

Three new species of algae-scraping cyprinid from Tigris River drainage in Iran (Teleostei: Cyprinidae)

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Abstract

Traditionally small-scale populations of *Capoeta* in the Tigris River drainage are identified as *Capoeta damascina*. The recent finding revealed that some populations of small-scaled *C. damascina* species group are not identified as any described species. We examined these populations and the results showed that there are pronounced differences between them in morphological and molecular characters. Therefore based on differences found, here we describe three new small-scaled *Capoeta* species from Zohreh, Tireh and Gamasiab Rivers, Tigris River drainage, Iran.

Keywords: Biodiversity, Cyprinid, Freshwater fish species, Iran, Taxonomy.

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Introduction

Among the family Cyprinidae, members of the genus *Capoeta* Valenciennes, 1842 are found in Southwest Asia from Anatolia to the Levant, Transcaucasia, Tigris-Euphrates basin, Turkmenistan, and northern Afghanistan, occurring in all Iranian freshwater bodies (Bănărescu 1999; Levin et al. 2012). There are 32 valid species in this genus, which 15 of them occur in Iranian inland waters (Table 1) (Jouladeh-Roudbar et al. 2015a, b; Alwan et al. 2016; Zareian et al. 2016; Jouladeh-Roudbar et al. 2016, 2017).

Previous phylogenetic and phylogeographic studies based on molecular mitochondrial data recognized three main clades within the genus *Capoeta* i.e. Mesopotamian, Aralo-Caspian and Anatolian-Iranian clades (Levin et al. 2012; Ghanavi et al. 2016). Iranian members of the Anatolian-Iranian clade, composed by five species of *C. buhsei*, *C. coadi*, *C. damascina*, *C. saadi* and *C. umbla*, are characterized by having small scales, known as *C. damascina* species group (Ghanavi et al. 2016).

Capoeta damascina is recorded from the most of Iranian inland waters, but Ghanavi et al. (2016) revealed that this species is only restricted to the Sirvan (=Sirwan) River drainage, inhabiting as sympatric with *C. umbla* (Esmaeili et al. 2016). Furthermore, Ghanavi et al. (2012) found that other small-scaled *Capoeta* populations in Iranian part of Tigris River drainage not identified as any described species. Among them, some populations are distributed in the Tireh, Gamasiab and Zohreh rivers, traditionally known as *C. damascina*. In the present work, we studied the small-scaled *Capoeta* populations collected from these rivers using morphological characters and molecular data (Cyt *b* gene), and based on differences found in comparison with the other species of this genus in Iran, here we describe three new species from *C. damascina* species group.

Material and Methods

Seventy *Capoeta* specimens were collected from the Zohreh, Tireh, Gamasiab, Sirvan and Beshar rivers in Iran using electrofishing device (Fig. 1), with local authority permission. A fragment of pelvic fin was cut and stored

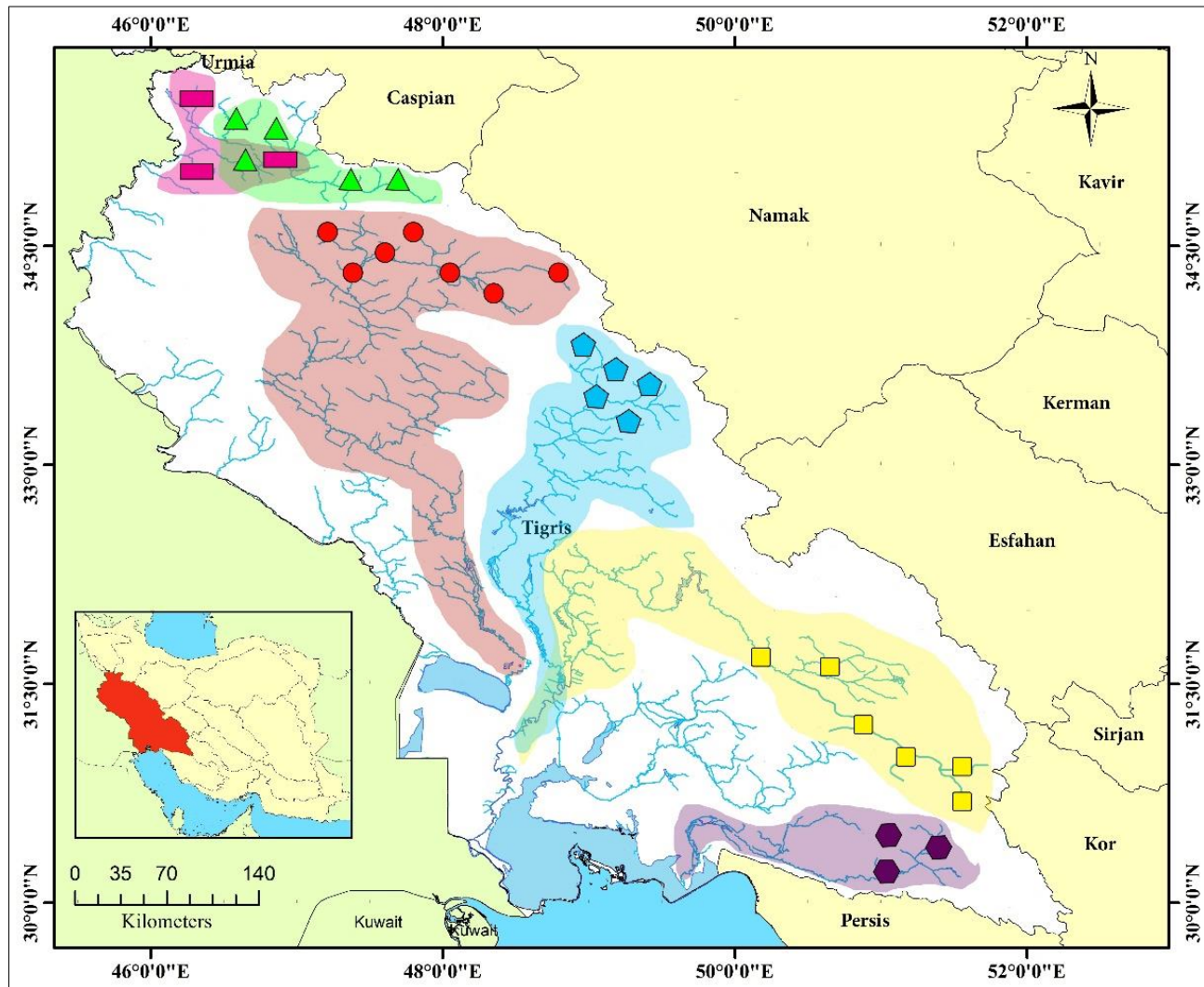


Figure 1. Map of the Tigris basin and distribution of *Capoeta coadi* (square), *Capoeta damascina* (triangle), *Capoeta ferdowsii* (hexagon), *Capoeta pyragyi* (pentagon), *Capoeta shajariani* (circle) and *C. umbla* (rectangular).

in micro-tubes in 96% ethanol and deposited in the Tissue and DNA Collection of the Ichthyological Museum of Natural Resources Faculty – University of Tehran (IMNRF-UT). The fish were killed with overdoses of MS222, fixed in 10% buffered formalin, and then preserved in IMNRF-UT.

Morphological study: Thirty morphometric measurements and nine meristic character countings were made using a digital calliper to the nearest 0.1 mm and stereomicroscope, respectively. Measurements follow Kottelat and Freyhof (2007). Gill rakers are counted on the first gill arch. Fin ray counts separate unbranched and branched rays. The last two branched rays articulated on a single pterygiophore in dorsal and anal-fins are noted as “1”.

Molecular data analysis: A total of 75 sequences of cytochrome *b* gene from previous studies are obtained from GenBank (Table 2) and aligned using Geneious software (Geneious v. 10.2.3, Biomatters, <http://www.geneious.com/>), and visually verified to maximize positional homology. Sequences of the species *Luciobarbus brachycephalus* (Kessler, 1872), *L. subquincunciatus* (Günther, 1868), *Barbus barbus* (Linnaeus, 1758) and *B. lacerta* (Heckel, 1843) were used as outgroup according to independent studies (Levin et al., 2012; Yang et al., 2015; Ghanavi et al., 2016). Uncorrected pairwise genetic distances (p-distances) between species (Table 3) were calculated with Mega 6 (Tamura et al. 2013).

Table 1. Species names mentioned in this study, and their authors.

<i>Capoeta aculeata</i> (Valenciennes, 1844)
<i>Capoeta alborzensis</i> Jouladeh-Roudbar, Eagderi, Ghanavi & Doadrio, 2016
<i>Capoeta anamisensis</i> Zareian, Esmaeili & Freyhof, 2016
<i>Capoeta barroisi</i> Lortet 1894
<i>Capoeta buhsei</i> Kessler, 1877
<i>Capoeta capoeta</i> (Güldenstaedt, 1773)
<i>Capoeta coadi</i> Alwan, Zareian, & Esmaeili, 2016
<i>Capoeta damascina</i> (Valenciennes, 1842)
<i>Capoeta fusca</i> Nikolskii, 1897
<i>Capoeta heratensis</i> (Keyser-ling, 1861)
<i>Capoeta mandica</i> Bianco and Bănărescu, 1982
<i>Capoeta razii</i> Jouladeh-Roudbar, Eagderi, Ghanavi & Doadrio 2017
<i>Capoeta saadii</i> (Heckel, 1847)
<i>Capoeta trutta</i> (Heckel 1843)
<i>Capoeta umbla</i> (Heckel, 1843)

Table 2. GenBank accession numbers of the Sequences used in this study. *Samples with the same haplotype was given the same GenBank accession number.

GenBank acc.	Species	GenBank acc.	Species	GenBank acc.	Species	GenBank acc.	Species
KM459637		KU167936		JF798316		KM459678	
KM459638	<i>Capoeta aculeata</i>	KU167937	<i>Capoeta capoeta</i>	JF798317	<i>Capoeta heratensis</i>	KM459679	
KM459640		KU167938		JF798318		KM459680	<i>Capoeta shajariani</i> sp. n.
KM459687		JF798297		JF798320		KM459681	
KM459688	<i>Capoeta alborzensis</i>	JF798298	<i>Capoeta capoeta sevangi</i>	JF798321	<i>Capoeta kosswigi</i>	KM459682	
KM459695		JF798299		JF798322		KM459664	
KU312380		KM459634		KM459650		KM459665	<i>Capoeta trutta</i>
KU312381	<i>Capoeta anamisensis</i>	KM459667	<i>Capoeta coadi</i>	KM459651	<i>Capoeta mandica</i>	KM459673	
AF145950		KM459669		KM459655		AF145937	<i>Luciobarbus subquincunatus</i>
HQ167620	<i>Capoeta angorae</i>	KU167952		JF798324		AY004729	<i>Luciobarbus brachycephalus</i>
JF798268		KU167953	<i>Capoeta damascina</i>	JF798325	<i>Capoeta maurici</i>	KU167892	<i>Barbus lacerta</i>
JF798279	<i>Capoeta barroisi</i>	KU167954		KM459675		KC465926	<i>Barbus barbus</i>
JF798280		KM459662		KM459675*	<i>Capoeta pyragyi</i> sp. n.		
JF798281	<i>Capoeta bergamae</i>	KM459662*		KM459630			
JF798282		KM459662*		KU167922	<i>Capoeta razii</i>		
KM459624		KM459663	<i>Capoeta ferdowsii</i> sp. n.	KU167933			
KM459686	<i>Capoeta buhsei</i>	KM459663*		KM459643			
KU167950		KM459663*		KM459645	<i>Capoeta saadii</i>		
JF798286		KU312371		KM459648			
JF798287	<i>Capoeta caelestis</i>	KU312372	<i>Capoeta fusca</i>	JF798339			
JF798288		JF798335	<i>Capoeta turani</i>	JF798340	<i>Capoeta shajariani</i> sp. n		

Table 3. Estimates of evolutionary divergence over sequence pairs between species. The number of base differences per site from averaging over all sequence pairs between groups are shown. The outgroup species used in this study are excluded.

Species	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
<i>C. barroisi</i>	1																							
<i>C. turani</i>	2	1.0																						
<i>C. mandica</i>	3	1.4	1.7																					
<i>C. anamisensis</i>	4	1.6	1.7	1.5																				
<i>C. trutta</i>	5	1.1	1.4	1.1	1.4																			
<i>C. capoeta</i>	6	8.0	8.4	8.7	8.0	8.3																		
<i>C. c. sevangi</i>	7	7.5	7.9	8.2	7.5	7.9	0.5																	
<i>C. razii</i>	8	8.5	9.0	9.1	8.8	8.8	2.1	2.1																
<i>C. aculeata</i>	9	8.1	8.5	8.8	8.7	8.5	2.0	1.7	1.8															
<i>C. heratensis</i>	10	9.0	9.4	9.4	9.0	8.9	2.5	2.7	2.5	2.6														
<i>C. fusca</i>	11	8.5	8.7	9.1	8.9	8.9	2.3	2.4	2.2	2.2	2.5													
<i>C. alborzensis</i>	12	7.8	8.2	8.5	8.2	8.1	1.7	1.7	1.4	1.3	2.1	1.6												
<i>C. maurici</i>	13	7.8	8.4	8.3	8.1	8.3	5.6	5.2	6.1	6.2	6.6	6.2	5.7											
<i>C. bergamae</i>	14	8.0	8.5	8.7	8.8	8.6	5.5	5.4	6.8	6.4	7.2	6.7	5.9	4.1										
<i>C. shajariani</i>	15	7.8	8.1	8.0	8.5	7.9	6.0	5.7	6.2	5.9	6.3	5.9	5.5	4.0	4.8									
<i>C. caelestis</i>	16	7.2	7.7	7.9	8.2	7.7	5.2	5.0	5.8	5.5	5.2	5.9	5.0	3.8	4.3	2.8								
<i>C. pyragyi</i>	17	7.9	8.2	8.3	8.6	8.2	5.9	5.8	5.9	6.3	5.7	6.7	5.5	4.4	5.1	2.9	2.2							
<i>C. angorae</i>	18	7.2	7.5	7.7	7.9	7.6	5.3	5.1	5.8	5.8	6.0	6.3	5.1	3.9	4.2	2.6	1.8	1.6						
<i>C. kosswigi</i>	19	7.4	7.6	7.8	8.1	7.7	5.5	5.3	5.7	5.7	6.0	6.3	5.0	4.1	4.3	2.5	1.7	1.5	0.5					
<i>C. damascina</i>	20	7.5	7.8	7.9	8.3	7.8	5.6	5.4	5.9	5.9	5.8	6.4	5.2	4.1	4.5	2.7	1.8	1.7	0.6	0.2				
<i>C. saadii</i>	21	7.7	8.0	8.3	8.3	8.2	5.9	5.7	6.1	6.2	6.3	6.4	5.5	4.6	4.5	3.6	2.9	3.2	2.5	2.4	2.5			
<i>C. ferdowsii</i>	22	7.9	8.4	8.5	8.2	8.4	5.6	5.4	5.8	5.8	5.3	5.4	5.1	3.9	4.5	3.4	2.6	3.0	2.7	2.6	2.8	2.9		
<i>C. coadi</i>	23	7.5	7.8	7.9	8.5	7.8	5.8	5.5	5.8	5.9	6.2	6.2	5.2	3.9	4.7	2.9	2.2	2.5	2.0	1.9	2.0	2.4	2.2	
<i>C. buhsei</i>	24	8.0	8.3	8.4	8.7	8.3	5.8	5.6	5.9	5.9	5.6	5.7	5.2	3.9	4.7	2.7	2.4	2.5	2.2	2.1	2.2	2.5	1.9	1.4

The best-fit model of molecular evolution was estimated via BIC Bayesian criterion in Jmodeltest 2.1.4 (Darriba et al. 2012) to find the best evolutionary model (TrN+I). Phylogenetic analyses were conducted using Maximum Likelihood (ML) in RAxML software (Stamatakis 2006) as is implemented in CIPRES Science Gateway (Miller et al. 2010). Node confidence in ML analyses was estimated by rapid bootstrapping using a random seed (1000 replicates). Bayesian inference was conducted on MrBAYES v. 3.2.6 (Ronquist et al. 2012). Two simultaneous analyses were run with each 2×10^7 generations and four MCMC chains sampling every 10000 generations. Convergence was checked on Tracer 1.6 (Rambaut and Drummond 2013). After discarding the first 10% of generations as burn-in, we obtained the 50% majority rule consensus tree and the posterior probabilities.

To delimit species, the Bayesian Poisson Tree Process (bPTP; Zhang et al. 2013) analysis was used. This analysis was performed using the online server of Exelixis Labs (<http://species.h-its.org/>). We ran the analyses for 100 000 generations with a thinning of 100 and burn-in of 0.1. Convergence was assessed by visualizing plots of MCMC iteration vs. log-likelihood.

Abbreviations used: SL, standard length; HL, lateral head length; IMNRFI-UT, Ichthyological Museum of Natural Resources Faculty - University of Tehran.

Results

From the 1141 bp of mitochondrial Cyt *b* gene, 906 positions were conserved and 216 were parsimony informative. Genetic distances between species are listed in Table 3. All analyses granted well-supported analogous topologies (Fig. 2). Obtained topologies recovered previously published higher-level phylogenies and the three main clades, Mesopotamian, Anatolian-Iranian, and Aralo-Caspian were recovered (Levin et al. 2012;

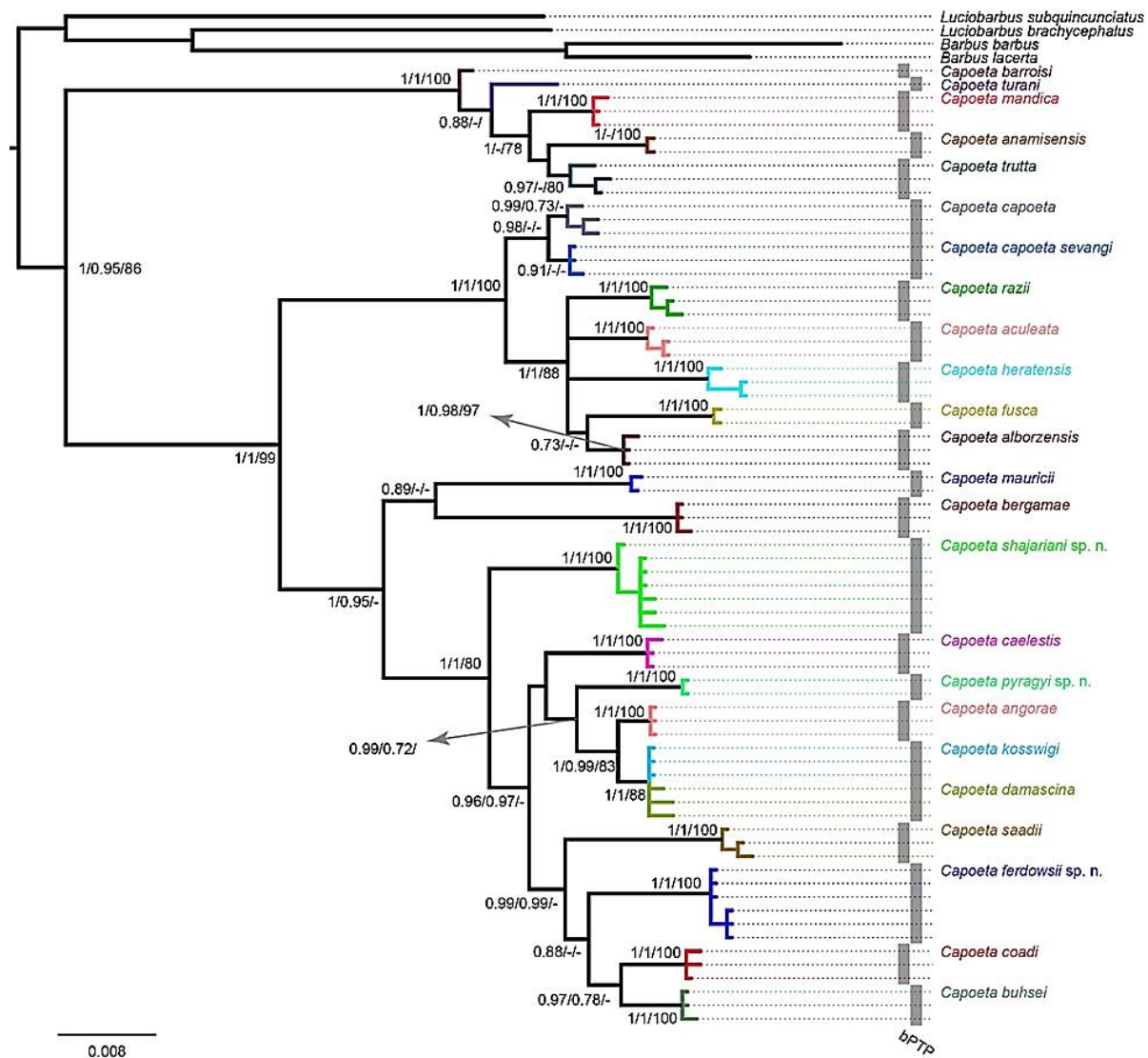


Figure 2. *Capoeta* genus; Values at nodes correspond to BI posterior probability/ PhyML bootstrap values /ML bootstrap. Grey bars represent the species delimitations performed with bPTP software.

Ghanavi et al. 2016; Jouladeh-Roudbar et al. 2016). As visible in the Figure 2, these studied *Capoeta* populations of the Gamasiab, Tireh and Zohreh Rivers are situated in Anatolian-Iranian clade as found in other phylogenetical studies before (Ghanavi et al., 2016). The species delimitation methodology used in this study (bPTP) supports the consideration of these populations as a different species from the other populations of the present study (Fig. 2).

Capoeta ferdowsii, new species

(Figs. 3-5)

Holotype: IMNRF-UT-1111 61, holotype, 121.6 mm SL; Iran: Fars Prov.: Tang-e Shiv River at Bekr sofia village, Zohre River drainage, Tigris River drianage, 30°25'26"N 51°21'55"E, S. Eagderi & A. Jouladeh-Roudbar, July 2017.

Paratypes: IMNRF-UT-1111, 8, 63.8-138.4 mm SL; data same as holotype.

Diagnosis: *Capoeta ferdowsii* is distinguished from the other species of *Capoeta* in Iran by following combination of characters, none of them unique: Elongate and cylindrical body; one pair of maxillary-barbel reaching vertical of anterior margin of pupil; last unbranched dorsal-fin ray moderately ossified, serrated with



Figure 3. *Capoeta ferdowsii*, IMNRF-UT-1111 61, holotype, 122 mm SL; Iran: Fars Prov.: Bekr sofia village, Tang-e Shiv River, Tigris River drainage.



Figure 4. *Capoeta ferdowsii*, IMNRF-UT-1111 67, 138 mm SL; Iran: Fars Prov.: Bekr sofia village, Tang-e Shiv River, Tigris River drainage.



Figure 5. *Capoeta ferdowsii*, paratypes; A: IMNRF-UT-1111 62, 130 mm SL; B: IMNRF-UT-1111 63, 112 mm SL; C: IMNRF-UT-1111 64, 112 mm SL.

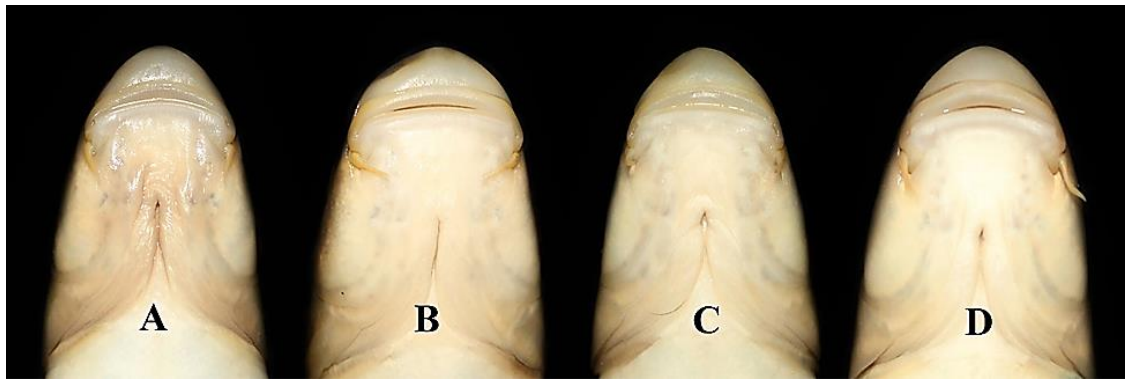


Figure 6. Ventral view of head. *Capoeta ferdowsii*, Holotype: A: IMNRF-UT-1111 61, 122 mm SL; Paratype: B: IMNRF-UT-1111 62, 130 mm SL; C: IMNRF-UT-1111 63, 112 mm SL; D: IMNRF-UT-1111 64, 112 mm SL.



Figure 7. Tang-e Shiv River at Bekr sofla village, Tigris basin, type locality of *Capoeta ferdowsii*.

flexible distal, 15–23 long serrae on its 40–60% of posterior margin, narrowly spaced and moderately strong; 15–18 gill rakers, 11–13 on lower limb; 23–25 circum-peduncular scales; lateral line complete with 68–77 scales; 13–15 scales between dorsal-fin origin and lateral line and 8–9 between anal-fin origin and lateral line.

Description: For general appearance see Figures 3–6 and morphometric and meristic data given in Tables 4–9. Body elongate and cylindrical, greatest body depth somewhat after posterior end of pectoral fin, predorsal body profile convex with a narrow keel in front of dorsal-fin origin, ventral profile straight or slightly convex. Snout rounded, blunt, triangular in ventral view, width markedly larger than inter nasal distance. Mouth wide, straight to arcuate shape and sexually dimorphic, width about equal to interorbital distance (Fig. 6). Rostral cap well-developed, cover upper lip. Upper and lower lips adnate to jaws, lower jaw covered with keratinized edge. Well-developed pelvic axillary scaled, triangular in shape and pointed. No tubercles on head. Dorsal profile of head slightly convex, with no marked hump between head and body, lower lip with small lateral lobes. Maxillary barbel reaching vertical of anterior margin of pupil. 4 unbranched and 8–9 branched dorsal-fin rays, its outer margin concave. Last unbranched dorsal-fin ray moderately ossified, serrated with flexible distal, 15–23 long serrae along its 40–60% of posterior margin, narrowly spaced and moderately strong (Fig. 8). Pelvic-fin insertion positioned posterior to first branched dorsal-fin ray. Caudal fin deeply forked, unequal pointed lobes with larger lower one. 15–17 branched pectoral-fin rays. 1 unbranched and 8 branched pelvic-fin rays. 3 unbranched and 5 branched anal-fin rays, with straight or slightly concave outer margin. 15–18 gill rakers, 11–13 on lower limb. 23–25 circum-peduncular scales. Complete lateral line with 68–77 scales, 13–15 scales between dorsal-fin origin and lateral line and 8–9 between anal-fin origin and lateral line.



Figure 8. Last simple dorsal-fin rays, *Capoeta coadi* (IMNRF-UT-1108 32, SL: 163 mm), *Capoeta ferdowsii* (IMNRF-UT-1111 65, SL: 135 mm), *Capoeta shajariani* (IMNRF-UT-1107 23, SL: 167 mm) above to below, respectively.

Table 4. Morphometric data of *Capoeta ferdowsii* (holotype, IMNRF-UT-1111 61; paratypes, IMNRF-1111, 8 specimens), *Capoeta coadi* (IMNRF-UT-1108, 18 specimens) and *Capoeta damascina* (IMNRF-UT-1112, 6 specimens).

Characters	Holotype	<i>C. ferdowsii</i>			<i>C. coadi</i>			<i>C. damascina</i>		
		Range	Mean	SD	Range	Mean	SD	Range	Mean	SD
Standard length (mm)	122	64-138			91-163			120-218		
In percent of standard length (SL)										
Body depth maximal	24.0	22.6-25.1	23.6	0.8	23.7-28	25.4	1.2	23.7-28	25.5	1.6
Caudal peduncle depth	12.1	10.9-12.8	11.7	0.5	10.9-12.6	11.7	0.5	10.9-13	11.8	0.9
Predorsal length	56.3	51.9-58.1	55.5	1.7	50.9-58	54.4	1.8	49.6-53.8	51.6	1.7
Postdorsal length	53.3	49.8-54.3	52.4	1.6	47.7-54	51.0	1.9	51.6-54.4	53.0	1.1
Prepelvic length	58.5	55-61.6	58.7	2.0	54.9-60	57.7	1.4	56-60.6	58.3	1.6
Preanal length	83.5	77.9-85.2	82.9	2.0	76.8-80.8	78.3	1.1	77.6-87.6	81.5	4.1
Caudal peduncle length	18.1	12.5-18.1	16.8	1.7	14.4-18.7	16.4	1.2	14-16	14.8	0.8
Dorsal-fin base length	16.2	14.9-16.8	15.9	0.6	13.1-16	14.4	0.8	15.3-16.1	15.6	0.3
Dorsal-fin depth	20.6	19.9-22.8	21.5	1.0	17.5-21.4	19.8	0.9	17.8-22.4	19.7	1.6
Anal-fin base length	8.1	7.6-10.3	8.6	0.9	6.6-9	8.0	0.6	6.7-9.7	8.4	1.0
Anal-fin depth	22.9	17.3-22.9	20.2	1.7	14.4-19.4	16.5	1.3	10.6-15.3	13.4	2.2
Pectoral-fin length	18.0	18-25.6	21.2	2.6	18.4-22.4	20.4	1.2	16.8-20.2	19.3	1.3
Pelvic-fin length	20.6	17.2-20.6	18.4	1.0	13.9-18.2	16.0	1.1	14.4-18.8	16.5	1.9
Pectoral – pelvic – fin origin distance	33.9	33.1-37.1	34.6	1.5	33.1-37.2	34.8	1.1	33.6-40.1	36.7	2.2
Pelvic – anal – fin origin distance	25.2	23.4-25.8	24.7	0.8	19.6-22.9	21.2	0.9	22.1-29.2	24.2	2.9
Body width	16.8	15.7-18.2	16.7	0.7	15.4-19.9	16.9	1.1	17.2-19.9	18.7	0.9
Caudal peduncle width	6.0	5.1-7.7	6.1	0.7	5.1-6.9	5.8	0.5	5.3-6.8	6.2	0.6
Head length (HL)	24.5	24.5-29.5	26.3	1.5	23.4-26.8	24.9	0.9	21-25.6	23.4	1.7
In percent of head length (HL)										
Snout length	32.4	28.7-33.4	30.9	1.6	26.3-34.6	31.3	2.2	22.7-29.3	25.6	2.6
Eye horizontal diameter	21.0	17.5-24.2	20.0	2.1	17.3-23	19.7	1.7	15.4-21.3	18.9	2.3
Postorbital distance	47.5	42.8-48.5	46.1	1.8	51-57	53.0	1.8	47.2-57	51.0	3.8
Head depth at nape	73.3	66.8-73.3	69.5	1.7	72.6-77.6	75.2	1.5	71.2-78.6	74.2	3.0
Head depth at eye	49.3	46.1-51	48.6	1.6	47.8-57.8	52.5	2.9	46.6-52	49.9	2.4
Head length at nape	88.2	81.1-88.2	85.1	2.2	75.4-93.3	84.8	4.7	79.8-87.7	83.3	2.9
Head width	60.1	57.4-60.8	59.0	1.2	57.5-64.8	61.1	2.3	61.4-81	67.8	7.2
Inter orbital	38.9	36.2-41.9	38.9	2.0	35.3-41.9	38.6	2.1	41-50.9	44.7	3.6
Inter nasal	24.2	18.6-24.2	22.5	1.7	19.3-26.4	22.7	1.9	23.5-31.5	27.8	3.5
Mouth width	35.9	25-40.9	36.3	4.9	25.2-37.5	30.9	3.5	28.5-40.8	33.8	5.2
Maxillary barbel	14.1	13.4-17.5	15.3	1.4	10.5-18.5	15.2	2.2	12.8-16.2	14.8	1.1
Ratios										
Pectoral-fin /pectoral – pelvic-fin origin	53.1	48.9-74.5	62.4	8.3	49.7-63.6	58.5	3.7	41.9-58.3	52.9	5.9

Table 5. Number of gill rakers on upper limb of first gill arch (UPL), scales below lateral line (LLB), dorsal branched rays (DBR), pelvic branched rays (PBR), gill rakers on lower limb of first gill arch (LWL), in *Capoeta ferdowsii* (IMNRF-1111, 9 specimens), *Capoeta coadi* (IMNRF-UT-1108, 18 specimens), *Capoeta pyragyi* (IMNRF-UT-1109, 16 specimens), *Capoeta damascina* (IMNRF-UT-1112, 6 specimens) and *Capoeta shajariani* (IMNRF-UT-1107, 11 specimens).

Species	4	5	6	7	8	9	10	11	12	13	14	15	16	Mode	Mean	SD
UPL																
<i>C. ferdowsii</i>	6	2	1											4	4.4	0.7
<i>C. coadi</i>	11	7												4	4.4	0.5
<i>C. damascina</i>			1	5										6	5.8	0.4
<i>C. pyragyi</i>	10	6												4	4.4	0.5
<i>C. shajariani</i>	3	8												5	4.7	0.5
LLB																
<i>C. ferdowsii</i>					4	5								9	8.6	0.5
<i>C. coadi</i>				1	6	6	4	1						8	8.9	1.0
<i>C. damascina</i>							1	3	2					11	11.2	0.8
<i>C. pyragyi</i>					5	8	3							9	8.9	0.7
<i>C. shajariani</i>						6	4	1						9	9.5	0.7
DBR																
<i>C. ferdowsii</i>					3	6								9	8.7	0.5
<i>C. coadi</i>					5	13								9	8.7	0.5
<i>C. damascina</i>						6								9	9.0	0.0
<i>C. pyragyi</i>					2	14								9	8.9	0.3
<i>C. shajariani</i>						9	2							9	9.2	0.4
PBR																
<i>C. ferdowsii</i>					9									8	8.0	0.0
<i>C. coadi</i>					2	13	3							9	9.1	0.5
<i>C. damascina</i>						3	3							10	9.5	0.5
<i>C. pyragyi</i>					3	12	1							9	8.9	0.5
<i>C. shajariani</i>						5	6							10	9.5	0.5
LWL																
<i>C. ferdowsii</i>									2	5	2			13	12.0	0.7
<i>C. coadi</i>							1	4	4	7	2			13	12.3	1.1
<i>C. damascina</i>												5	1	15	15.2	0.4
<i>C. pyragyi</i>										5	7	4		14	13.9	0.8
<i>C. shajariani</i>									2	5	4			13	13.2	0.8

Coloration: In life: The dorsum entirely silverish to brown or olive-green, upper flank brownish, belly and lower flank cream up to the lateral line. Flanks silvery or white. Some specimen with small black spots scattered on flanks. Dorsal-, anal-, pelvic- and caudal-fins cream in colour. Pectoral-fin reddish-brown to yellowish. Iris silverish or golden (Fig. 4). In preservation: Head and dorsum dark-brown or brownish to olive, flanks cream or white, lighter below lateral line. Caudal- and dorsal-fins with melanophores on rays without any distinctive pattern (Fig. 5). Peritoneum black.

Distribution: *Capoeta ferdowsii* is known from the Zohreh and Fahlian Rivers in Tigris river drainage (Fig. 7).

Etymology: The species is named to honor of Abu Al-Qasim Ferdowsi Tusi (Persian: ابوالقاسم فردوسی توسی) a Persian poet and the author of Shahnameh book which is the world's longest epic poem created by a single poet, and the national epic of Greater Iran.

Remark: *Capoeta ferdowsii* is distinguished from *C. aculeata*, *C. alborzensis*, *C. anamisensis*, *C. fusca*, *C. heratensis*, *C. mandica* and *C. razii* by having lateral line with smaller scale size and more scales (68-77 vs. 39-68).

Table 6. Number of total lateral-line scales in *Capoeta ferdowsii* (IMNRF-1111, 9 specimens), *Capoeta coadi* (IMNRF-UT-1108, 18 specimens), *Capoeta pyragyi* (IMNRF-UT-1109, 16 specimens), *Capoeta damascina* (IMNRF-UT-1112, 6 specimens) and *Capoeta shajariani* (IMNRF-UT-1107, 11 specimens).

Species	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	Mode	Mean	SD
<i>C. ferdowsii</i>	2		3	1		1	1			1														70	71.2	2.9
<i>C. coadi</i>	2	1	2	1	2		2	2	1	2	2					1								77	73.7	4.1
<i>C. damascina</i>															1	1		2				1	1	85	85.7	3.2
<i>C. pyragyi</i>	2	4	2	3	2	1	1		1															69	70.8	2.2
<i>C. shajariani</i>			1	1	4	3			1	1														72	72.8	2.0

Table 7. Number of scales above lateral line in *Capoeta ferdowsii* (IMNRF-1111, 9 specimens), *Capoeta coadi* (IMNRF-UT-1108, 18 specimens), *Capoeta pyragyi* (IMNRF-UT-1109, 16 specimens), *Capoeta damascina* (IMNRF-UT-1112, 6 specimens) and *Capoeta shajariani* (IMNRF-UT-1107, 11 specimens).

Species	12	13	14	15	16	17	18	19	20	21	Mode	Mean	SD
<i>C. ferdowsii</i>			6	1	2						13	13.6	0.9
<i>C. coadi</i>		1	4	8	5						14	13.9	0.9
<i>C. damascina</i>							1	3	1	1	19	19.3	1.0
<i>C. pyragyi</i>				6	6	3	1				14	13.9	0.9
<i>C. shajariani</i>			2	5	4						14	14.2	0.8

Table 8. Number of circum-pendicular *Capoeta ferdowsii* (IMNRF-1111, 9 specimens), *Capoeta coadi* (IMNRF-UT-1108, 18 specimens), *Capoeta pyragyi* (IMNRF-UT-1109, 16 specimens), *Capoeta damascina* (IMNRF-UT-1112, 6 specimens) and *Capoeta shajariani* (IMNRF-UT-1107, 11 specimens).

Species	23	24	25	26	27	28	29	30	31	32	Mode	Mean	SD
<i>C. ferdowsii</i>	1	5	3								24	24.2	0.7
<i>C. coadi</i>	1	7	4	6							24	24.8	1.0
<i>C. damascina</i>								2	2	2	30	31.0	0.9
<i>C. pyragyi</i>			4	6	6						26	25.1	0.8
<i>C. shajariani</i>				1	9	1					26	26.0	0.4

Table 9. Number of total gill rakers in *Capoeta coadi* (IMNRF-UT-1108, 18 specimens), *Capoeta damascina* (IMNRF-UT-1112, 6 specimens), *Capoeta ferdowsii* (IMNRF-1111, 9 specimens), *Capoeta pyragyi* (IMNRF-UT-1109, 16 specimens) and *Capoeta shajariani* (IMNRF-UT-1107, 11 specimens).

Species	14	15	16	17	18	19	20	21	22	Mode	Mean	SD
<i>C. ferdowsii</i>			2	2	4	1				17	16.4	1.0
<i>C. coadi</i>		1	2	4	7	3	1			17	16.7	1.2
<i>C. damascina</i>								5	1	21	21.2	0.4
<i>C. pyragyi</i>					2	7	7			18	18.3	0.7
<i>C. shajariani</i>				1	2	5	3			18	17.9	18

Capoeta ferdowsii is distinguished from *C. barroisi* by having more scales in the lateral line (68–77 vs. 76–84), fewer scales between anal-fin origin and lateral line (8–9 vs. 10–13) (data from Turan et al. 2006).

Capoeta ferdowsii is distinguished from *C. buhsei* by having large and fewer scales in the lateral line (68–77 vs. 80–89) and more gill rakers (15–18 vs. 11–13).

Capoeta ferdowsii is distinguished from *C. coadi* by having moderately ossified last unbranched dorsal-fin ray (vs. soft and flexible unbranched dorsal-fin ray, see Fig. 8), fewer branched pelvic-fin rays (mean-mode 8-8 vs. 9.1-9), larger distance between pelvic-fin origin to anal-fin origin (23.4-25.8 vs. 19.6-22.9 %SL) and

smaller postorbital length (42.8-48.5 vs. 51.0-57.0 %HL).

Capoeta ferdowsii is distinguished from *C. damascina* (Fig. 20) by having fewer scales in the lateral line (68-77 vs. 82-90), fewer scale between dorsal-fin origin and lateral line (13-15 vs. 18-21), fewer gill rakers (15-18 vs. 21-22) and fewer circum-pendicular scales (23-25 vs. 30-32).

Capoeta ferdowsii is distinguished from *C. saadi* by having fewer caudal-fin rays (19 (mean-mode, 19-19) vs. 16-19 (mean-mode, 17.1-17) (data from Alwan et al. 2016).

Capoeta ferdowsii is distinguished from *C. trutta* by having fewer circum-pendicular scales (23-25 vs. 27-31), fewer gill rackers (15-18 vs. 20-30), a moderately ossified last unbranched dorsal-fin ray, smaller than HL (vs. strong ossified last unbranched dorsal fin ray, longer than HL), head and body without any black spots (vs. head and body covered with small, distinctive black spots).

Capoeta ferdowsii is distinguished from *C. umbla* by having a larger scale size and fewer scales in the lateral line (68-77 vs. 90-102), more scales between dorsal-fin origin and lateral line (13-15 vs. 18-23) and fewer circum-pendicular scales (23-25 vs. 33-36).

***Capoeta pyragyi*, new species**

(Figs. 9-11)

Holotype: IMNRF-UT-1109 141, holotype, 118.1 mm SL; Iran: Lorestan Prov.: Tire River at Kaghe Village (Fig. 13), Sezar River drainage, Tigris River drianage, 33°37'06"N 48°58'13"E, S. Eagderi, July 2017.

Paratypes: IMNRF-UT-1109, 16, 79.6–155.8 mm SL; data same as holotype.

Diagnosis: *Capoeta pyragyi* is distinguished from the other species of *Capoeta* in Iran by following combination of characters, none of them unique: Body relatively high and compressed laterally; Mouth with sexually dimorphic, arched in male and straight in female; Dorsal-fin with 4 unbranched and 8–9 branched rays, its outer margin concave; 18–26 long serrae along its 50–60% of posterior margin, narrowly spaced and moderately strong; 17–19 gill rakers, 13-15 on lower limb; 24–26 circum-peduncular scales; Lateral line complete with 68–76 scales; 13–16 scales between dorsal-fin origin and lateral line and 8–10 between anal-fin origin and lateral line.

Description: See Figure 9–12 for general appearance and Tables 5-10 for morphometric and meristic data. Body relatively high and compressed laterally. Dorsal profile of head slightly convex with less arched ventral profile. Predorsal body profile convex with elevated keel in front of dorsal-fin origin. Snout rounded, blunt, arched in ventral view. Mouth arched in male and straight in female (Fig. 12). Rostral cap well-developed and partly cover upper lip. Upper and lower lips adnate to jaws, lower jaw covered with keratinized edge. Male with tubercles on head. Maxillary barbel reaching to pupil. Pelvic axillary well-developed, pointed, scaled and triangular. Dorsal-fin with 4 unbranched and 8–9 branched rays, its outer margin concave. Last unbranched dorsal-fin ray moderately ossified, serrated with flexible distal, 18–26 long serrae along its 50–60% of posterior margin, narrowly spaced and moderately strong. Pelvic-fin insertion positioned posterior to first branched dorsal-fin ray. Caudal fin deeply forked with unequal size of lobes, usually upper lobe pointed and lower one round. Pectoral-fin with 16–18 branched rays. Pelvic-fin with 1 unbranched and 9–10 branched rays. Anal-fin with 3 unbranched and 5 branched rays, and its outer margin slightly concave or straight. 17–19 gill rakers; 13-15 on lower limb. 24–26 circum-peduncular scales. Lateral line complete with 68–76 scales, 13–16 scales between dorsal-fin origin and lateral line and 8–10 between anal-fin origin and lateral line.

Coloration: In life: Head and dorsum brown or dark olive or golden, checks or golden-green, belly beige (Fig. 10), flanks light olive with small black spots scattered in some specimen, lighter below lateral line. Fins cream



Figure 9. *Capoeta pyragyi*, IMNRF-UT-1109 21, holotype, 118 mm SL; Iran: Lorestan Prov.: Tire River, Sezar River drainage, Tigris River drainage.



Figure 10. *Capoeta pyragyi*, IMNRF-UT-1109 134, 155.8 mm SL; Iran: Lorestan Prov.: Tire River, Sezar River drainage, Tigris river drainage.

with dark pigments on rays. In preservation: Head and body dark olive or dark brown, flanks pale brown, belly beige to white. Fins cream, brown or grey with melanophores on rays, peritoneum black (Fig. 11).

Distribution: *Capoeta pyragyi* is known from the Tireh and Sezar Rivers (Fig. 13).

Etymology: The species is named to honor of Magtymguly Pyragy (Persian: مختم‌قلی فراغی) a Turkmen spiritual leader and philosophical poet.

Remarks: *Capoeta pyragyi* is distinguished from *C. aculeata*, *C. alborzensis*, *C. anamisensis*, *C. fusca*, *C. heratensis*, *C. mandica* and *C. razii* by having small and more scales in the lateral line (68–76 vs. 39–68).

Capoeta pyragyi is distinguished from *C. barroisi* by having fewer gill rakers (17–19 vs. 26–29) (data from Turan et al. 2006).

Capoeta pyragyi is distinguished from *C. buhsei* by having large and fewer scales in the lateral line (68–76 vs. 80–89) and more gill rakers (17–19 vs. 11–13).

Capoeta pyragyi is distinguished from *C. coadi* by having moderately ossified last unbranched dorsal-fin ray with 18–26 strong denticles (vs. soft and flexible unbranched dorsal-fin ray with 14–20 small denticles, see Fig. 8), more gill rakers (mean–mode, 18.3–18 vs. 16.7–17), and more circum-pendicular scales (mean–mode, 25.1–26 vs. 24.8–24).

Capoeta pyragyi is distinguished from *C. damascina* by having fewer scales in the lateral line (68–76 vs. 82–90), fewer scales between dorsal-fin origin and lateral line (13–16 vs. 18–21), fewer gill rakers (17–19 vs. 21–22) and fewer circum-pendicular scales (24–26 vs. 30–32).



Figure 11. *Capoeta pyragyi*, paratypes; A: IMNRF-UT-1109 140, 147 mm SL; B: IMNRF-UT-1109 142, 112 mm SL; C: IMNRF-UT-1109 143, 109 mm SL.

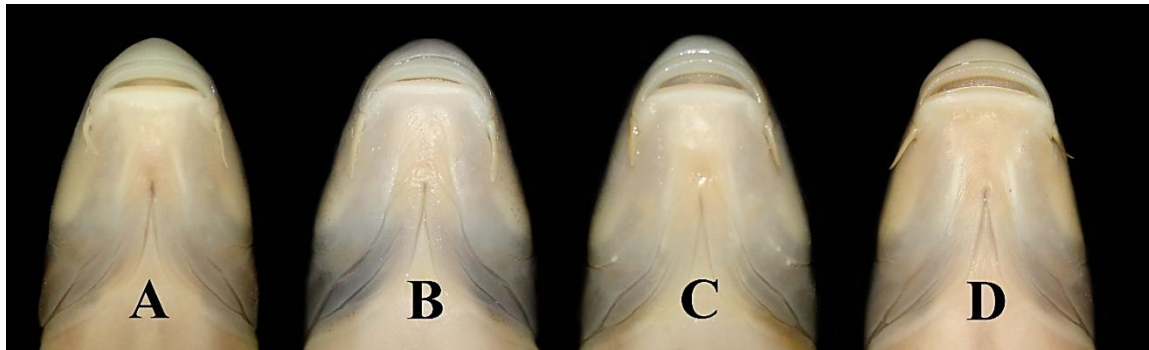


Figure 12. Ventral view of head. *Capoeta pyragyi*, Holotype: A: IMNRF-UT-1109 141, 118 mm SL; Paratype: B: IMNRF-UT-1109 142, 112 mm SL; C: IMNRF-UT-1109 143, 109 mm SL; D: IMNRF-UT-1109 140, 147 mm SL.

Capoeta pyragyi is distinguished from *C. ferdowsii* by having more circum-pendicular scales (min-max, 24-26 (mean-mode, 25.1-26) vs. 23-25 (mean-mode, 24.2-24)), more gill rakers (17-19, 18:18.3 vs. 15-18, 17:16.4), longer postorbital length (range, mean 47.6-60.4, 53.7 vs. 42.8-48.5, 46.1 %HL) and longer head width (60.1-69.2, 63.4 vs. 57.4-60.8, 59.0 %HL).

Capoeta pyragyi is distinguished from *C. saadi* by having fewer caudal-fin rays (19 (mean-mode, 19-19) vs. 16-19 (mean-mode, 17.1-17)), more scales between dorsal-fin origin and lateral line (13-16 (mode, 14) vs. 9-14 (mode, 12)), shorter distance between pelvic- and anal-fin origins (22.5-26.3 vs. 18.3-23.4 %SL), longer



Figure 13. Tireh River at Kaghe village, Tigris River drainage, type locality of *Capoeta pyragyi*.

Table 10. Morphometric data of *Capoeta pyragyi* (holotype, IMNRF-UT-1109 140; paratypes, IMNRF-1109, 16 specimens).

Characters	Holotype	<i>C. pyragyi</i>		
		Range	Mean	SD
Standard length (mm)	118	80-156		
In percent of standard length (SL)				
Body depth maximal	27.8	26.1-29.8	28.0	1.1
Caudal peduncle depth	13.4	12.2-14.5	13.3	0.7
Predorsal length	55.8	54.6-59.4	56.8	1.5
Postdorsal length	54.4	51.9-57.2	54.6	1.7
Prepelvic length	59.7	58.3-63.8	61.0	1.3
Preanal length	81.9	82.4-87.5	84.4	1.4
Caudal peduncle length	18.2	15-18.6	17.1	1.1
Dorsal-fin base length	15.5	14.5-17	15.6	0.7
Dorsal-fin depth	21.2	19.3-23.9	21.3	1.3
Anal-fin base length	8.6	7-11.3	8.2	1.1
Anal-fin depth	18.1	14.4-19.8	17.5	1.4
Pectoral-fin length	20.1	19.6-23.1	21.3	1.1
Pelvic-fin length	17.1	15.8-18.4	17.2	0.8
Pectoral – pelvic – fin origin distance	34.7	35-38.7	36.5	1.3
Pelvic – anal – fin origin distance	22.5	22.5-26.3	23.8	1.1
Body width	19.9	17.6-21.1	19.1	1.0
Caudal peduncle width	5.4	5.1-7.2	5.9	0.6
Head length (HL)	27.8	24.9-27.3	26.1	0.6
In percent of head length (HL)				
Snout length	26.8	26.5-34.5	29.3	2.2
Eye horizontal diameter	30.4	14.6-22.4	18.0	2.2
Postorbital distance	16.7	47.6-60.4	53.7	3.4
Head depth at nape	52.5	69.3-79.6	74.8	3.2
Head depth at eye	71.8	47.2-56.1	51.4	2.9
Head length at nape	51.1	80.4-88.4	83.9	2.5
Head width	79.7	60.1-69.2	63.4	2.3
Inter orbital	63.0	37.2-41.9	39.3	1.2
Inter nasal	39.9	20.9-27.3	24.2	1.9
Mouth width	23.7	24.4-36.4	30.0	3.5
Maxillary barbel	33.5	13.8-21.1	16.8	1.8
Ratios				
Pectoral-fin /pectoral – pelvic-fin origin	58.1	52.3-65.1	58.4	3.7

preanal length (82.4–87.5 vs. 69.4–78.4 %SL) and longer dorsal-fin base (14.5–17 vs. 10.5–14.4 %SL) (data from Alwan et al. 2016).

Capoeta pyragyi is distinguished from *C. trutta* by having fewer circum-pendicular scales (24–26 vs. 27–31), fewer gill rakers (17–19 vs. 20–30), a moderately ossified last unbranched dorsal-fin ray smaller than HL (vs. strong ossified last unbranched dorsal-fin ray longer than HL), head and body without any black spots (vs. head and body covered with small and distinctive black spots).

***Capoeta shajariani*, new species**

(Figs. 14–16)

Holotype: IMNRF-UT-1107_21, holotype, 162.4 mm SL; Iran: Hamedan Prov.: Gamasiab River near Doab Village, Tigris River drainage, 34°22'13"N 47°54'26"E, S. Eagderi & A. Jouladeh-Roudbar, July 2017.

Paratypes: IMNRF-UT-1107_10, 93.5–173.0 mm SL; data same as holotype. — IMNRF-UT-1106_10, 93.9–203.2 mm SL; Iran: Hamedan Prov.: Gamasiab River at Saad-e Vaghas Village, Tigris River drainage, 34°16'54"N 48°14'29"E, S. Eagderi & A. Jouladeh-Roudbar, July 2017.

Diagnosis: *Capoeta shajariani* is distinguished from the other species of *Capoeta* in Iran by following combination of characters, none of them unique: Maxillary barbel not reaching to pupil; Dorsal-fin with 4 unbranched and 8–9 branched rays, its outer margin concave; last unbranched dorsal-fin ray moderately ossified and serrated with flexible distal, 18–26 serrae on 50–60% of its posterior margin; 16–19 gill rakers, 12–14 on lower limb; 25–27 circum-peduncular scales; lateral line with 70–77 scales, 13–15 scales between dorsal-fin origin and lateral line and 9–11 scales between anal-fin origin and lateral line.

Description: See Figure 14–18 for general appearance and Tables 5–9, 11 for morphometric and meristic data. Body relatively high and compressed laterally. Dorsal profile of head slightly convex with less arched ventral profile. Predorsal body profile convex with elevated keel in front of dorsal-fin origin. Snout rounded, blunt, arched in ventral view. Mouth arched in male and straight in female (Figs. 18–19). Rostral cap well-developed and partly cover upper lip. Upper and lower lips adnate to jaws, lower jaw covered with keratinized edge. Male with tubercles on head. Maxillary barbel mostly not reaching to pupil (Fig. 17). Pelvic axillary well-developed, pointed, scaled and triangular. Dorsal-fin with 4 unbranched and 9–10 branched rays, its outer margin concave. Last unbranched dorsal-fin ray moderately ossified, serrated with flexible distal, 18–26 long serrae along its 50–60% of posterior margin, narrowly spaced and moderately strong (Fig. 8). Pelvic-fin insertion positioned posterior to first branched dorsal-fin ray. Caudal fin deeply forked with unequal size of lobes, usually upper lobe pointed and lower one round. Pectoral-fin with 16–18 branched rays. Pelvic-fin with 1 unbranched and 9–10 branched rays. Anal-fin with 3 unbranched and 5 branched rays, and its outer margin slightly concave or straight. 16–19 gill rakers, 12–14 on lower limb. 25–27 circum-peduncular scales. Lateral line complete with 70–77 scales, 13–15 scales between dorsal-fin origin and lateral line and 9–11 between anal-fin origin and lateral line.

Coloration: In life: Head and dorsum brown to olive, flanks light olive or silvery, lighter below lateral line; belly cream to yellowish; cheeks cream or golden-green; black or dark brown spots scattered on flanks anteriorly; pectoral and pelvic fin usually orange, sometimes hyaline, orange colour fade in distal part of fins; dorsal, anal and caudal fins olive to dark-grey (Fig. 15). In preservation: Head and body dark brown; flanks pale brown lighter below lateral line; fins beige or whitish with melanophores on rays Peritoneum black (Fig. 16).

Distribution: *Capoeta shajariani* is known from the Gamasiab (Fig. 20), Dinevar, Qarasu, Khoram (Khoram Abad), Aran and Sarab-e Maran Rivers in the Tigris River drainage.



Figure 14. *Capoeta shajariani*, IMNRF-UT-1107 21, holotype, 162 mm SL; Iran: Hamedan Prov.: Gamasiab River, Doab village, Tigris River drainage.



Figure 15. *Capoeta shajariani*, IMNRF-UT-1106 49, 149 mm SL; Iran: Hamedan Prov.: Gamasiab River, Saad-e Vaghas Village, Tigris River drainage.

Etymology: The species is named to honor of Mohammad-Reza Shajarian, an acclaimed Iranian classical singer, composer and master of Persian traditional music.

Remarks: *Capoeta shajariani* is distinguished from *C. aculeata*, *C. alborzensis*, *C. anamisensis*, *C. fusca*, *C. heratensis*, *C. mandica* and *C. razii* by having smaller and more scales in the lateral line (70–77 vs. 39–68).

Capoeta shajariani is distinguished from *C. barroisi* by having fewer gill rakers (16–19 vs. 26–29) (data from Turan et al. 2006).

Capoeta shajariani is distinguished from *C. buhsei* by having larger and fewer scales in the lateral line (70–77 vs. 80–89) and more gill rakers (16–19 vs. 11–13).

Capoeta shajariani is distinguished from *C. coadi* by having moderately ossified last unbranched dorsal-fin ray with 18–26 strong denticles (vs. soft and flexible unbranched dorsal-fin ray with 14–20 small denticles, see Fig. 8), more gill rakers (mean–mode: 17.9–18 vs. 16.7–17), and more circum-pendicular scales (mean–mode: 26.0–26 vs. 24.8–24).

Capoeta shajariani is distinguished from *C. damascina* by having fewer scales in the lateral line (70–77 vs. 82–90), fewer scales between dorsal-fin origin and lateral line (13–15 vs. 18–21), fewer gill rakers (16–19 vs. 21–22), fewer circum-pendicular scales (25–27 vs. 30–32), more gill rakers in upper limb (mean–mode: 4.7–5 vs. 4.4–4), fewer gill rakers in lower limb (mean–mode: 13.2–13 vs. 15.2–15) and fewer scale between anal-fin origin and lateral line (mean–mode: 9.5–9 vs. 11.2–11).

Capoeta shajariani is distinguished from *C. ferdowsii* by having more branched pelvic-fin rays (9–10 vs. 8), more mode of scale between dorsal-fin origin and lateral line (14 vs. 13), and more circum-pendicular scales (25–27 (mode, 26 vs. 23–25 (mode, 24)).

Capoeta shajariani is distinguished from *C. pyragyi* by having more gill rakers in upper limb (mode 5 vs. 4), more unbranched pelvic-fin rays (mode 10 vs. 9), and longer barbel (9.8–13 vs. 13.8–21%HL).

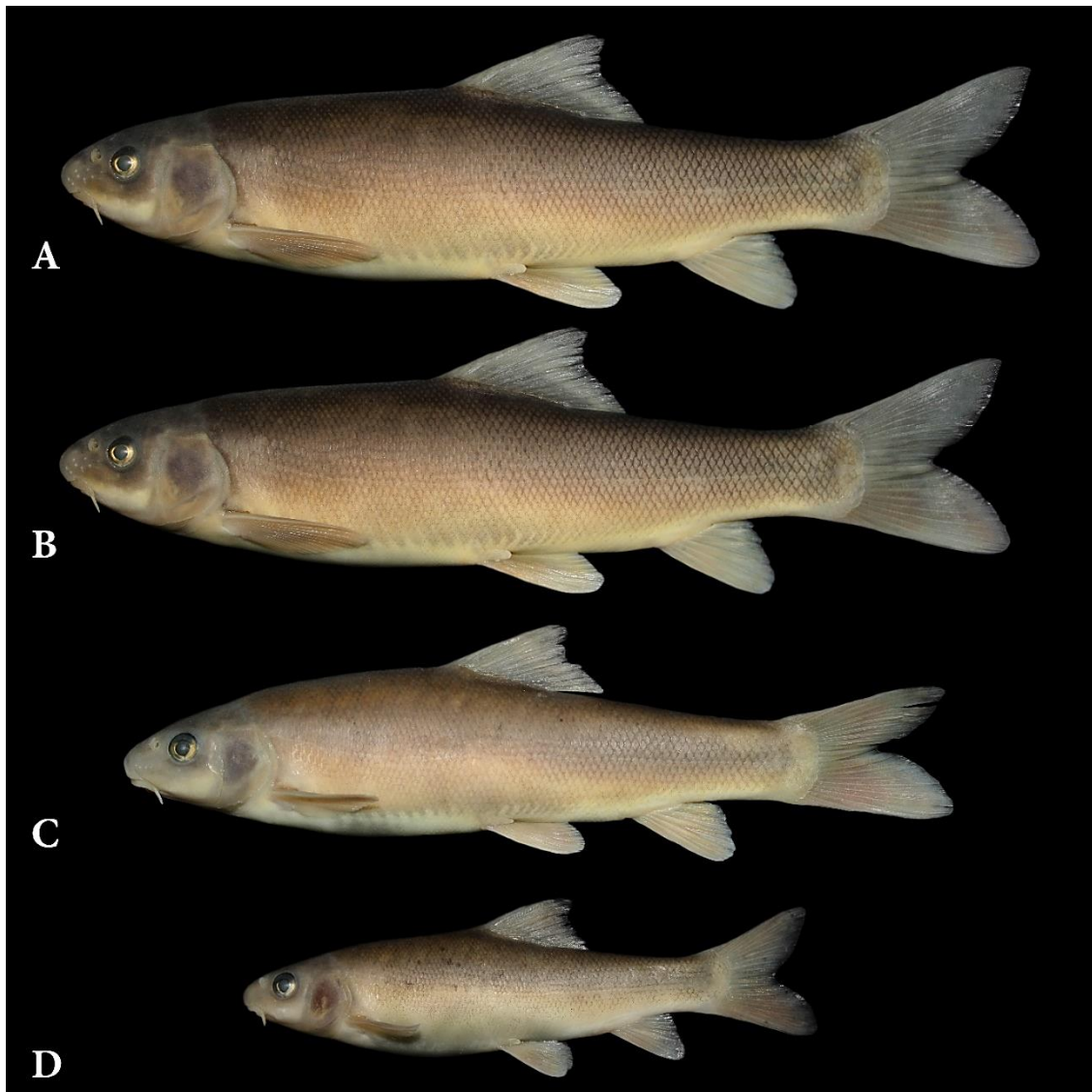


Figure 16. *Capoeta shajariani*, paratypes; A: IMNRF-UT-1107 26, 169 mm SL; B: IMNRF-UT-1107 24, 160 mm SL; C: IMNRF-UT-1107 27, 142 mm SL; IMNRF-UT-1107 29, 93 mm SL.

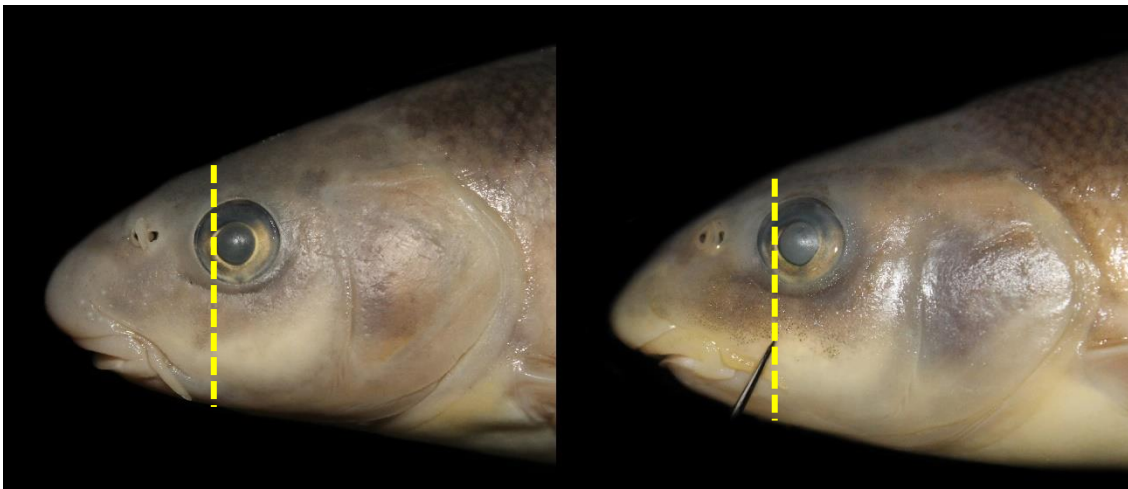


Figure 17. *Capoeta shajariani*, IMNRF-UT-1107 21, 162 mm SL (left), and *Capoeta coadi*, B: IMNRF-UT-1108 32, 163 mm SL (right).



Figure 18. Ventral view of head. *Capoeta shajariani*, Holotype: A: IMNRF-UT-1107 21, 162 mm SL; Paratype: B: IMNRF-UT-1107 24, 160 mm SL; C: IMNRF-UT-1107 26, 169 mm SL; IMNRF-UT-1107 27, 142 mm SL.

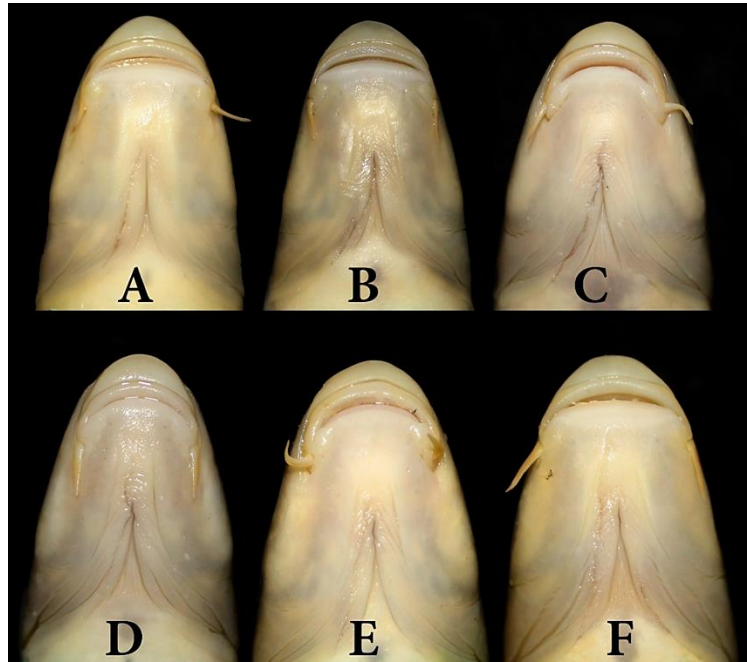


Figure 19. Ventral view of head. *Capoeta coadi*. A: IMNRF-UT-1108 30, 159 mm SL; B: IMNRF-UT-1108 32, 163 mm SL; C: IMNRF-UT-1108 34, 156 mm SL; D: IMNRF-UT-1108 35, 138 mm SL; E: IMNRF-UT-1108 37, 153 mm SL; F: IMNRF-UT-1108 40, 143 mm SL; F: IMNRF-UT-1108 43, 132 mm SL.



Figure 20. Gamasiab River at Doab village, Tigris River drainage, type locality of *Capoeta shajariani*.

Capoeta shajariani is distinguished from *C. saadi* by having fewer caudal fin rays (19–21 (mean-mode, 19.1–19) vs. 16–19 (mean-mode, 17.1–17), more scales between dorsal-fin origin and lateral line (13–15 (mode, 14) vs. 9–14 (mode, 12), shorter distance between pelvic and anal-fin origins (23.3–26.2 vs. 18.3–23.4 %SL), longer pre anal length (78.9–86.0 vs. 69.4–78.4 %SL) and longer dorsal-fin base (14.2–17.8 vs. 10.5–14.4 %SL) (data from Alwan et al. 2016).

Capoeta shajariani is distinguished from *C. trutta* by having fewer circum-pendicular scales (24–27 vs. 27–31), fewer gill rakers (16–19 vs. 20–30), a moderately ossified last unbranched dorsal-fin ray usually smaller

Table 11. Morphometric data of *Capoeta shajariani* (holotype, IMNRF-UT-1107 21; paratypes, IMNRF-1107, 10 specimens).

Characters	Holotype	<i>C. shajariani</i>		
		Range	Mean	SD
Standard length (mm)		93-173		
In percent of standard length (SL)				
Body depth maximal	27.4	24.6-27.6	26.3	0.9
Caudal peduncle depth	12.4	11.5-13.3	12.4	0.5
Predorsal length	55.9	51.2-57.1	54.6	2.1
Postdorsal length	57.5	52-57.7	55.3	2.0
Prepelvic length	58.7	56.5-62.6	59.6	1.7
Preal length	84.3	78.9-86	83.5	1.9
Caudal peduncle length	18.7	15.1-19.5	17.3	1.4
Dorsal-fin base length	16.2	14.2-17.8	16.1	1.2
Dorsal-fin depth	21.9	17.9-21.9	20.5	1.2
Anal-fin base length	9.7	7.5-9.7	8.3	0.7
Anal-fin depth	19.3	15.4-19.3	17.1	1.2
Pectoral-fin length	21.4	16.4-21.7	19.5	1.9
Pelvic-fin length	19.1	16-19.1	17.1	1.1
Pectoral – pelvic – fin origin distance	33.5	33.5-39.8	36.0	1.9
Pelvic – anal – fin origin distance	25.5	23.3-26.2	24.6	1.0
Body width	16.3	15-18.9	17.2	1.2
Caudal peduncle width	6.5	5.3-6.9	6.3	0.5
Head length (HL)	25.7	24.5-28.3	25.8	1.0
In percent of head length (HL)				
Snout length	30.4	25.3-33.3	28.8	2.8
Eye horizontal diameter	15.2	14.4-19.5	16.9	1.7
Postorbital distance	53.8	47.3-57.1	52.2	2.8
Head depth at nape	71.5	68.1-79	73.7	3.8
Head depth at eye	53.5	46.4-58.9	51.1	3.6
Head length at nape	85.2	75.1-88.7	81.5	5.3
Head width	62.4	57.4-68.1	63.7	2.8
Inter orbital	40.7	37.4-46.2	42.4	2.2
Inter nasal	25.6	23.5-27.5	25.3	1.3
Mouth width	29.7	24.9-32.6	28.2	2.7
Maxillary barbel	9.8	9.8-13	11.5	1.1
Ratios				
Pectoral-fin /pectoral – pelvic-fin origin	74.7	61.4-77.5	69.0	7.9

than HL (vs. strong ossified last unbranched dorsal-fin ray usually longer than HL), head and body without any black spots (vs. head and body covered with small and distinctive black spots).

Capoeta shajariani is distinguished from *C. umbla* by having larger and fewer scales in the lateral line (70–77 vs. 90–102), more scales between dorsal-fin origin and lateral line (13–15 vs. 18–23) and fewer circum-pendicular scales (24–27 vs. 33–36).

Comparative Material: — *Capoeta aculeata*: IMNRF-UT-1058, 9, 53-116 mm SL; Iran: Fars prov.: Kor River, Tang-e Boragh Village, Kor River basin, 37°14'46"N 58°08'01"E, S. Eagderi & H. Mossavi-Sabet, Aug 2014. — *Capoeta alborzensis*: IMNRF-1063, 7, 50-153 mm SL; Iran: Tehran prov.: Nam River, tributary of Hableh River, near Arjomand village, Dasht-e Kavir basin, 35°48'00"N 52°30'57"E. — IMNRF-UT-2063, 23, 46-163 mm SL; Iran: Tehran prov.: Nam River, tributary of Hableh River, near Harandeh Village, Dasht-e Kavir basin, 35°42'41"N 52°40'19"E, S. Eagderi & A. Jouladeh-Roudbar, September 2014.



Figure 21. *Capoeta damascina*, ~250 mm SL; Iran: Kermanshah Prov.: Sirvan (=Sirwan) River, Tigris River drainage (not preserved).



Figure 22. Sirvan (=Sirwan) River, Tigris River drainage, natural habitat of *Capoeta damascina*.

- *Capoeta buhseri*: IMNRF-UT-1075, 12, 103.9-211.8 mm SL; Iran: Markazi prov.: Mazlaghan-Chay River, near Khalife-Kandy Village, Namak Lake basin, 34°45'34"N 49°56'50"E, A. Rahmani, M.A. Jahazi, R. Rahbar-Zare, A. Jouladeh-Roudbar, Nov 2016.
- *Capoeta capoeta*: IMNRF-UT-1067, 15, 66-157 mm SL; Iran: East Azarbayjan prov.: Ghale-Chay River, near Ajab-Shir city, Urmia Lake basin, 37°29'25"N 45°59'57"E, T. Hosseinpour, M. Ahmadian & A. Jouladeh-Roudbar, Nov 2016.
- *Capoeta coadii*: IMNRF-UT-1108, 18, 91-163 mm SL; Iran: Kohgiluyeh and Boyer-Ahmad prov.: Beshar River, near Ghalat Village, Tigris basin, 30°27'47"N 51°45'10"E, S. Eagderi & A. Jouladeh-Roudbar, Jul 2017.
- IMNRF-UT-1110, 1, 143 mm SL; Iran: Kohgiluyeh and Boyer-Ahmad prov.: Khersan River, near Lama Village, Tigris basin, 31°02'11.9"N 51°13'20.1"E, A. Soleymani & A. Jouladeh-Roudbar, Jul 2017.
- *Capoeta damascina*: IMNRF-UT-1112, 6, 120-218 mm SL; Iran: Kermanshah prov.: Gaveh River, Songhor to Satar road at Tape Esmail Village, Tigris basin, 34°56'01"N 47°12'49"E, T. Hosseinpour, A. Soleymani & A. Jouladeh-Roudbar, Aug 2016 (Figs. 21, 22).
- *Capoeta fusca*: IMNRF-UT-1065, 8, 46-121 mm SL; Iran: North Khorasan prov.: Qanat-e Segonbadan, Near Farooj town at segonbadan Village, Hari River basin, 37°14'46"N 58°08'01"E, S. Eagderi & A. Jouladeh-Roudbar, Jun 2016.
- *Capoeta heratensis*: IMNRF-UT-1064, 15, 116-161 mm SL; Iran: Khorasan-e Razavi prov.: Hari River, near Sarakhs at Pole-e Khaton, Hari River basin, 35°56'51"N 61°08'51"E, S. Eagderi & A. Jouladeh-Roudbar, Jun 2016.

- *Capoeta trutta*: IMNRF-UT- 1073, 15, 54.1-165.2 mm SL; Iran: Kermanshah prov.: , Gaveh River, Songhor to Satar road at Tape Esmail village Tigris basin, 34°56'01"N 47°12'49"E, T. Hosseinpour, A. Soleymani & A. Jouladeh-Roudbar, Aug 2016.
- *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, S. Eagderi, H. Porbagher, P. Jalili & A. Jouladeh-Roudbar, May 2016.

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