± 0.6	11.5–13.8	12.5 ± 0.6	10.4–13.8	11.8 ± 1.0
In percent of head length										
Head depth at eye	42.5–58.6	51.7 ± 5.0	44.7–56.9	51.5 ± 3.7	50.3–55.6	52.5 ± 2.0	47.2–54.5	50.7 ± 2.5	44.7–53.9	49.9 ± 2.9
Snout length	31.4–39.2	36.2 ± 2.2	35.4–47.2	38.5 ± 3.5	36.4–40.0	38.2 ± 1.3	33.6–39.9	36.8 ± 1.7	36.3–39.9	37.8 ± 1.1
Eye horizontal diameter	15.0–21.0	18.3 ± 2.0	14.8–21.0	17.6 ± 1.7	15.8–20.0	17.7 ± 1.3	17.6–22.1	20.1 ± 1.4	16.7–19.1	17.7 ± 0.8
Interorbital width	32.7–49.1	39.6 ± 4.2	37.8–46.4	42.5 ± 2.9	37.4–44.1	40.8 ± 1.7	40.8–45.0	41.5 ± 1.3	39.0–45.0	41.7 ± 1.7
Postorbital distance	43.5–53.7	49.0 ± 3.1	47.4–54.1	50.9 ± 2.1	46.4–51.5	49.3 ± 1.5	45.9–52.3	48.1 ± 2.4	45.1–52.7	49.2 ± 2.2
Maximum head width	57.9–68.9	62.4 ± 3.4	59.3–70.8	64.4 ± 3.8	59.3–67.6	63.4 ± 2.7	59.5–67.7	62.9 ± 2.5	58.9–67.7	62.4 ± 2.9

Table 2. Meristic data of *Capoeta kosswigi* and *Capoeta damascina*.

Examined materials	Lateral line scales							
	75	76	77	78	79	80	81	82
Capoeta kosswigi NUIC-1907	1	1	4	7		3	2	2
Capoeta damascina NUIC-1519			7	5	2	4		2
Capoeta damascina NUIC-1520			1	7		2		10
Capoeta damascina NUIC-1521		4		11		3		2
Capoeta damascina NUIC-1817		6	2	10		2		
	Scales above lateral line					Scales below lateral line		
	16	17	18	19	20	7	8	9
Capoeta kosswigi NUIC-1907	2		11	5	2		13	7
Capoeta damascina NUIC-1519	4	2	10	4			9	11
Capoeta damascina NUIC-1520			18	2			11	9
Capoeta damascina NUIC-1521			16	2	2		14	6
Capoeta damascina NUIC-1817		2	15	2	1		16	4
	Branched dorsal-fin rays							
	7½		8½		9½		Mode	
Capoeta kosswigi NUIC-1907	2				11		5	
Capoeta damascina NUIC-1519	4		2		10		4	
Capoeta damascina NUIC-1520					18		2	
Capoeta damascina NUIC-1521					16		2	
Capoeta damascina NUIC-1817			2		15		2	
	Branched dorsal-fin rays							
	5		6		7		Mode	
Capoeta kosswigi NUIC-1907	15		5				5	
Capoeta damascina NUIC-1519	13		7				5	
Capoeta damascina NUIC-1520	14		6				5	
Capoeta damascina NUIC-1521	11		9				5	
Capoeta damascina NUIC-1817	16		4				5	
	Pelvic-fin rays							
	8		9		10		Mode	
Capoeta kosswigi NUIC-1907	3		14		3		9	
Capoeta damascina NUIC-1519	4		11		5		9	
Capoeta damascina NUIC-1520	3		17				9	
Capoeta damascina NUIC-1521	4		14		2		9	
Capoeta damascina NUIC-1817			18		2		9	
	Pectoral-fin rays							
	18		19		20		21	Mode
Capoeta kosswigi NUIC-1907	7		2		11			20
Capoeta damascina NUIC-1519	6		4		10			20
Capoeta damascina NUIC-1520	3		1		15			20
Capoeta damascina NUIC-1521	2				18			20
Capoeta damascina NUIC-1817	4				16			20

suggested conspecificity of this lineage (Turan, 2008; Levin et al., 2012; Alwan et al., 2016a, 2016b; Ghanavi et al., 2016; Zareian and Esmaeili, 2017; Zareian et al., 2018; Bektaş et al., 2017, 2019). Nevertheless, *C. caelestis*, and *C. umbla* differ significantly from *C. damascina*in their morphological (Alwan, 2011; Esmaeili et al., 2016; Kaya, 2019) and osteological characters (Jawad and Alwan, 2020) despite having molecular similarity. These morphological and osteological differences may indicate their further adaptions (Alwan, 2011) leading to speciation event, however needs further investigation. Whereas based on our results, all morphometric and meristic characteristics of *C. kosswigi* are overlapped with those of *C. damascina* for such a conclusion and even those distinguishing characters between *C. damascina* and *C. kosswigi* i.e. snout and mouth shapes show high intraspecific variation that probably related to their local adaptation to their feeding behaviour and suggested cannot to be considered as taxonomic characters in members of the genus *Capoeta* (Zareian and Esmaeili, 2017; Zareian et al., 2018). In addition, Özdemir (2013) and Kaya (2019) showed similar results. *Capoeta damascina* is a widespread species found in the Jordan River drainage, Tigris-Euphrates and Orontes river basins (Alwan, 2011; Alwan et al., 2016a; Esmaeili et al., 2016, 2018). In Iran, this species was reported from the Sirwan basin, Tigris river drainage (Alwan, 2011; Ghanavi et al., 2016). Therefore, in a species with wide distribution i.e. *C. damascina,* a degree of phenotypic plasticity in different habitats is an expected phenomenon (Marcil et al. 2006; Alwan, 2011; Alwan et al., 2016a; Eagderi et al., 2019; Mouludi-Saleh et al., 2020).

In the recent molecular published works (Turan, 2008; Levin et al., 2012; Alwan et al., 2016a, 2016b; Ghanavi et al., 2016; Zareian and Esmaeili, 2017; Zareian et al., 2018; Bektaş et al., 2017, 2019) using COI, cyt*b* and 16S rDNA genes, *C. kosswigi* was clustered with *C. damascina* and *C. umbla* in the same clade. Based on cyt*b*, as most accepted gene in the phylogeny of the genus *Capoeta* (Levin et al., 2012; Ghanavi et al., 2016; Zareian et al., 2018; Bektaş et al., 2019), *C. kosswigi* has a genetic distance of 0.1%–1.0% (0.1–0.6 with those of Euphrates-Tigris river system and 0.4–1.0 with those of Orontes River basin) and 0.3–0.8 with *C. damascina* and *C. umbla*, respectively. In addition, *C. kosswigi* has no diagnostic nucleotide substitutions in mtDNA *cytb* and is identical with *C. damascina*. In addition, we calculated the available COI genes (KU948082 and KU948083) of the *C. damascina* from its type locality i.e. spring of Nahr Barada, Syria, with *C. damascina* from other basins of its distribution that revealed a low K2P genetic distances of 0.17%–0.35% supporting our morphological identification as well as conspecificy of different populations of *C. damascina*.

Lake Van is surrounded by mountain in the south and west, metamorphic rocky zone in the east and a composition of plateaus and mountain in the east. It was formed by an extended lava flow across the southwestern end of this basin from the Nemrut Volcano, which had blocked westward drainage toward Murat River about 2,600,000 to 11,700 years ago (i.e. Pleistocene Epoch). Therefore, *C. kosswigi* and *C. damascina* have been recently separated maximum about 11000 years ago, however headwater capture is common in the Euphrates-Tigris river system and in Anatolia as well that the pluvial conditions would have facilitated fish dispersal after separation of the Lake Van and Euphrates River (Oberlander, 1965). These two allopatric species have no diagnostic morphological and molecular characters and therefore is not acceptable to be considered as distinct species. Having phenotype or molecular differences as great as those displayed by sympatric species in the same group is some criteria for considering allopatric populations as distinct species (Futuyma and Kirkpatrick, 2017). Therefore, without having any diagnostic characters, we treat *C. kosswigi* as a junior synonym of *C. damascina*.

Material examined. All from Turkey.

Capoeta caelestis NUIC-1716. 20. 115.4–231.6 mm SL; Turkey: Mersin prov.: Göksu Stream, Eastern Mediterranean basin, 36°24’09”N 33°48’59”E.

Capoeta damascina. NUIC-1519. 20. 104.8–218.1 mm SL; Turkey: Malatya prov.: Sürgü Stream, Tigris-Euphrates basin, 38°02’34”N 37°51’21”E. — NUIC-1520. 20. 112.9-201.7 mm SL; Turkey: Gaziantep prov.: Merzimen Stream. Tigris-Euphrates basin, 37°16’02”N 37°48’52”E. — NUIC-1521. 20. 133.4–188.1 mm SL; Turkey: Adıyaman prov.: Input of Atatürk Dam Lake. Tigris-Euphrates basin, 37°48’01”N 38° 18’21”E. — NUIC-1817. 20. 89.0–150.8 mm SL; Turkey: Kilis prov.: Sapkanlı Pond, Orontes basin. 36°50’08”N 36°49’34”E.

Capoeta kosswigi. NUIC-1907. 20. 115.4–195.7 mm SL; Turkey: Van prov.: Karasu Stream, Lake Van basin, 38°39’15”N 43°17’47”E.

Capoeta umbla: IMNRF-UT-1077, 15, 107.3–175.9 mm SL; Iran: Kurdistan prov.: Little Zab River, near Sardasht Town at Barisu Village, Tigris basin, 36°08’48”N 45°32’17”E, May 2016.

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