**FishTaxa** (2017) 2(3): 134-155
E-ISSN: 2458-942X
Journal homepage: www.fishtaxa.com


# 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.
**Zoobank:** urn:lsid:zoobank.org:pub:0150BC64-4CC1-48AC-838F-45AA113056FC
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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 (see Alwan 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

*Accepted: 7 May 2017; Published: 1 August 2017*

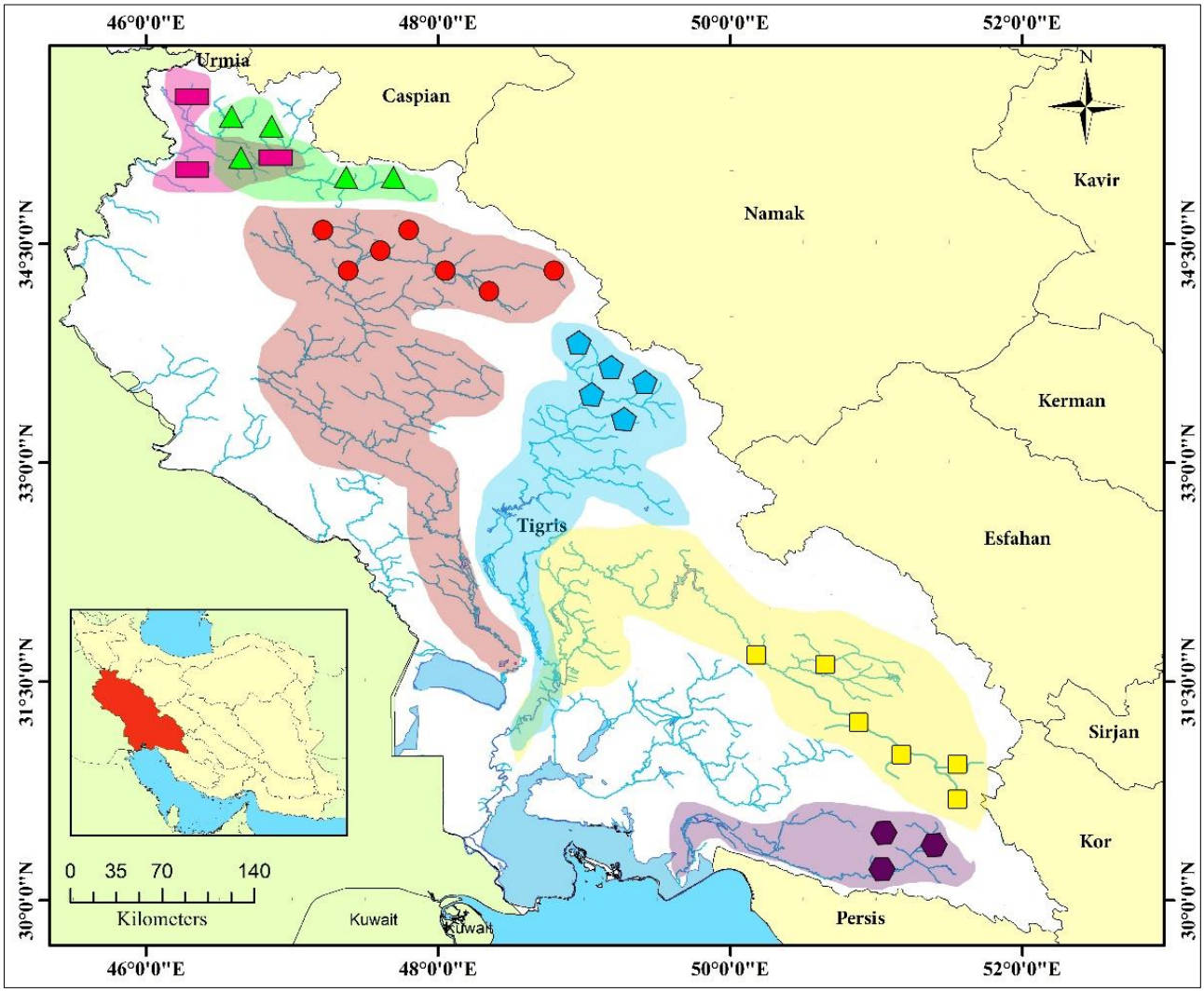


**Figure 1.** Map of the Tigris basin and distribution of *Capoeta coadi* (square), *Capoeta damascina* (triangle), *Capoeta ferdowsii* (hexagon), *Capoeta pyragyi* (pentagon), *Capoeta shajariani* (circle) and *C. umbla* (rectangular).

in micro-tubes in 96% ethanol and deposited in the Tissue and DNA Collection of the Ichtyological 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.

| |
|---|
| *Capoeta aculeata* (Valenciennes, 1844) |
| *Capoeta alborzensis* Jouladeh-Roudbar, Eagderi, Ghanavi & Doadrio, 2016 |
| *Capoeta anamisensis* Zareian, Esmaeili & Freyhof, 2016 |
| *Capoeta barroisi* Lortet 1894 |
| *Capoeta buhsei* Kessler, 1877 |
| *Capoeta capoeta* (Güldenstaedt, 1773) |
| *Capoeta coadi* Alwan, Zareian, & Esmaeili, 2016 |
| *Capoeta damascina* (Valenciennes, 1842) |
| *Capoeta fusca* Nikolskii, 1897 |
| *Capoeta heratensis* (Keyser-ling, 1861) |
| *Capoeta mandica* Bianco and Bănărescu, 1982 |
| *Capoeta razii* Jouladeh-Roudbar, Eagderi, Ghanavi & Doadrio 2017 |
| *Capoeta saadii* (Heckel, 1847) |
| *Capoeta trutta* (Heckel 1843) |
| *Capoeta umbla* (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 | *Capoeta aculeata* | KU167937 | *Capoeta capoeta* | JF798317 | *Capoeta heratensis* | KM459679 | |
| KM459640 | | KU167938 | | JF798318 | | KM459680 | *Capoeta shajariani* sp. n. |
| KM459687 | | JF798297 | | JF798320 | | KM459681 | |
| KM459688 | *Capoeta alborzensis* | JF798298 | *Capoeta capoeta sevangi* | JF798321 | *Capoeta kosswigi* | KM459682 | |
| KM459695 | | JF798299 | | JF798322 | | KM459664 | |
| KU312380 | *Capoeta anamisensis* | KM459634 | | KM459650 | | KM459665 | *Capoeta trutta* |
| KU312381 | | KM459667 | *Capoeta coadi* | KM459651 | *Capoeta mandica* | KM459673 | |
| AF145950 | | KM459669 | | KM459655 | | AF145937 | *Luciobarbus subquincunciatus* |
| HQ167620 | *Capoeta angorae* | KU167952 | | JF798324 | *Capoeta maurici* | AY004729 | *Luciobarbus brachycephalus* |
| JF798268 | | KU167953 | *Capoeta damascina* | JF798325 | | KU167892 | *Barbus lacerta* |
| JF798279 | *Capoeta barroisi* | KU167954 | | KM459675 | *Capoeta pyragyi* sp. n. | KC465926 | *Barbus barbus* |
| JF798280 | | KM459662 | | KM459675* | | | |
| JF798281 | *Capoeta bergamae* | KM459662* | | KM459630 | | | |
| JF798282 | | KM459662* | *Capoeta ferdowsii sp. n.* | KU167922 | *Capoeta razii* | | |
| KM459624 | | KM459663 | | KU167933 | | | |
| KM459686 | *Capoeta buhsei* | KM459663* | | KM459643 | | | |
| KU167950 | | KM459663* | | KM459645 | *Capoeta saadii* | | |
| JF798286 | | KU312371 | | KM459648 | | | |
| JF798287 | *Capoeta caelestis* | KU312372 | *Capoeta fusca* | JF798339 | | | |
| JF798288 | | JF798335 | *Capoeta turani* | JF798340 | *Capoeta shajariani* 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. barroisi* | **1** | | | | | | | | | | | | | | | | | | | | | | | |
| *C. turani* | **2** | 1.0 | | | | | | | | | | | | | | | | | | | | | | |
| *C. mandica* | **3** | 1.4 | 1.7 | | | | | | | | | | | | | | | | | | | | | |
| *C. anamisensis* | **4** | 1.6 | 1.7 | 1.5 | | | | | | | | | | | | | | | | | | | | |
| *C. trutta* | **5** | 1.1 | 1.4 | 1.1 | 1.4 | | | | | | | | | | | | | | | | | | | |
| *C. capoeta* | **6** | 8.0 | 8.4 | 8.7 | 8.0 | 8.3 | | | | | | | | | | | | | | | | | | |
| *C. c. sevangi* | **7** | 7.5 | 7.9 | 8.2 | 7.5 | 7.9 | 0.5 | | | | | | | | | | | | | | | | | |
| *C. razii* | **8** | 8.5 | 9.0 | 9.1 | 8.8 | 8.8 | 2.1 | 2.1 | | | | | | | | | | | | | | | | |
| *C. aculeata* | **9** | 8.1 | 8.5 | 8.8 | 8.7 | 8.5 | 2.0 | 1.7 | 1.8 | | | | | | | | | | | | | | | |
| *C. heratensis* | **10** | 9.0 | 9.4 | 9.4 | 9.0 | 8.9 | 2.5 | 2.7 | 2.5 | 2.6 | | | | | | | | | | | | | | |
| *C. fusca* | **11** | 8.5 | 8.7 | 9.1 | 8.9 | 8.9 | 2.3 | 2.4 | 2.2 | 2.2 | 2.5 | | | | | | | | | | | | | |
| *C. alborzensis* | **12** | 7.8 | 8.2 | 8.5 | 8.2 | 8.1 | 1.7 | 1.7 | 1.4 | 1.3 | 2.1 | 1.6 | | | | | | | | | | | | |
| *C. maurici* | **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 | | | | | | | | | | | |
| *C. bergamae* | **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 | | | | | | | | | | |
| *C. shajariani* | **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 | | | | | | | | | |
| *C. caelestis* | **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 | | | | | | | | |
| *C. pyragyi* | **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 | | | | | | | |
| *C. angorae* | **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 | | | | | | |
| *C. kosswigi* | **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 | | | | | |
| *C. damascina* | **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 | | | | |
| *C. saadii* | **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 | | | |
| *C. ferdowsii* | **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 | | |
| *C. coadi* | **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 | |
| *C. buhsei* | **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, Ichtyological 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;

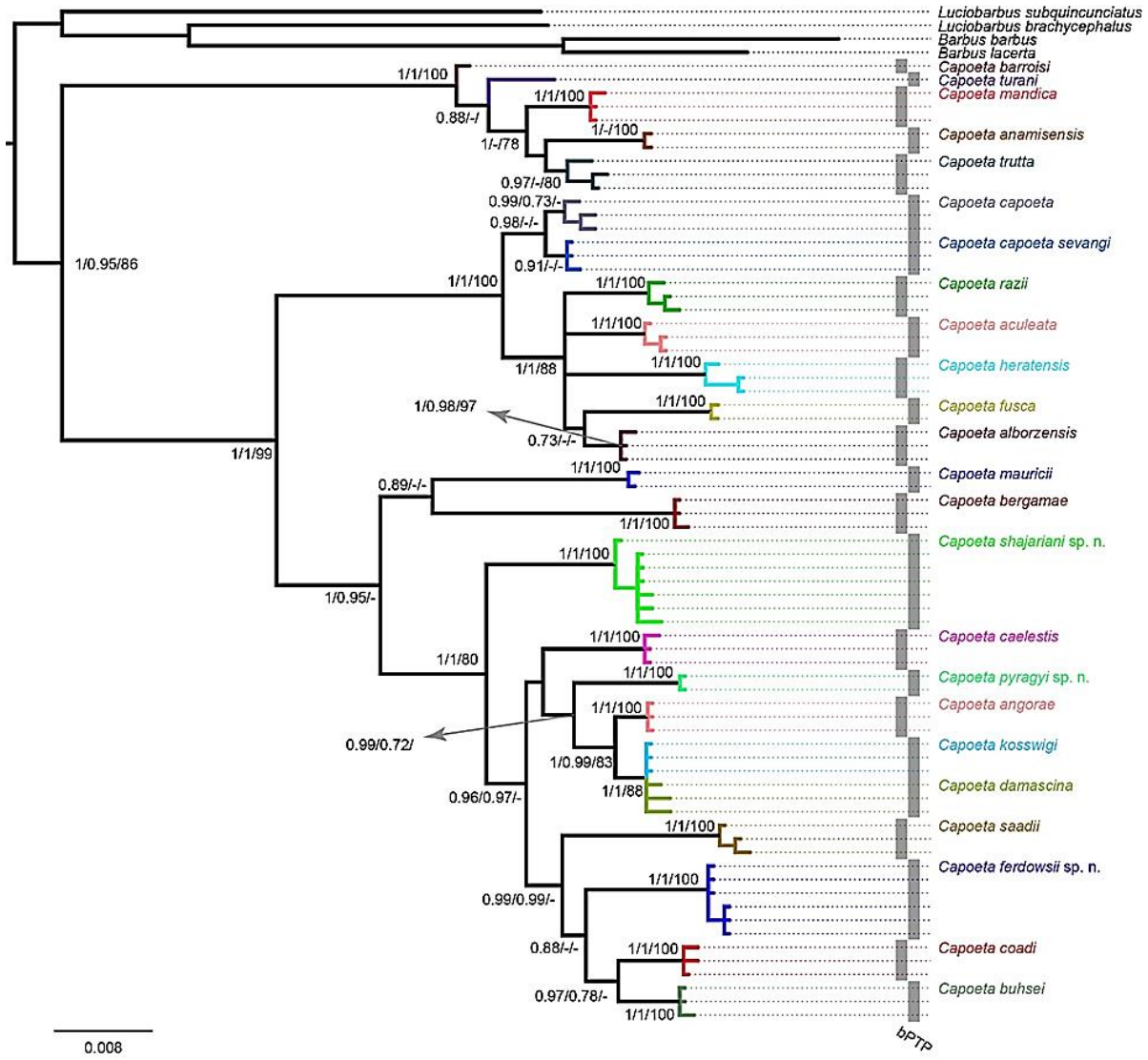


**Figure 2.** *Capoeta* genus; Values at nodes correspond to BI posterior probability/ PhyML bootstrap values /ML bootstrap. Grey bars represent the species delimitations performed with bPTP software.

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 sofla 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 sofla village, Tang-e Shiv River, Tigris River drainage.

**Figure 4.** *Capoeta ferdowsii*, IMNRF-UT-1111 67, 138 mm SL; Iran: Fars Prov.: Bekr sofla 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.

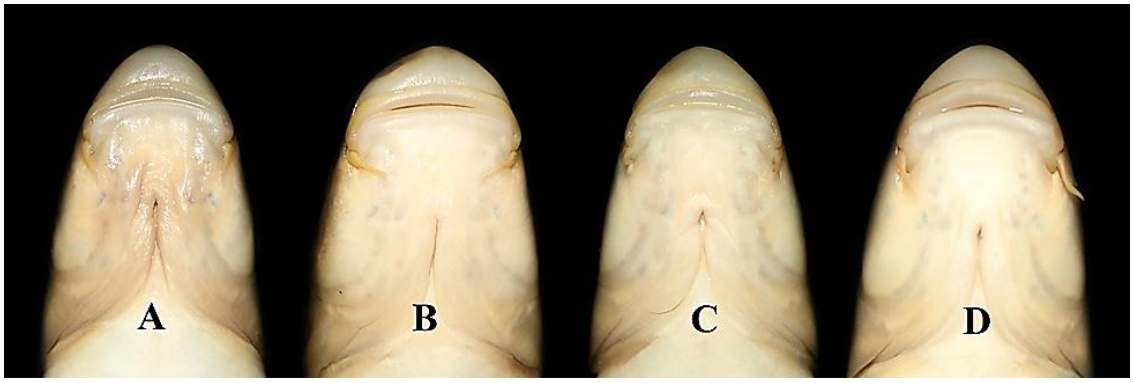


**Figure 6.** Ventral view of head. *Capoeta ferdowsii*, Holotype: A: IMNRF-UT-1111 61, 122 mm SL; Paratype: B: IMNRF-UT-1111 62, 130 mm SL; C: IMNRF-UT-1111 63, 112 mm SL; D: IMNRF-UT-1111 64, 112 mm SL.

**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).

| | | ***C. ferdowsii*** | | | ***C. coadi*** | | | ***C. damascina*** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characters** | **Holotype** | **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).

| | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **Mode** | **Mean** | **SD** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | | | | | | | **UPL** | | | | | | | | | |
| *C. ferdowsii* | **6** | 2 | 1 | | | | | | | | | | | 4 | 4.4 | 0.7 |
| *C. coadi* | **11** | 7 | | | | | | | | | | | | 4 | 4.4 | 0.5 |
| *C. damascina* | | 1 | **5** | | | | | | | | | | | 6 | 5.8 | 0.4 |
| *C. pyragyi* | **10** | 6 | | | | | | | | | | | | 4 | 4.4 | 0.5 |
| *C. shajariani* | 3 | **8** | | | | | | | | | | | | 5 | 4.7 | 0.5 |
| | | | | | | | **LLB** | | | | | | | | | |
| *C. ferdowsii* | | | | | 4 | **5** | | | | | | | | 9 | 8.6 | 0.5 |
| *C. coadi* | | | | 1 | **6** | **6** | 4 | 1 | | | | | | 8 | 8.9 | 1.0 |
| *C. damascina* | | | | | | | 1 | **3** | 2 | | | | | 11 | 11.2 | 0.8 |
| *C. pyragyi* | | | | | 5 | **8** | 3 | | | | | | | 9 | 8.9 | 0.7 |
| *C. shajariani* | | | | | | **6** | 4 | 1 | | | | | | 9 | 9.5 | 0.7 |
| | | | | | | | **DBR** | | | | | | | | | |
| *C. ferdowsii* | | | | | 3 | **6** | | | | | | | | 9 | 8.7 | 0.5 |
| *C. coadi* | | | | | 5 | **13** | | | | | | | | 9 | 8.7 | 0.5 |
| *C. damascina* | | | | | | **6** | | | | | | | | 9 | 9.0 | 0.0 |
| *C. pyragyi* | | | | | 2 | **14** | | | | | | | | 9 | 8.9 | 0.3 |
| *C. shajariani* | | | | | | **9** | 2 | | | | | | | 9 | 9.2 | 0.4 |
| | | | | | | | **PBR** | | | | | | | | | |
| *C. ferdowsii* | | | | | **9** | | | | | | | | | 8 | 8.0 | 0.0 |
| *C. coadi* | | | | | 2 | **13** | 3 | | | | | | | 9 | 9.1 | 0.5 |
| *C. damascina* | | | | | | 3 | 3 | | | | | | | 10 | 9.5 | 0.5 |
| *C. pyragyi* | | | | | 3 | **12** | 1 | | | | | | | 9 | 8.9 | 0.5 |
| *C. shajariani* | | | | | | 5 | **6** | | | | | | | 10 | 9.5 | 0.5 |
| | | | | | | | **LWL** | | | | | | | | | |
| *C. ferdowsii* | | | | | | | | | 2 | **5** | 2 | | | 13 | 12.0 | 0.7 |
| *C. coadi* | | | | | | | 1 | 4 | 4 | **7** | 2 | | | 13 | 12.3 | 1.1 |
| *C. damascina* | | | | | | | | | | | | **5** | 1 | 15 | 15.2 | 0.4 |
| *C. pyragyi* | | | | | | | | | | 5 | **7** | 4 | | 14 | 13.9 | 0.8 |
| *C. shajariani* | | | | | | | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. ferdowsii* | 2 | | **3** | 1 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | 70 | 71.2 | 2.9 |
| *C. coadi* | 2 | 1 | 2 | 1 | 2 | | 2 | 2 | 1 | 2 | 2 | | | | | 1 | | | | | | | | 77 | 73.7 | 4.1 |
| *C. damascina* | | | | | | | | | | | | | | | 1 | 1 | | **2** | | | | 1 | 1 | 85 | 85.7 | 3.2 |
| *C. pyragyi* | 2 | **4** | 2 | 3 | 2 | 1 | 1 | | 1 | | | | | | | | | | | | | | | 69 | 70.8 | 2.2 |
| *C. shajariani* | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. ferdowsii* | | **6** | 1 | 2 | | | | | | | 13 | 13.6 | 0.9 |
| *C. coadi* | 1 | 4 | **8** | 5 | | | | | | | 14 | 13.9 | 0.9 |
| *C. damascina* | | | | | | | 1 | **3** | 1 | 1 | 19 | 19.3 | 1.0 |
| *C. pyragyi* | | 6 | 6 | 3 | 1 | | | | | | 14 | 13.9 | 0.9 |
| *C. shajariani* | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. ferdowsii* | 1 | **5** | 3 | | | | | | | | 24 | 24.2 | 0.7 |
| *C. coadi* | 1 | **7** | 4 | 6 | | | | | | | 24 | 24.8 | 1.0 |
| *C. damascina* | | | | | | | | 2 | 2 | 2 | 30 | 31.0 | 0.9 |
| *C. pyragyi* | | 4 | 6 | 6 | | | | | | | 26 | 25.1 | 0.8 |
| *C. shajariani* | | | 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-UT-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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. ferdowsii* | | 2 | 2 | **4** | 1 | | | | | 17 | 16.4 | 1.0 |
| *C. coadi* | 1 | 2 | 4 | **7** | 3 | 1 | | | | 17 | 16.7 | 1.2 |
| *C. damascina* | | | | | | | | **5** | 1 | 21 | 21.2 | 0.4 |
| *C. pyragyi* | | | | 2 | **7** | 7 | | | | 18 | 18.3 | 0.7 |
| *C. shajariani* | | | 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 at 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 rackers (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 dork 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: مختومقلی 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 at 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 rackers (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.

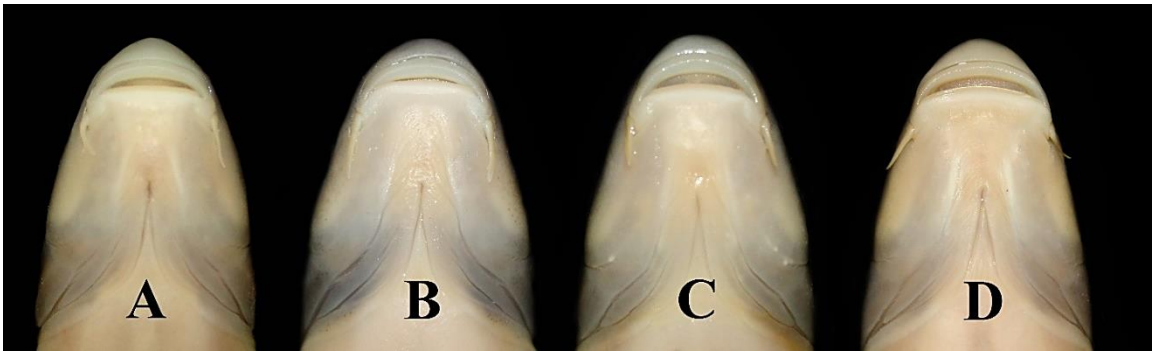


**Figure 12.** Ventral view of head. *Capoeta pyragyi*, Holotype: A: IMNRF-UT-1109 141, 118 mm SL; Paratype: B: IMNRF-UT-1109 142, 112 mm SL; C: IMNRF-UT-1109 143, 109 mm SL; D: IMNRF-UT-1109 140, 147 mm SL.

*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

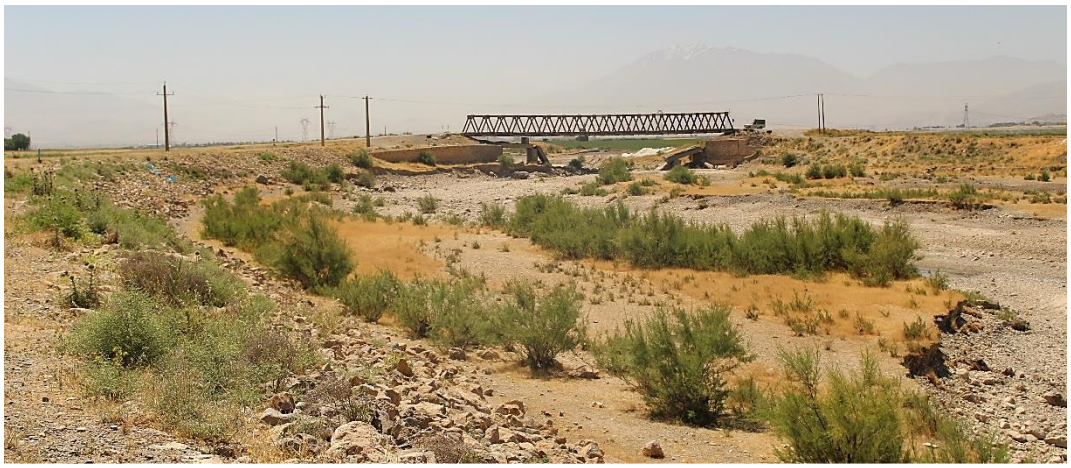

**Figure 13.** Tireh River at Kaghe village, Tigris River drainage, type locality of *Capoeta pyragyi*.

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

| | | *C. pyragyi* | | |
|---|---|---|---|---|
| **Characters** | **Holotype** | **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 rackers (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 at 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 rackers (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).

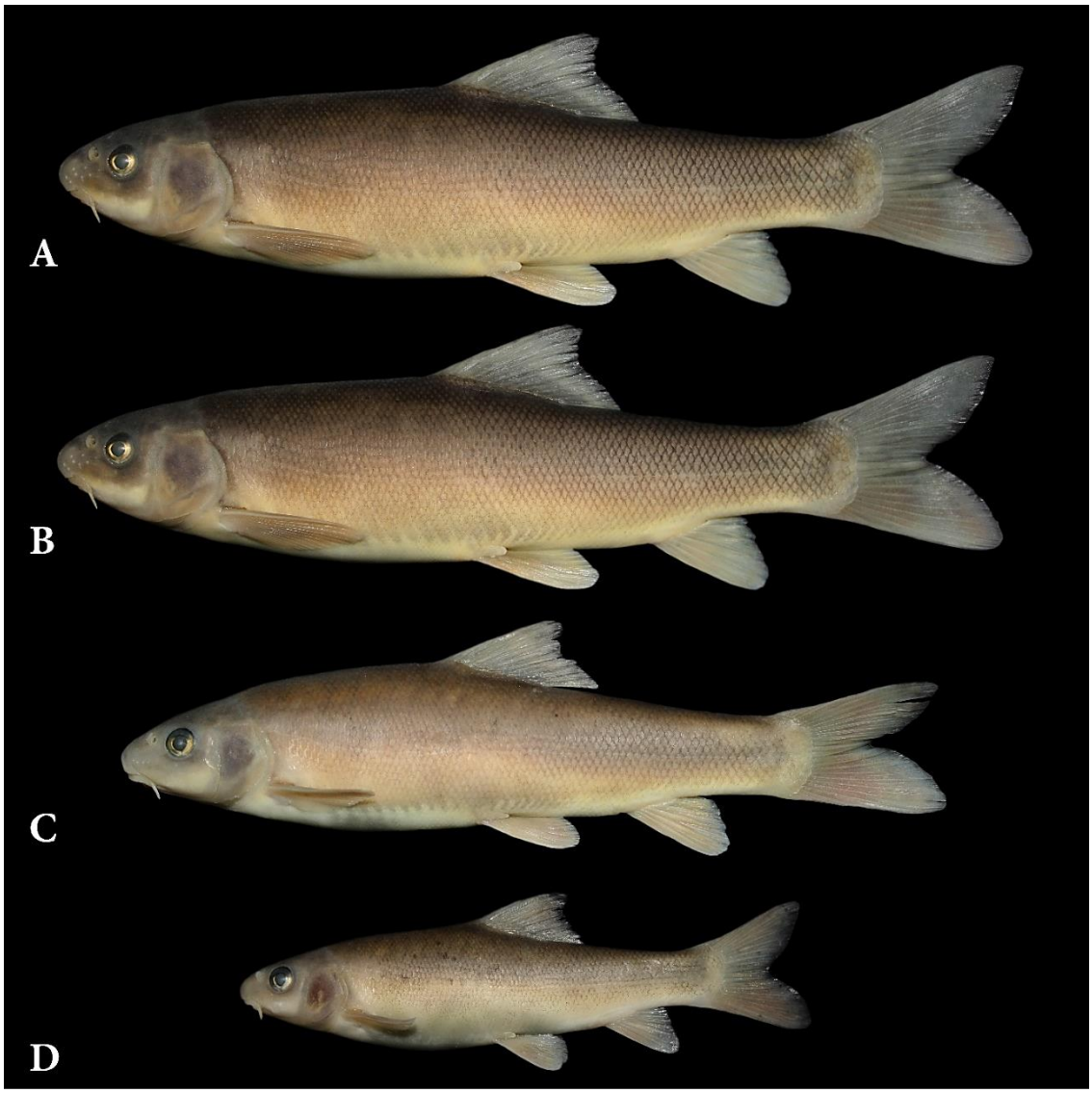


**Figure 16.** *Capoeta shajariani*, paratypes; A: IMNRF-UT-1107 26, 169 mm SL; B: IMNRF-UT-1107 24, 160 mm SL; C: IMNRF-UT-1107 27, 142 mm SL; IMNRF-UT-1107 29, 93 mm SL.

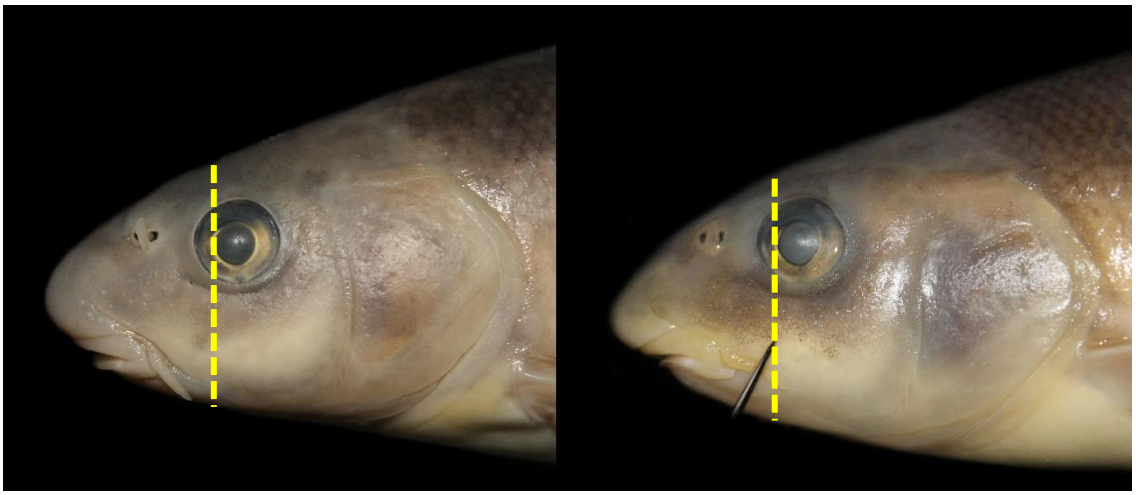

**Figure 17.** *Capoeta shajariani*, IMNRF-UT-1107 21, 162 mm SL (left), and *Capoeta coadi*, B: IMNRF-UT-1108 32, 163 mm SL (right).

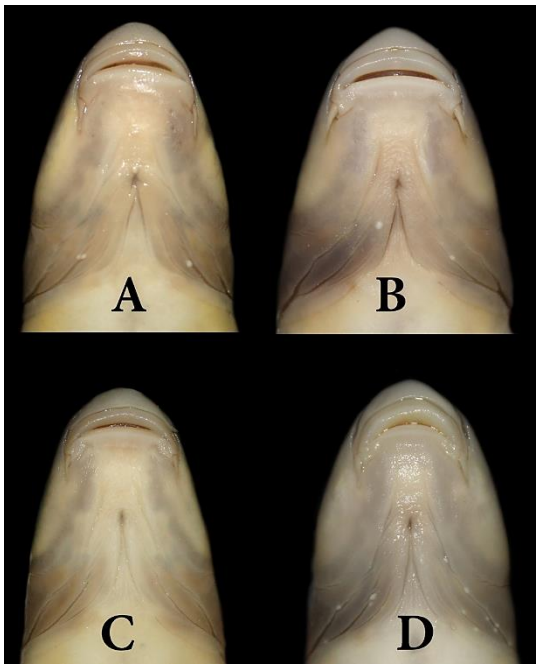


**Figure 18.** Ventral view of head. *Capoeta shajariani*, Holotype: A: IMNRF-UT-1107 21, 162 mm SL; Paratype: B: IMNRF-UT-1107 24, 160 mm SL; C: IMNRF-UT-1107 26, 169 mm SL; IMNRF-UT-1107 27, 142 mm SL.

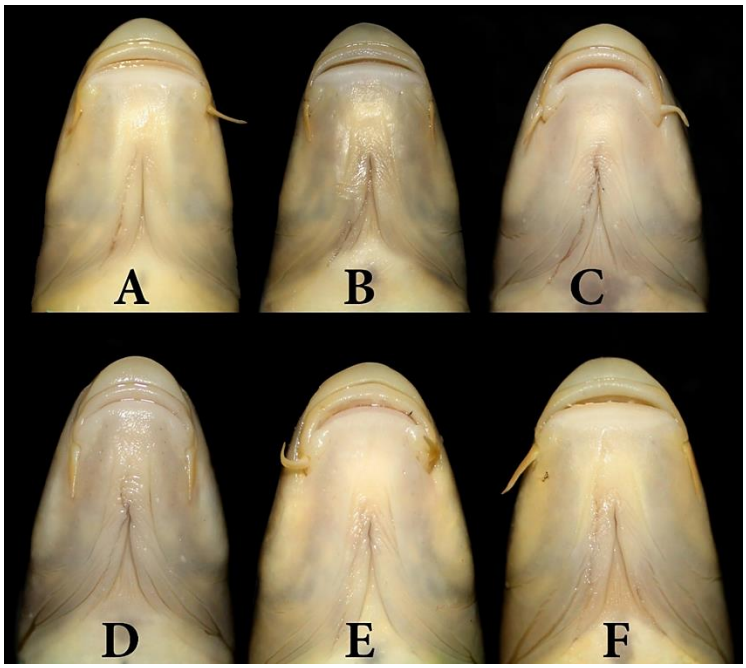


**Figure 19.** Ventral view of head. *Capoeta coadi*. A: IMNRF-UT-1108 30, 159 mm SL; B: IMNRF-UT-1108 32, 163 mm SL; C: IMNRF-UT-1108 34, 156 mm SL; D: IMNRF-UT-1108 35, 138 mm SL; E: IMNRF-UT-1108 37, 153 mm SL; E: IMNRF-UT-1108 40, 143 mm SL; F: IMNRF-UT-1108 43, 132 mm SL.

**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 rackers (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 | *C. shajariani* | | |
|---|---|---|---|---|
| | | 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 |
| Preanal 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 buhsei*: 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 coadi*: 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 villageTigris 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.

## Acknowledgments

We would like to thank P. Rahimi and D. Corona-Santiago for assistance in the laboratory and fish collection, and E. Elahi for proofreading this work. This research was funded by University of Tehran and the Spanish Ministry of Economy and Competitiveness (project number CGL2016-75262-P).

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