

A new species of the genus *Garra* (Teleostei: Cyprinidae) from Oman

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Abstract

Garra smarti n. sp. a new species of the cyprinid fish genus *Garra* Hamilton, 1822 is described from Wadi Hasik, Dhofar Province, Oman, based on 11 specimens of 24.8 to 49.5 mm standard length. It differs from all other Arabian *Garra* by the following combination of characters: acutely pointed snout tip; anus immediately in front of anal-fin origin; 3 unbranched and 7 branched dorsal-fin rays; 34 or 35 pored scales in the lateral line, 14-16 circumpeduncular scale rows; 13-15 gill rakers on lower limb of first gill arch; mental disc small, usually longer than wide.

Zusammenfassung

Garra smarti n. sp., eine neue Art der Gattung *Garra* Hamilton, 1822 wird anhand von 11 Exemplaren (24.8-49.5 mm Standardlänge) beschrieben. Sie unterscheidet sich von allen anderen *Garra* der Arabischen Halbinsel durch folgende Merkmalskombination: spitz zulaufende Schnauze; Anus unmittelbar vor dem Ansatz der Analflosse; 3 ungespaltene und 7 gespaltene Dorsalstrahlen; 34 oder 35 perforierte Schuppen in der Seitenlinie, 14-16 Schuppenreihen um die Schwanzwurzel; 13-15 Kiemenreusen auf dem unteren Schenkel des ersten Kiemenbogens; Mund-scheibe klein, zumeist länger als breit.

Résumé

Garra smarti n. sp., une nouvelle espèce de Cyprinidé du genre *Garra* Hamilton 1822 est décrite, originaire du Wadi Hasik, Dhofar, Oman, sur base de 11 spécimens de 24,8 à 49,5 mm de longueur standard. Elle se distingue de tous les autres *Garra* arabes par la combinaison des caractéristiques suivantes: rostre très pointu; anus immédiatement devant la naissance de l'anale; 3 rayons dorsaux non ramifiés et 7 ramifiés; 34-35 écailles à pores sur la ligne latérale; 14-16 rangs d'écailles circumpédonculaires; 13-15 branchiospines sur le limbe inférieur du premier arc branchial; disque mentonnier généralement plus long que large.

INTRODUCTION

The cyprinid fish genus *Garra* Hamilton, 1822 is distributed across southern Asia, the Middle East and tropical Africa. More than 50 species of *Garra* are

known from Asia (Menon 1964, Kullander & Fang 2004) and 17 from Africa, which have recently been revised by Stiassny & Getahun (2007). Nine species are known from the Arabian Peninsula (Krupp 1983, Banister 1987). Stiassny & Getahun (2007) provide a detailed diagnosis of *Garra* and a discussion of the phylogenetic relationships of the subtribe Garraina, which they place in the tribe Labeonini. In the present paper we describe a new species of *Garra* from Wadi Hasik, Dhofar Province, Oman.

MATERIALS AND METHODS

The holotype and nine paratypes were preserved in 10% formalin and later on transferred to 70% ethanol. One paratype was kept in an aquarium at the Breeding Centre for Endangered Arabian Wildlife (BCEAW) in Sharjah, U.A.E. and transferred to absolute ethanol for DNA sequencing. Morphometric measurements and meristic counts follow Krupp (1983) for easy comparison with other Arabian *Garra*. Terminology of head and mental disc anatomy follows Stiassny & Getahun (2007). Type specimens were deposited in the Oman Natural History Museum (ONHM), Muscat, Sultanate of Oman, and the Senckenberg Research Institute and Natural History Museum (SMF), Frankfurt, Germany.

Garra smarti n. sp.

Holotype: SMF 31301, 49.5 mm SL, Oman, Wadi Hasik, 17°26'5.77"N 55°13'40.11"E, 31 August 2002, E. Smart.

Paratypes: ONHM, 5: 27.5-34.6 mm SL, collected with holotype; SMF 31302, 4: 24.8-32.9 mm SL, collected with holotype; SMF 31303, 48.6 mm SL, collected with holotype, but reared in aquarium at BCEAW and preserved in absolute ethanol.

Diagnosis: The new species differs from all other Arabian *Garra* by the following combination of char-

acters: elongate body with acutely pointed snout tip; consistently 3 unbranched and 7 branched dorsal-fin rays; 34 or 35 scales in the lateral line, 14-16 circum-peduncular scale rows; 13-15 gill rakers on lower limb of first gill arch; mental disc small, usually longer than wide; anus closer to anal-fin origin than in any other Arabian *Garra*.

Description: A small species of *Garra* with an elongate body; predorsal body profile smoothly convex to dorsal-fin origin; greatest body depth at level of dorsal-fin origin; ventral surface flattened; tip of snout pointed in lateral and dorsal view; orbit in middle of head length (Figs 1, 3, 4). Morphometric characters are given in Table I.

Dorsal fin inserted anterior to pelvic-fin origin; posterior dorsal-fin margin concave; first and second branched rays longest; 3 unbranched and 7 branched dorsal-fin rays; anal fin long, posterior margin straight; 3 unbranched and 5 branched anal-fin rays; pectoral fins with pointed tips, not extending to pelvic-fin base; pelvic fins pointed, extending or almost extending to anal-fin base; caudal fin deeply forked and tips pointed; total vertebrae 28 (f1, holotype), 29 (f3) or 30 (f2); abdominal vertebrae 15 or 16, caudal vertebrae 13-15 (counts excluding those forming the Weberian apparatus and counting the hypural plate as one vertebra).

Lateral line with 34 (f6, including holotype) or 35 (f1) pored scales (counted to the last scale on the caudal-fin base); 4.5 scales above and 3.5 scales below lateral line, 14 (f5, including holotype) or 16 (f2) scales encircling least circumference of caudal peduncle; chest asquamate (except for some scale beds with microscopic scales); ventral midline and pectoral region covered with few, isolated, deeply embedded scales of reduced size; post-pelvic region fully scaled.

No tubercles on snout; mental disc development intermediate (sensu Stiassny & Getahun 2007), but

Table I. Morphometric measurements of *Garra smarti* n. sp. in % of standard length (SL). Measurements follow Krupp (1984).

	Holotype	Paratypes (N = 6)		
		Mean	SD	Range
Total length	130.1	123.7	1.4	121.4 – 125.2
SL (mm)	49.5			30.2 – 34.6
Predorsal length	53.5	52.7	1.2	50.9 – 54.6
Prepelvic length	58.8	57.0	1.3	54.6 – 58.6
Preanal length	78.4	77.5	1.7	75.5 – 80.1
Head length	25.9	27.8	0.7	26.5 – 28.5
Caudal peduncle length	14.7	16.7	0.9	15.5 – 18.2
Body depth	21.6	21.1	0.6	20.0 – 21.4
Caudal peduncle depth	11.5	11.1	0.6	10.2 – 11.8
Dorsal fin length	23.2	21.2	0.8	20.4 – 22.2
Anal fin length	19.0	16.2	0.5	15.7 – 17.0
Pelvic fin length	20.6	18.2	1.1	17.0 – 19.9
Pectoral fin length	22.4	22.1	1.1	20.6 – 23.7
Mouth width	5.7	5.7	0.6	4.9 – 6.4
Disc length	6.9	6.8	0.5	6.2 – 7.6
Disc width	5.7	5.3	1.7	3.7 – 7.6
Rostral barbel length	4.0	4.0	0.3	3.6 – 4.3
Maxillary barbel length	3.0	3.9	0.2	3.4 – 4.0
Orbit diameter	5.7	6.6	0.3	6.1 – 6.9
Interorbital width	8.7	9.3	0.3	8.0 – 10.1

varying markedly among specimens; usually longer than wide (Fig. 2), but in two paratypes as wide as long; rostral cap thin, leaving upper jaw exposed; invected margin of rostral cap papillate, anterior fold and anterolateral lobe of lower lip strongly papillate; central callus and free lateroposterior flap of lower lip covered with small papillae, or almost smooth; disc fully developed in smallest specimen (24.8 mm SL), but rudimentary in a specimen of 32.4 mm SL; two pairs of barbels of about equal length; pharyngeal teeth 2.4.5-5.4.2, of typical *Garra* shape; gill rakers short and slightly hooked, 13 (f3), 14 (f3, including holotype) or 15 (f1) gill rakers on lower limb of first gill arch.

Live colour: Dorsum, sides and head greyish



Fig. 1. *Garra smarti* n. sp., holotype in lateral view (SMF 31301). Photo by S. Tränkner.

brown, darker dorsally and somewhat lighter below the lateral line, with a silvery tinge at the edge of some scales, below the dorsal fin and on the lower sides; few individual scales dark brown; ventral side of head, chest and abdomen dark silvery grey; an indistinct dark dot posterior to dorsal gill opening; lower half of membranes between second to sixth branched dorsal-fin rays with dark pigmentation; membranes of other fins usually without pigmentation, branched fin rays covered with widely-spaced black pigments (Figs 3-4).

Colour in preservative: Dorsum and sides brownish grey turning lighter below the lateral line; head ventrally, chest and abdomen whitish yellow; pigmentation pattern of fins similar to live specimens (Figs 1-2).

Etymology: The new species is named in honour of Ms Emma Smart, Dubai, in recognition of her



Fig. 2. *Garra smarti* n. sp., mental disc of holotype (SMF 31301). Photo by S. Tränkner.



Fig. 3. *Garra smarti* n. sp., photograph of live specimen at collecting site. Photo by K. Kawai.



Fig. 4. *Garra smarti* n. sp., photograph of aquarium specimen at BCEAW. Photo by K. Budd.

studies of Arabian wadi fish and her contributions to the conservation of freshwater habitats in Arabia. She also collected the type specimens and provided detailed information about the collecting site.

Habitat and distribution: *Garra smarti* n. sp. is only known from Wadi Hasik in the Dhofar Region of Oman, approximately 280 km NE of Salalah. The following information about the collecting site was kindly provided by Emma Smart: The mouth of the wadi lies 2 km W from the village of Hasik. While in the estuary only *Aphanius dispar*, *Terapon jarbua* and *Anguilla bicolor* were recorded, the *Garra* occurred further upstream in a series of isolated pools, that measured a maximum of 8 m in length. In August 2002, a flash flood occurred in Wadi Hasik resulting in a complete temporary transformation of the topography of the wadi. The flood waters extended to the sea connecting isolated pools into a flowing, turbid 'river', which filled the surface area of the wadi bed for several kilometres. A large waterfall pool was discovered at 17°26'5.77"N 55°13'40.11"E (Fig. 5). Juvenile *Garra* were observed swimming in shoals near the surface of this pool. The type specimens were caught from this water body. Water quality measurements recorded at the collection site showed a temperature of 27.9 °C, pH 7.6, conductivity 543 µS and total dissolved solids (TDS) 265 mg/l.

Remarks: Like other SE Arabian members of this genus, *Garra smarti* n. sp. presumably belongs to the *Garra rufa* complex (sensu Menon 1964, DNA studies are presently underway). In dorsal view, the snout is more pointed than in other Arabian *Garra* and the distance between the anus and the anal-fin origin is much smaller (1.6% of SL vs. 2.9-4.9% of SL). The mental disc is small and usually much longer than wide, a character the new species shares with *Garra mamshuqa* Krupp, 1983 only. However, the latter species differs markedly in general body shape, coloration and a



Fig. 5. Waterfall and pool in Wadi Hasik where the type specimens were collected. Photo by E. Smart.

higher number of branched dorsal-fin rays. *Garra barreimiae* Banister & Clarke, 1977, which is widespread in SE Arabia differs in having lower numbers of scales in the lateral line and around the least circumference of the caudal peduncle, much shorter fins and a different colour pattern. Geographically, the new species is closest to *G. dunsirei* Banister, 1987, the only other cyprinid species occurring in Dhofar, which inhabits Tawi Atair sinkhole. Both species have consistently three unbranched dorsal-fin rays, while all other Arabian *Garra* usually have four. However, *G. dunsirei* has a much lower number of gill rakers (6-7 vs. 13-15), much smaller eyes, and unlike any other *Garra* its neural arches and spines below the dorsal fin bent sharply back (see Banister 1987: Fig. 4).

The largest specimen of *G. smarti* examined is the holotype (49.5 mm SL). At present about 60 specimens are kept at the BCEAW, of which 12 to 15 are wild caught. The smallest captive born specimen, which hatched in September 2002, measures 21 mm SL (in March 2009), while the largest wild caught specimen (collected in August 2002) now measures 52 mm SL. This indicates that *G. smarti* this is indeed a very small member of the genus *Garra*.

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REFERENCES

- BANISTER, K. E. 1987. Two new species of *Garra* (Teleostei – Cyprinidae) from the Arabian peninsula. *Bulletin of the British Museum of Natural History (Zoology)* 52(1): 59-70.
- KRUPP, F. 1983. Freshwater fishes of Saudi Arabia and adjacent regions of the Arabian peninsula. *Fauna of Saudi Arabia* 5: 568-636.
- KULLANDER, S. O. & FANG, F. 2004. Seven new species of *Garra* (Cyprinidae: Cyprininae) from the Rakhine Yoma, southern Myanmar. *Ichthyological Explorations of Freshwaters* 15(3): 257-278.
- MENON A. G. K. 1964. Monograph of the cyprinid fishes of the genus *Garra*, Hamilton. *Memoirs of the Indian Museum* 14: 173-260.
- STIASSNY, M. L. J. & GETAHUN, A. 2007. An overview of labeonin relationships and the phylogenetic placement of the Afro-Asian genus *Garra* Hamilton, 1922 [sic] (Teleostei: Cyprinidae), with the description of five new species of *Garra* from Ethiopia, and a key to all African species. *Zoological Journal of the Linnean Society* 150: 41-83.