

## Article

# Re-description of *Barbus miliaris* De Filippi, 1863 (Teleostei: Cyprinidae) from the endorheic Namak Lake basin of Iran

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### Abstract

*Barbus miliaris* was described in 1863 by De Filippi on the basis of three specimens collected from the endorheic Namak Lake basin (a stream near Tehran). But it was later assigned to the subspecies of *Barbus lacerta*, *B. cyclolepis* or *Luciobarbus mursa*. Here, we revalidate and re-describe it. *Barbus miliaris* is distinguished from the other species of *Barbus* by having more scales along the lateral line (69-87, mode 77 vs. 50-66, mode 57 in *B. cyri*; 52-66, mode 61 in *B. lacerta*) and 80-95% of the posterior margin of the last unbranched dorsal-fin ray covered with denticles (vs. 60-70%). *Barbus miliaris* is also distinguished from *B. cyri* by having more predorsal scales (37-47, mode 42 vs. 24-34, mode 29); a narrower upper lip (its width 4-6 vs. 7-9 %HL). In *B. miliaris*, the maxillary barbel is longer than that of the others (26-41 vs. 12-32 %HL in other species, not reaching to posterior eye margin vs. reaching in *B. lacerta*).

**Keywords:** Freshwater fish, Middle East, Taxonomy, Distribution.

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## Introduction

The Iranian Plateau is located in the Palearctic region bordering the Oriental and African zones (Coad and Vilenkin 2004) characterized by high biodiversity. This diversity is especially observed in the freshwater fishes mainly cyprinid fishes (Esmaeili et al. 2010, 2014a, b). Only two cyprinid species are now assigned to the genus *Barbus* in the political borders of Iran: Kura barbel, *Barbus cyri* De Filippi, 1865 from the Caspian Sea and Urmia Lake basins (see Naseka and Bogutskaya 2009; Motamedi et al. 2014; Esmaeili et al. 2014b) and Tigris barbel, *B. lacerta* Heckel, 1843 from Tigris River drainage. *Barbus cyri* was originally described from the "Kur presso Tiflis" (= Kura River near Tbilisi, Georgia) and *Barbus lacerta* from the "Flüssen Kueik bei Aleppo" (Heckel 1843). The Namak Lake populations have an ambiguous situation: De Filippi (1863) considered Namak Lake population (from a "fiumicelli presso Teheran" (= a stream near Tehran)), as a distinct species, *Barbus miliaris*. Since the original description, the taxonomic status of this species was controversial, with some authors considering it a subspecies of *B. lacerta*, *B. cyclolepis* Heckel, 1837 or *Luciobarbus mursa* (Güldenstaedt, 1773) (see Berg 1949; Karaman 1971; Bianco and Bănărescu 1982; Esmaeili et al. 2010; Coad 2016). The aim of this study is to clarify the systematic status of *B. miliaris* from the Namak Lake basin, give a detailed re-description and its distribution.

## Material and Methods

Fishes were collected at in the Namak Lake basin using electrofishing device. After anesthesia, the collected samples were fixed in 10% formaldehyde and stored in 70% ethanol. Measurements were made with a digital caliper and recorded to the nearest 0.1 mm. All measurements were made point to point (never by projections). Methods for counts and measurements follow Kottelat and Freyhof (2007). Standard length (SL) was measured from the tip of the snout to the end of the hypural complex. The length of the caudal peduncle was measured from the insertion of the last anal-fin ray to the end of the hypural complex, at mid-height of the caudal-fin base. The width of the upper lip was measured ventrally at the anterior tip of the lip. The scales in the lateral line were counted as total scales from the first scale on flank to the last scale on the caudal-fin base. The last two branched

rays articulating on a single pterygiophore in the dorsal and anal fins were counted as "1½". Several *Barbus* species show a sexual dimorphism of the shape and length of the anal-fin. Such sexual dimorphism were not observed in the material of the examined species of the *B. lacerta* group.

**Abbreviations used:** SL, standard length; HL, lateral head length; JNMP, Národní Museum, Natural History Museum, Praha; NMW, the Naturhistorisches Museum Wien; MZUT, the Istituto e Museo di Zoologia della R. Università di Torino; ZM-CBSU, Zoological Museum of Shiraz University, Collection of Biology Department, Shiraz.

## Results

*Barbus miliaris* De Filippi, 1863.

(Figs.1-7, Table 1)

**Material examined:** All from Iran. MZUT 676, syntype, 1. - ZM-CBSU G1101, 24, 70-97 mm SL; Markazi prov.: Qara Chai (Gharehchai) River, at Jalayer, 34°53'13.9"N 50°02'10.9"E, S. Vatandoust 29 July 2012. - ZM-CBSU M426, 1, 118 mm SL; Qom prov.: Qom River, about 35 km South West of Emamzadeh Abdollah, 34°22'47"N 50°36'08"E, H.R. Esmaeili. - ZM-CBSU G980, 4, 103-140 mm SL; ZM-CBSU G1051, 2, 97-107 mm SL; Semnan prov.: Hableh River at 20 km north of Garmsar, 35°18'07"N 52°24'58"E, H.R. Esmaeili.

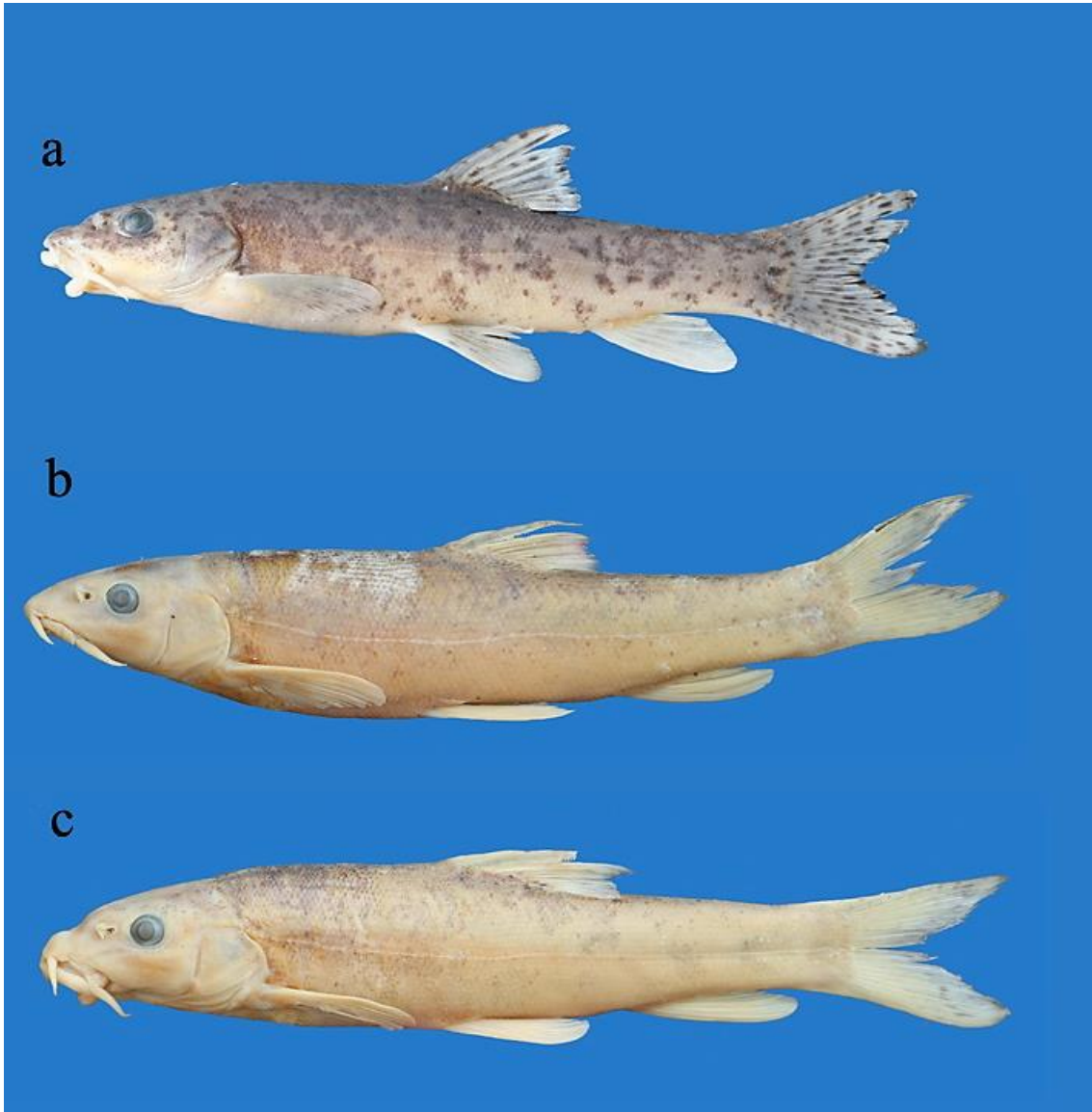
**Diagnosis:** *Barbus miliaris* is distinguished from other species of *Barbus* by more lateral line scales (69-87, mode 77 vs. 50-66, mode 57 in *B. cyri*; 52-66, mode 61 in *B. lacerta*) and 80-95% of the posterior margin of the last unbranched dorsal-fin ray covered with denticles (vs. 60-70% in *B. cyri* and *B. lacerta*). *Barbus miliaris* is also distinguished from *B. cyri* by more predorsal scales (37-47 (mode 42) vs. 24-34 (mode 29)), a narrower upper lip (4-6 vs. 7-9 %HL) and longer maxillary barbel (26-41 vs. 12-32 %HL in *B. lacerta*, not reaching to posterior eye margin (vs. reaching in *B. lacerta*). Other useful characters to identify *B. miliaris* are: snout length 54-57 %body depth at dorsal-fin origin; eye diameter 2.3-2.6 times in snout length; length of caudal peduncle 1.7-2.2 times longer than deep; median pad of lower lip shallow.

**Description:** For general appearance and ventral side of mouth see Figures 1-7. Morphometric data are provided in Table 1. Small-sized and slender species. Body compressed laterally. Dorsal profile almost arched; ventral profile almost straight. Predorsal profile convex. Head profile convex, head deep and narrow. Body deepest at dorsal-fin origin, depth decreases towards middle of caudal peduncle. Snout 54-57 %body depth at dorsal-fin origin. Lips covered with papillae. Width of upper lip 4-6 %HL. Lower lip thicker than upper lip, with a well-developed median pad separated by a deep groove from adjacent gular tissue. Four barbels, rostral barbel short, not reaching nostril; maxillary barbell 26-41 %HL, not reaching to the posterior eye margin. Caudal peduncle 1.7-2.2 times longer than deep. Largest known individual 140 mm in SL.

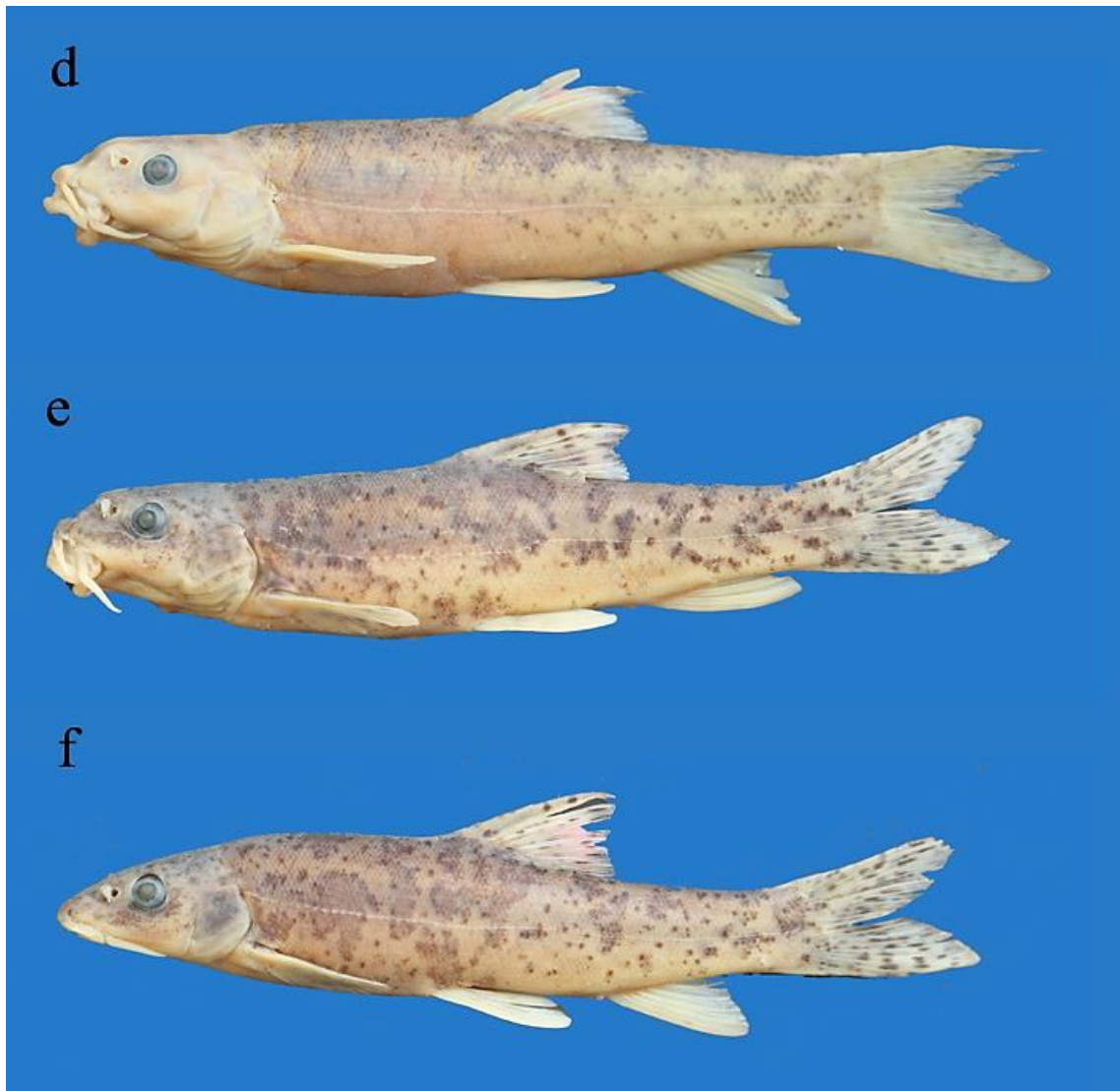
Dorsal fin with 4 unbranched rays and 7½-8½ (mode 8½) branched rays, 80-95% of posterior margin of last unbranched dorsal-fin ray covered with denticles, dorsal-fin posterior margin almost straight, dorsal-fin origin at vertical through pelvic-fin origin. Pectoral fin rounded with 14-17 (mode 16) rays, reaching approximately 50-65% distance from pectoral-fin origin to pelvic-fin origin. Pelvic fin with 8-10 (mode 9) rays not reaching anus. Pelvic-fin origin below vertical of last unbranched to 1-3 branched dorsal-fin ray. Triangular axillary scale at pelvic-fin base. Anal fin with 4 unbranched and 5 ½ branched rays. Tip of anal fin, when pressed to body, reaching to middle of caudal peduncle, 3-6 (mode 4) scale rows between the tip of anal fin and base of the caudal fin. Caudal fin forked. Lateral line with 71-90+2-4 (mode 82) scales. Scale rows between dorsal-fin origin and lateral line 13-17 (mode 15). Scale rows between pelvic-fin origin and lateral line 10-14 (mode 12). Predorsal scales 37-47 (mode 41). Circumpeduncular scales 28-35 (mode 32). Gill rakers on first gill arch 9-12 (mode 10). Vertebrae 41-42. No external sexual dimorphism observed.



**Figure 1.** *Barbus miliaris*, C. N. 676, holotype, 100 mm SL, Iran: a stream nearby Tehran.



**Figure 2.** *Barbus miliaris*. (a) ZM-CBSU G1001, 107 mm SL, (b) ZM-CBSU G1002, 101 mm SL, (c) ZM-CBSU G1003, 96 mm SL; Iran: Semnan prov.: Hableh River at 20 km northeast of Garmsar city, and (d) ZM-CBSU G1105, 90 mm SL, (e) ZM-CBSU G1106, 87 mm SL, and (f) ZM-CBSU G1101, 70 mm SL, Iran: Markazi prov.: Saveh Dam, Namak Lake basin.



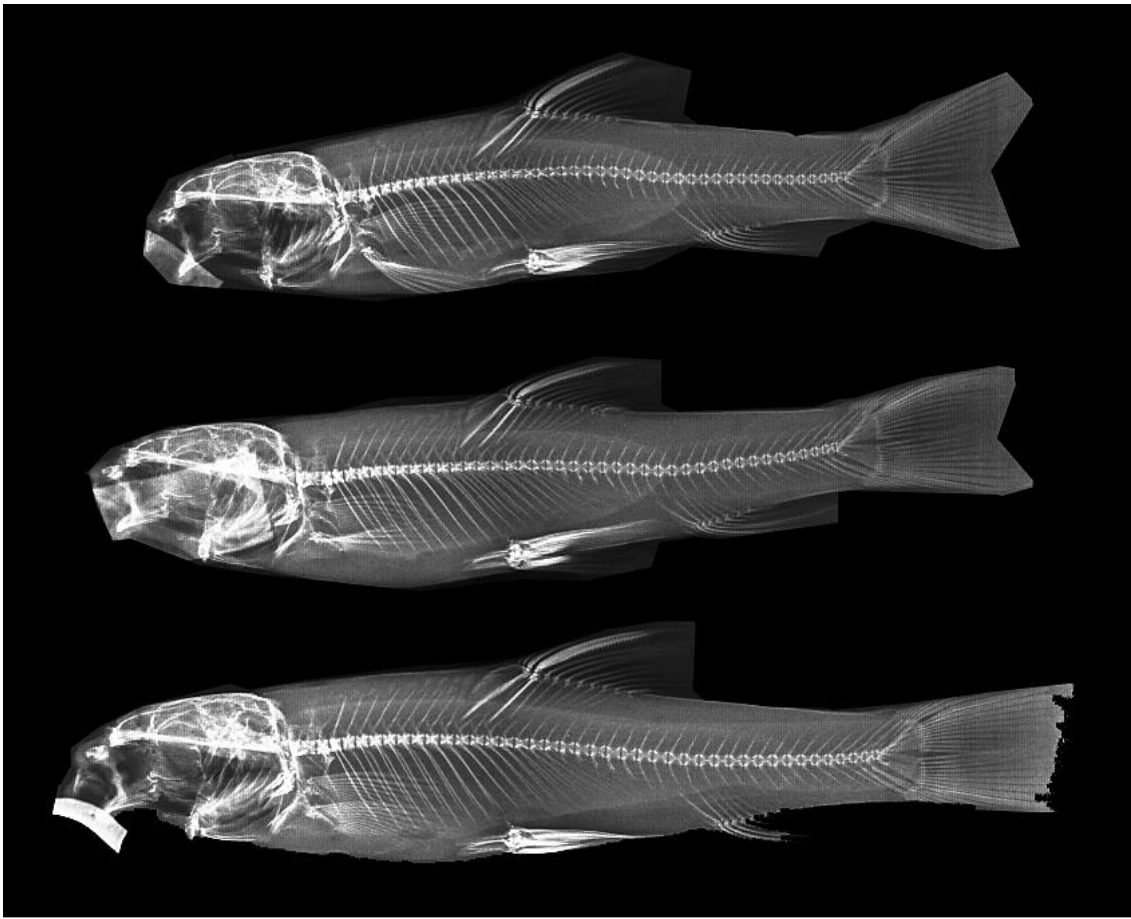
**Figure 2.** Continued.

**Habitat and Conservation:** At the Emamzadeh Abdollah sampling site (Fig. 8), the river flows about 2-3 m wide, with substrate consisting of coarse gravel and boulders, moderate riparian vegetation and almost slow-flowing and transparent waters. The physicochemical parameters at the spot were: dissolved oxygen:  $8.44 \text{ mg L}^{-1}$ , total dissolved solids:  $2.67 \text{ g L}^{-1}$ , salinity:  $2.72 \text{ ‰}$ , conductivity:  $5.08 \text{ ms cm}^{-1}$ , pH: 8.19 and water temperature:  $30.15^\circ\text{C}$ . At the Hableh River sampling site (Fig. 9), the river flows about 5-10 m wide, with substrate consisting of coarse gravel and boulders, poor riparian vegetation and almost fast-flowing and transparent waters. The physicochemical parameters at the spot were: dissolved oxygen:  $7.96 \text{ mg L}^{-1}$ , total dissolved solids:  $2.27 \text{ g L}^{-1}$ , salinity:  $2.06 \text{ ‰}$ , conductivity:  $3.91 \text{ ms cm}^{-1}$ , pH: 8.32 and water temperature:  $21.8^\circ\text{C}$ .

**Distribution:** *Barbus miliaris* is known from the Qom and Qareh Chai River drainages of Namak Lake basin and from the Hableh River in the Kavir basin (Fig. 10).

**Remarks:** *Barbus miliaris* has been described by De Filippi (1863) from a "fiumicelli presso Teheran" (a stream near Tehran). This is very likely to be situated within the Karaj River near Tehran. The Karaj River belongs to the Lake Namak basin, as do all streams near Tehran. There is only one species of *Barbus* found in the Lake Namak basin. We suspect that *B. miliaris* still occurred in the northern tributaries of the Lake Namak basin (near Tehran) in the 19<sup>th</sup> century (see Tortonese 1940; Coad 2016), but has been extirpated from that area since.





**Figure 3.** X-ray of *Barbus miliaris* showing vertebrae. ZM-CBSU G1101, 70 mm SL; ZM-CBSU G1104, 84 mm SL; ZM-CBSU G1116, 93 mm SL. Iran: Markazi prov.: Qara Chai River, at Jalayer, Namak Lake basin.



**Figure 4.** Live specimen of *Barbus miliaris*, ZM-CBSU G1037, 71 mm SL, Iran: Semnan prov.: Hableh River.



**Figure 5.** Live specimen of *Barbus miliaris*, ZM-CBSU G1040, 65 mm SL, Iran: Qom River, Emamzadeh Abdolah, Namak Lake basin.



**Figure 6.** Live specimen of *Barbus miliaris*, ZM-CBSU G1039, 68 mm SL, Iran: Hableh River, Garmsar, Kavir basin.



**Figure 7.** *Barbus miliaris*, uncatalogued fish, head, ventral view; Iran: Markazi prov.: Marzaghan Chai, a tributary of Qara Chai River, at Nowbaran ( $35^{\circ}05'55.01''\text{N}$ ,  $49^{\circ}42'58.80''\text{E}$ ), Namak Lake basin.



**Figure 8.** Natural habitat of *Barbus miliaris*. Iran: Qom River, at Emamzadeh Abdollah, Namak Lake basin.

**Table 1.** Morphometric data of *Barbus miliaris* (ZM-CBSU G1101, 24 specimens from Iran: Markazi prov.: Saveh Dam at Saveh City, Qara chai River, Namak Lake basin).

	<i>Barbus miliaris</i>			
	Min	Max	Mean	SD
Total length (mm)	84.7	117.5	104.3	8.65
<b>In percent of standard length</b>				
Head length	24	29.7	25.7	1.13
Pre orbital distance	9.8	14	11.1	0.80
Post orbital distance	10.5	13.2	11.9	0.60
Inter orbital distance	7.5	9.7	8.8	0.50
Predorsal length	49.3	55.4	51.8	1.63
Postdorsal length	52.3	58.7	55.7	1.60
Dorsal-fin length	18.4	22.6	20.7	1.25
Dorsal-fin depth	11.8	14.8	13.3	0.66
Anal-fin length	17.2	21.6	19.3	1.18
Anal-fin depth	6.8	9.1	7.9	0.61
Preanal length	70.2	74.8	72.8	1.15
Pectoral-fin length	16.5	20.7	19.8	1.05
Pelvic-fin length	16	19.7	18.5	0.96
Minimum body depth	9.9	11.4	10.5	0.38
Maximum body depth	17.5	21.9	20.1	1.08
Distance between pectoral and Anal-fin	45.1	50.3	47.9	1.21
Distance between pectoral and pelvic-fin	22.1	26.2	24.2	1.16
Distance between pelvic and anal-fin	21	25.8	23.6	1.03
First barbel	3.7	6.4	5.7	0.60
Second barbel	6.4	10.1	7.9	0.75
<b>In percent of head length</b>				
Head depth	46.7	60.3	52.6	3.03
Pre orbital distance	39.3	47.7	43.1	2.24
Post orbital distance	42.9	51.3	46.3	1.64
Inter orbital width	28.2	38.6	34.3	2.41
Eye diameter	15.9	21.8	18.4	1.23
Maximum body length	70.7	87.6	78.2	4.37
Length of caudal fin	72.2	96.1	87.4	5.47
Mouth width	12.9	28	24.1	2.97
Dorsal fin unbranched rays	4	4	4	0.00
Dorsal fin branched rays	7	8	7.9	0.33
Pectoral fin rays	14	17	15.9	2.38
pelvic fin rays	8	10	9	0.68
Anal fin unbranched rays	4	4	4	0.00
Anal fin branched rays	5	5	5	0.00
Lateral line scales	71	90	80	5.11
Caudal peduncle scales	28	35	32	1.55
Scale above lateral line	13	17	15.5	1.05
Scale below lateral line	10	14	12.4	1.11
Predorsal scale	37	45	41	2.21
Gill raker	9	12	10.3	0.87

Berg (1949) considered *B. miliaris* to be a subspecies of *B. lacerta*, but it has been considered as a subspecies of *Luciobarbus mursa* by Karaman (1971) and Coad (2016). Syntypes of *B. miliaris* are deposited in MUZT and access to them was not possible due to an accident in the museum. Elena Gavetti and Franco Andreone (MUZT) took pictures of one of the syntypes, which were examined for this study. This individual has 78 total lateral line scales (69-87+3-5 in *Barbus* from Namak Lake basin, 79-95+4-6 in *L. mursa*), a slightly forked caudal fin (slightly forked in *Barbus* from Namak basin vs. deeply forked in *L. mursa*), 14 scales above lateral line (13-17 in *Barbus* from Namak Lake basin and 16-22 in *L. mursa*), a moderately long and pointed head (head moderately long and pointed in *Barbus* from Namak basin and very long and almost cone-shaped in *L. mursa*) and the upper





**Figure 9.** Natural habitat of *Barbus miliaris*. Iran: Hableh River, Kavir basin.

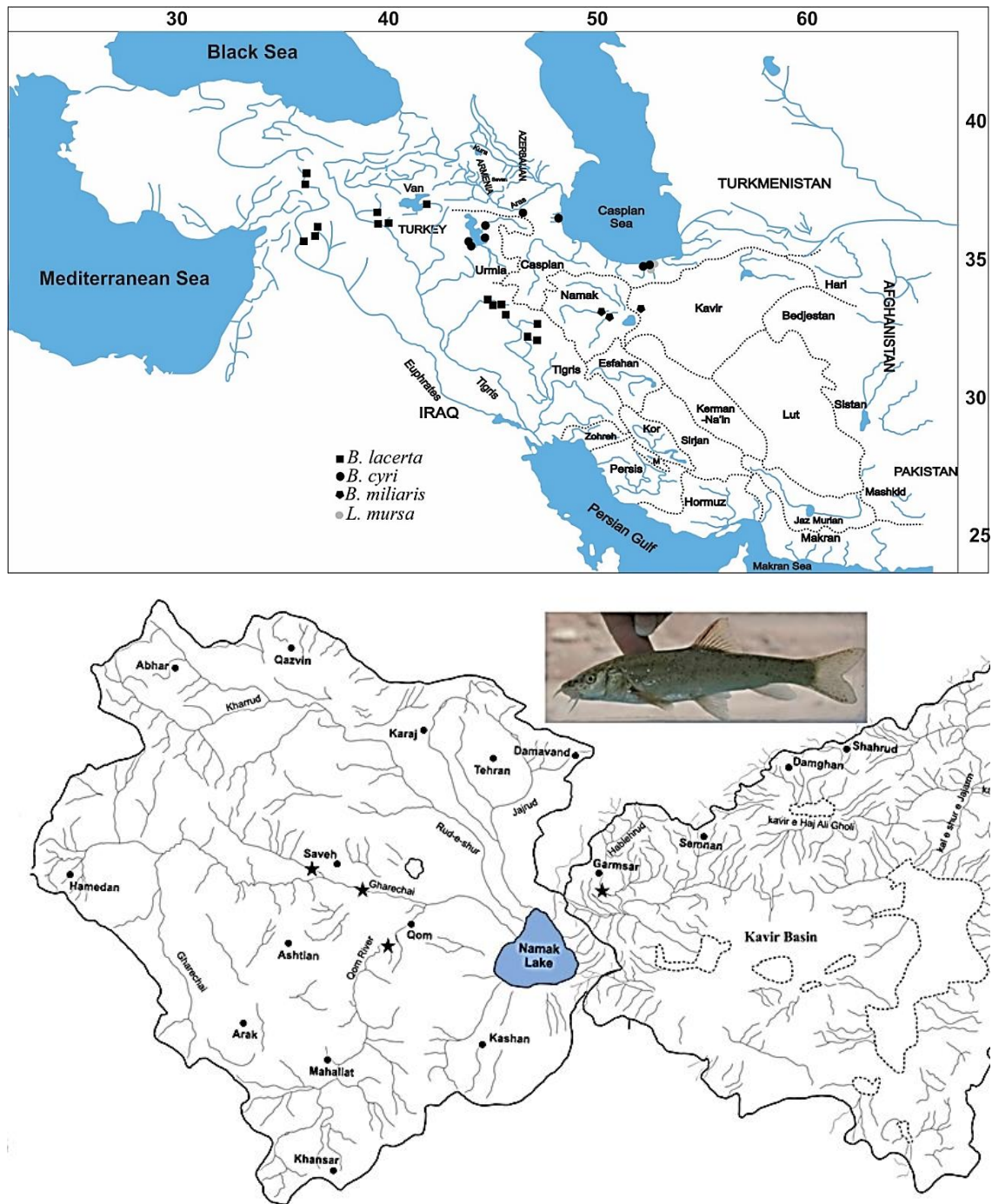
lips is narrow (narrow in *Barbus* from Namak basin but thick in *L. mursa*). The color pattern of the syntype of *B. miliaris* examined lacks dark-brown spots or blotches on the flank that are invariably present in *Barbus* from Namak basin, but absent in *L. mursa*. We suspect that the spots and blotches might have faded completely during the long time of preservation. Based on the characters mentioned above, we identify the type specimen of *B. miliaris* to be identical with the *Barbus* species from the Lake Namak basin. Therefore, we identified this species as *B. miliaris* and do not treat it as a synonym of *L. mursa*. *Barbus miliaris* belongs to the *B. lacerta* group, as already suggested by Berg (1949) and Karaman (1971). Saadati (1977) also recognized *Barbus* from the Namak basin as different from *B. lacerta* by having more lateral line scales. This was confirmed by Bianco and Bănărescu (1982), who suggested that the *Barbus* from the Namak basin might be related to *B. cyclolepis*, a species from the eastern Aegean Sea basin. However, *B. miliaris* is distinguished from *B. cyclolepis* by having 9-12 gill rakers (vs. 8-10, data from Turan et al. 2009) and more number of lateral line scales (71-90 vs. 63-76, data from Turan et al. 2009).

**Comparative material:** *Barbus cyri*: ZM-CBSU G1125, 24, 69-127 mm SL; Iran: Mazandaran prov.: Tajan River at Sari, 36°12'13.8"N 53°05'10.7"E. - ZM-CBSU G968, 12, 81-117 mm SL; Iran: West Azarbaijan prov.: Baranduz Chay River at Urmia, 37°24'59.95"N 45°08'56.34"E. - ZM-CBSU M488, 56 mm SL; Iran: West Azarbaijan prov.: Ghara Chay River at Shahrchay at Bardehsue village, 5 km northwest of Silvana, 37°26'18.4"N 44°49'46.7"E.

*Barbus lacerta*: NMW 54227-1, lectotype, 181.6 mm SL; Syria: Aleppo. - NMW 54227 2-4, paralectotypes; Syria: Aleppo. - ZM-CBSU D111, 8, 57-139 mm SL; Iran: Lorestan prov.: Karkheh River at Kashkanrud 25 km west of Khoramabad, 33°35'14"N 47°52'55"E. - ZM-CBSU G964, 4, 104-136 mm SL; Iran: Kermanshah prov.: Lylehrud River at Shervineh west of Javanrud, 34°52'29"N 46°21'06"E. - ZM-CBSU J1688, 34, 36-126 mm SL; Iran: West Azarbaijan prov.: Little Zab, 10 km south of Piranshahr, 36°28'36.3"N 45°19'54.0"E.

*Luciobarbus mursa*: ZM-CBSU G916, 12, 66-127 mm SL; Iran: Mazandaran prov.: Tajan River at Sari, 36°12'13.8"N 53°05'10.7"E. - ZM-CBSU G1298, 4, 87-109 mm SL, Iran: Mazandaran prov.: Ghaemshar, Telarrud, 36°28'42.8"N 52°49'04.7"E.





**Figure 10.** Distribution map of *Barbus miliaris*, *Barbus cyri* and *Barbus lacerta* in the region (above) and *Barbus miliaris* in the Namak Lake and Kavir basins (below).

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