Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 4, No. 3, p. 196-201, 2014
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

New report of *Capoeta damascina* (Teleostei: Cyprinidae) from aqueducts and springs in Kerman province, Iran

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Article published on March 15, 2014

Key words: Kerman, Siahmahi, *Capoeta damascina,* Cyprinidae, Aqueduct.

Abstract

This study investigated fish fauna identification of Zarand and Kouhbanan in Kerman province to reveale the range extension of *Capoeta damascina*, Siahmahi, in northwest of Kerman basin aqueducts and springs. In this study totally 39 sites in Zarand and Kouhbanan were investigated based on having or not having fish species. Sampling was carried out in most sites and 56 specimens were studied morphologically. Results showed that captured specimens have represented 8-9 branched fin rays, the last dorsal unbranched fin ray, which was clearly thickened and serrated, number of gill rakers 10-15 and Lateral line scales 60-76. By comparing given data and other morphological body patterns with present references, we convinced that these samples belong to *Capoeta damascina* (Valenciennes, 1842). Moreover length-weight relationship, length-width relationship and sex ratio of *C. damascina* were calculated by statistical software analysis SPSS 17. Results indicated that in Siahmahi, there were close relationships between body length-weight and body length-width with the R values of 0.96 and 0.94, respectively. In favour of males the sex ratio obtained 1:2.8.

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Introduction

Capoeta damascina, (Teleostei: Cyprinidae), is one of the most common freshwater fish species, which was known as Siahmahi and found throughout the Levant, Mesopotamia, Turkey and Iran (Alwan, 2010). According to the state of knowledge, *C. damascina*, which is distributed over a wide range of isolated water bodies, is not a well-distinguished species and can be regarded as species complexes, probably containing several undescribed species.

In Iran, *Capoeta damascina* (Valenciennes, 1842) is recorded from Namak Lake, Kavir, Esfahan, Tigris River, Gulf, Kor River, Lake Maharlu, Sirjan, Naein, Hormuz, Lut and Hamun-e Jaz Murian basins (Coad, 2013; Esmaeili *et al*., 2011). There are several synonyms for it regarding as: *Scaphiodon amir* Heckel, 1849, *Scaphiodon niger Heckel*, 1849, *Scaphiodon saadii* Heckel, 1849 *Scaphiodon chebisiensis* Keyserling, 1861, *Scaphiodon rostratus* Keyserling, 1861 and *Capoeta capoeta intermedia* Bianco and Bănărescu, 1982 (Esmaeili *et al*., 2010).
Zarand is located in northwest of Kerman Province and 1650m altitude. It has an arid climate in north and moderate climate in mountainous regions. Kouhbanan has mountainous regions and is known to be the most northern spot of Kerman Province, southeast of Iran. Both towns are located within Kerman-Na'in drainage basin, which embedded aqueducts (Qanats) and minor springs in this area, have not been extensively explored yet. Aqueducts are an unusual yet important habitat for fish in Iran.

The Kerman- Na'in basin is extended from Ardestan (33°22'N, 52°23'E) in the north-west to Kerman (30°17'N, 57°05'E) in the south-east of Iran. It is an elongate series of small basins combined here for convenience and named for two major towns at the ends of the basin. Its length exceeds 600 km and maximum width 175km. A continuous range of mountains, paralleling the Zagros Mountain range, flanks this basin on the west, while the eastern edge is lower and abuts the Dasht-e Kavir and Dasht-e Lut basins, particularly in the north-east. The Kerman-Na'in basin lies at a similar altitude to the other interior basins, ca. 1000 m (Coad, 2013). The investigations on the aqueducts and springs fish species in northwest of Kerman province are rare. This study is the first investigation on fish identification in this area.

Materials and methods

This study was carried out in Zarand and Kouhbanan Cities in northwest of Kerman Province, Iran. In order to identify fish fauna of aqueducts and springs in Zarand and Kouhbanan, sampling was done in 21 and 18 sites, respectively, during summer 2013, which precise geographical properties have been presented in table 1 and 2 respectively by GPS. However, not all sites showed the presence of fish (Table 1 and 2). While sampling, all physical and chemical factors of habitats were investigated. Fish was captured by hand net, and pictures of all specimens were taken and also specimen's biometry performed before fixing in formalin (10%). Finally all fish were transferred to lab for identification. Specimens were preserved in 10% formalin, afterwards, labeled individually and deposited in the Zoology Museum of Biology Department in Kerman Shahid Bahonar University. Identification was based on the number of dorsal fin rays, lateral line scales, gill rakers and the morphological characteristics of specimens including body shape, body pattern and scale types. More meristic and morphometric parameters are given in Table 3.

Results

Specimens were collected from a variety range of aqueducts and springs habitats characterized by shallow, clear water, heterogeneous bed morphology with a variety of substrata (e.g. sand, gravel, cementitious).

Totally 56 specimens were collected from 39 different sites. Morphologically, males exhibited breeding tubercles around the snout. However, collected specimens demonstrated various patterns from not

developing black spots to several large black spots developed on the body of adults to quite numerous small black spots on lateral sides of the body of juveniles (Figure 2a, b and c).

Table 1. Geographical status and fish recorded (*) of Zarand Aqueducts and Springs.

Qanat	altitude	latitude	longitude	Fish presence
Jorjafak	2200	3038408	5619780	*
Jorjafak Khita	2163	3038357	5619953	*
Chahkin	2115	3040442	5617321	*
Hesn (Dehbala Hosn)	1753	3045935	5606832	*
Hesn (Banehestan Hosn)	1691	3046244	5607398	*
Hashish	2040	3043512	5606881	*
Dar Kaj	2033	3043833	5606841	--
Farah Abad	1606	3048389	5606037	*
Esfand	2043	3046276	5606253	--
Sang Seyriz	1474	3052153	5608335	--
Hisein Abad	1587	3048795	5605847	*
Aberan	1736	3048999	5603866	*
Deh Ahmadi Shabjare	1659	3100814	5612591	*
Mohamad Abad Shabjare	1716	3103819	5612824	*
Deh Ahmadi Srbanan	2219	3100717	5638049	--
Sarbanan	3016	3109222	5632969	--
Isa Abad Sarbanan	2038	3059497	5641927	*
Kahnooj Sarbanan	2085	3100148	5640493	*
Morsi	2168	3110677	5633054	--
Bageshtoonieh	2480	3109583	5633159	--
Dasht Khak	2600	3101813	5633370	--

Table 2. Geographical status and fish recorded (*) of Kouhbanan Aqueducts and Springs.

Qanat	altitude	latitude	longitude	Fish presence
Deh Malek	1587	3124795	5621847	*
Rashid Abad	2063	3123357	5619953	--
Hosein Abad	1975	3123442	5617321	*
Jozi	1753	3122935	5617832	--
Sharif Abad	1791	3119244	5618398	*
Karvangah	1814	3122512	5617881	--
Esmaeil Abad	1973	3123833	5616841	*
Rizoueiye	1806	3118389	5616037	--
Deh Sang	1904	3122153	5618335	--
Dar Gazag	1846	3122410	5611566	*
Seyed Abad	1936	3122399	5613866	--
Deh Ali	2017	3122311	5626955	--
Fath Abad	1716	3113812	5617824	*
Deh Khaje	2005	3124851	5616154	*
Jevar	2010	3121400	5617119	*
Rizoueiye Spring	2085	3120158	5633054	--
Bondar Spring	2068	3123755	5625041	--
Shourak Spring	2120	3127183	568370	--

Specimens were measured with their (DL) dorsal fin length, (AL) anal fin length, (PL) pectoral fin length and (VL) ventral fin length and also number of lateral line scales (L.l), (D) dorsal branched and unbranched fin rays and (G.r) gill rakers were also counted (Table 2). Results showed that the number of branched fin rays differed between 8 and 9, also the number of unbranched fin rays stayed at 3 and the last dorsal unbranched fin ray was clearly thickened and serrated. The number of gill rakers on the lower arm of gill arch counted from 10 to 15. Lateral line scales also varied between minimum of 60 and maximum of

76 among populations of different collecting sites. Taking all above in to account, the genus *Capoeta* is speculated to belong to species *Capoeta damascina* (Valenciennes, 1842) (Figure 1). There were positive significant correlations between length-weight and length-width (maximum body width) of *C. damascina* with the R values of 0.96 and 0.94 respectively (Table 4). The ratio of Females to males obtained 1:2.8 that shows a significant deviation from the expected sex ratio of 50:50 (Table 4).

Table 3. Morphometric and meristic characters of *Capoeta damascina* from Kerman, Iran.N, number of specimens collected; DL, Dorsal fin length; AL, Anal fin length; PL, Pectoral fin length; VL, Ventral fin length; L.l, Lateral line scales; G.r, gill raker; D, dorsal fin rays. Roman numbers (III) show the unbranched rays; Arabic numbers show the branched rays for D.

Locality	N	TL	FL	SL	Preo.	DL	PL	VL	AL	L.l	G.r	D	f:m
Koojahr	6	105.65	97.41	89.36	8.09	17.77	16.95	13.60	15.70	65-74	11-14	III8	2:4
Aberan	8	60.80	54.83	50.09	4.10	10.78	9.75	7.67	8.38	60-76	11-15	III8-9	3:5
Chahkin	15	95.34	86.40	79.12	7.26	16.36	15.64	11.57	13.76	64-76	11-15	III8-9	3:12
Farah Abad	13	88.97	81.25	73.90	6.83	15.32	14.30	10.64	12.90	67-75	10-14	III8-9	3:10
Hashish	14	93.99	85.56	78.16	6.84	16.99	15.41	11.92	14.60	64-76	10-14	III8-9	4:10

Table 4. Chi-square analysis parameters: sex ratio, expected number, chi-square; length-weight relationship and length-width relationship parameters: R and b of *Capoeta damascina* from Iran.

Total number	males	females	Sex ratio	Expected number	Chi-square value	R	b	Sig.
56	41	15	1:2.8	28.5	12.789	0.96 0.94*	3.04 1.06*	0.00

*R and b values for length-width relationship are marked with.

Discussion

Capoeta damascina, Siahmahi, from various sampling stations showed different meristic features of all posited in the determined ranges cited for *C. damascina* (Coad, 2013). It is stated that changes in the rate of ontogeny can affect meristic features in fish (Smirnov and Levin, 2007).

Fig. 1. *Capoeta damascina* from Kerman, Iran.

Alwan (2010) in her doctoral thesis based on morphological and molecular investigation of *C. damascina* complex from all over the middle east distinguished *C. damascina* from all other *Capoeta* species by following combination of characteristics: 7-11 branched dorsal fin rays; last unbranched dorsal fin ray weakly to moderately ossified and serrated; 6-11 total pelvic fin rays; small scales, 11-20 above lateral line, 7.5-14.5 below the lateral line, 61-91 scales in the lateral line series (usually 68-82); 12-18 gill rakers on lower limb of first gill arch; 43-48 total vertebrae; one posterior pair of barbells; very dark grey-golden to greenish, olive-brown or silvery-grey body coloration in life; absence of black spots in

adults. However, it is seen that Iranian specimens develop less number of gill rakers, also most adults develop black to brownish spots on body.

Fig. 2. Three different morphological patterns of body spots on *C. damascina* from northwest of Kerman, Iran. a) No black spots, b), few black spots, c), numerous large and small black spots.

Moreover, morphologically *C. damascina* from Zarand and Kouhbanan identified by comparing its body profile to below data: body usually elongate and cylindrical, greatest body depth at the level of dorsal fin origin; dorsal head profile straight or convex; predorsal body profile smoothly convex to dorsal fin origin but can be slightly convex or straight; snout usually rounded but can be pointed in some specimens; mouth ventral; lower lip is keratinized (Alwan, 2010).

C. damascina is an endemic fish species of Iran which is widely distributed throughout most drainage Basins including those are in west, south and east of Iran (Coad, 2013). In Kerman it is recorded from western and southern regions of Kerman Province (Ebrahimi, 2007). Apparently habitat resistance and the considerable capability of adjusting to new habitats, *C. damascina* has extended its range of distribution to northern aqueducts and springs of Kerman- Na'in Basin with various physical characteristics.

Rasheed (2012) reported a high length-weight correlation in *C. damascina*, 0.99, from Kurdistan region, Iraq, which it is in consistent with the current data. However, the sex ratio between males and females have been reported 1:1.57 in favour of females by Asadollah, *et al.* (2011) which completely conflicts with the current figure of 1:2.8 in favour of males. According to Nikolsky (1963) variation in sex ratio can be due to the variation in growth rate, age, season and tools of sampling, also, different populations of a species are likely to show different sexual status in different habitats depend on their chemical, environmental and physical characteristics and also the presence of food and other rival fish species that in turn affect their reproductive behaviors. In this study the sampling was carried out in summer, which is reported to be the reproduction season of Siahmahi (Asadollah *et al.*, 2011). Regarding that, before spawning occurs, females are too much heavy, carrying ripped gonads, therefore females are more likely tend to stay near the bottom and males are more frequently present near the surface where they will be caught during sampling process. Furthermore, once fertilization occurs, males tend to go away from spawning areas towards feeding areas of the leas deeper sites, where the sampling had more frequently occurred. The females possibly remain in the submerged vegetation.

Other studies have been done on *C. damascina* including the report of the existence of several different parasitic genus in *C. damascina* and the study of Siahmahi's scale structure and feeding biology (Esmaeili *et al.*, 2007; Jalali *et al.*, 2007; Nazari Chamak *et al.*, 2012).

Aknowledgement

The authors wish to thank Shahid Bahonar University of Kerman for its financial support. We also thank Mr. Abbas Motlaghnejad for his help in during field work.

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