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Article

Remarkable rediscovery of *Barbus* (=*Hypselobarbus*) *mussullah* (Sykes) after 175 years of hiatus and description of a new species of *Hypselobarbus* Bleeker from peninsular India (Cyprinidae: Cypriniformes)

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Abstract
In 1838 Sykes described three species of Cyprindae, *Barbus mussullah*, *B. khudree* and *B. kolus*, all possessing barbels. Since that time the taxonomies of *B. mussullah* and *B. khudree* have been in a state of confusion. Annandale (1919) stated that Sykes' description of *B. mussullah* was inadequate. Hora (1942) described *Barbus* (=*Hypselobarbus*) *mussullah* and relegated it to a synonym of *Cyprinus* (=*Barbus*) *curmuca* Hamilton. Subsequently, Hora (1943) indicated that *Barbus mussullah* belongs to the genus *Tor*. The generic identity of *Barbus* (=*Hypselobarbus*) *mussullah* is important because it is the type species of the genus *Hypselobarbus* Bleeker. Knight et al. (2013, 2104) incorrectly identified *Barbus mussullah* based on specimens from Thunga River, Karnataka and Krishna River, Maharashtra. Examination of their collections and eight additional specimens already collected from Thunga River reveals their incorrect identification of specimens that represent an undescribed species described herein as *Hypselobarbus pseudomussullah*. *Hypselobarbus mussullah* collected from Krishna River is distinguished from *Hypselobarbus pseudomussullah* sp. nov. in having more lateral-line scale rows (44 vs. 41-42), more pre-dorsal scale rows (14 vs. 12-13), more lower transverse scale rows (7.5 vs. 5.5-6), more circumferential scale rows (36 vs. 30-31) and more transverse breast scale rows (14 vs.11-12).
Keywords: Cyprinid fishes, Taxonomic ambiguity, *H. mussullah*, *H. pseudomussullah* sp. nov.
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Introduction

In 1838 Sykes described three species belonging to Cyprindae, *Barbus mussullah*, *B. khudree* and *B. kolus*, all possessing barbels. Since that time the taxonomies of *B. mussullah* and *B. khudree* have been in a state of confusion (Hora 1942); Hora (1942) added that it was hard to identify *B. mussullah* based on the figure and description provided by Sykes (1838). Günther (1868) did not recognize *B. mussullah* but referred to it as *B. tor* and Day (1876) synonymized *B. mussullah* under *B. tor*. Annandale (1919) stated that Sykes' (1838) description of *B. mussullah* is inadequate and his figure is inaccurate but he referred to and illustrated one trivial but apparently constant character that gives the confidence in identifying specimens by Mr. Mciver as distinct. This character is the presence under the eye of a group of small tubercles not contained to one sex and visible with the aid of a lens in quite young fish. Hora (1942) mentioned that he examined Annandale's (1919) specimens of *B. mussullah* and *B. tor* from the Krishna River and stated that if the tubercles on the snout constitute a valid specific character, then there are certainly two distinct species. However, he further claimed that specimens from Deolali referred to *B. khudree* (Hora and Misra 1938) also had tubercles but they were small and low and not as prominent as those of the *Bokar Mahseer*, *Lissochilus* (=*Neolissochilus*) *hexagonolepis* Mc Clelland. Hora (1942) concluded that "based on field investigations and taxonomic findings", *B. mussullah* is in all probability a synonym of *B. curmuca*. If that be so *mussullah* is not a fish of the Mahseer or *Tor* type, but of the *Puntius* type". Menon (1992, 1999, 2004) included *mussullah* under the genus *Hypselobarbus* based on the statement of Rainboth (1989) that if the Sykes' (1838) drawings are accurate, then the species belongs to the genus *Hypselobarbus*.

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Recently Knight et al. (2013) tried to resolve the taxonomic ambiguity with regard to the placement of the species *B. mussullah* in the genus *Hypselobarbus*. Their findings were based on their collections and meticulous examination of the figures and descriptions of *B. kolus* and *B. mussullah* by Sykes (1838, 1841). However, the lack of specimens from the type locality for examination hampered their conclusions. They relied more on their collections of *Hypselobarbus* from Thunga River and reached a conclusion that their specimens of *Hypselobarbus* with four barbels and a rounded anal fin clearly belonged to *H. mussullah*. Knight et al. (2014) further reported that their neotype designation of *H. musssullah* from specimens from Thunga River was not correct. These authors stated that they obtained two specimens from Mula River, a tributary of the Bhima River, Maharashtra, and they designated one of them as the neotype of *H. mussullah*. This prompted the senior author to look into the collections of specimens from both the Krishna and Thunga rivers. Observations of these materials resulted in a specimen, upon close examination, that has a head shape, horny tubercles on the snout, anal fin and caudal peduncle and shape of the anal fin exactly like what was described and figured in Sykes (1841). Herein, we redescribe a specimen from Krishna River at Wai in Satara district, Maharashtra as *H. mussullah*, the type species of the genus *Hypselobarbus* (Bleeker, 1863 a, b) and designate this specimen as a neotype of *H. mussullah* Sykes. Hence it is our opinion that *B. musssullah*, described and figured by Sykes (1841) should be recognized as a species of *Hypselobarbus*. Furthermore, based on closer examination of the senior author's collections of species of *Hypselobarbus* from Thunga River, the neotype designated by Knight et al. (2013) and also again the designation of another neotype from Krishna River, Maharashtra by Knight et al. (2014) clearly belong to an undescribed species that we describe herein as a new species with an additional eight specimens already collected from Thunga River.

Methods

Fish collections were made during 1996-2005 at river sites by earlier workers led by M. Arunachalam. Measurements were made point to point using digital calipers. Methods used for the meristic and morphometric characters are based Hubbs and Lagler (1964). Morphometric characters from landmarks 9, 18-26, 29-31 and 34-35 (Table 1) were the additional truss measurements (Strauss and Bookstein 1982). Preanal scales (Jayaram 1991) are the scales from the anus to the isthmus. Body measurements are expressed as percentage of Standard Length (%SL); head measurements are expressed as percentage of Head Length (%HL).

Abbreviations used: ZSI/SRC (Zoological Survey of India, Southern Regional Centre, Chennai), MSUMNH (Manonmaniam Sundaranar University, Museum of Natural History) and also from CMA (collections of M. Arunachalam).

Comparative materials

Hypselobarbus mussullah: ZSI/SRC F. 8750, 3ex, 169-185 mm SL, Uppinangudi, Nethravathi River, collected by Aswin Rai, 07 April 2013.

Hypselobarbus curmuca: ZSI/SRC F. 8749/1, 94 mm SL, Thunga River. Holehoddu, collected by Aswin Rai, 16 May 2013.

Hypselobarbus curmuca: MSUMNH 83, 1ex, 219.52 mm SL, Sholaiyar Dam of Chalakudi River, collected by M. Arunachalam, 23 March 2001. CMA 32, 5ex, 118.15-199.79 mm SL, Sholaiyar Dam of Chalakudi River, collected by M. Arunachalam, 23 March 2001. CMA 33, 1ex, 144.37 mm SL. Upper Kanneri, tributary of Kali River, Karnataka, collected by M. Arunachalam, 10 May 2002.

Hypselobarbus kolus: (labeled as *H. curmuca* (neotype)), ZSI/SRC F. 8748/1, 141.20 mm SL, Thunga River, Holehoddu, collected by Aswin Rai, 16 May 2013. ZSI/SRC F 8057/1, 120 mm SL. Holebagilu, Sharavathi River, Karnataka, collected by Sreekantha, 15 September 2002. ZSI/SRC F 8751/1, 145.00 mm SL, Mutha River, Pune, Maharashtra, collected by Hemant Ghate, June 2002. MSUMNH 84, 1ex, 186.51 mm SL, Sholaiyar Dam of

Table 1. Morphometric characters of *Hypselobarbus mussullah* and *Hypselobarbus pseudomussullah* sp. nov. Body character measurements are represented as % standard length; head character measurements are represented as % head length.

Measurements from point to point (identified by numbers and names)	***H. mussullah* MSUMNH 93. Neotype n=1**	***H. pseudomussullah* sp. nov.**	
		MSUMNH 94. Holotype n=1	**ZSI/SRC F 8750; ZSI/SRC F 8759; CMA 44. Paratype n=7**
Standard length	258.08	222.69	146.39-240.57
% Standard Length			
Snout to urocentrum	98.54	94.16	90.86-97.30
Pre-anal length	73.26	75.59	74.94-77.16
Pre-dorsal length	45.67	45.51	45.51-50.42
Pre-pelvic length	47.37	51.16	51.16-53.56
Pre-pectoral length	23.55	26.10	25.85-29.16
Pre-occipital length	21.71	22.43	22.43-25.04
Caudal peduncle length	16.10	14.17	11.52-19.01
Dorsal origin to pelvic insertion	27.80	23.20	23.20-27.38
Dorsal spinous height	25.23	21.55	14.90-24.17
Anal fin height	19.24	27.69	16.62-27.69
Depth of caudal peduncle	10.98	9.33	9.16-11.07
Caudal-fin length	29.06	28.80	25.03-32.60
Dorsal-fin height	26.16	23.18	23.05-24.84
Pectoral-fin length	20.27	20.22	19.63-20.63
Pelvic-fin length	18.78	16.07	15.64-18.37
Pelvic auxiliary scale length	6.95	7.42	6.70-9.37
Occiput to dorsal fin origin	25.75	24.53	22.93-27.05
Occiput to pectoral fin insertion	19.49	18.79	18.79-21.04
Occiput to pelvic fin insertion	40.10	38.40	37.25-41.32
Dorsal insertion to pelvic fin insertion	20.81	19.90	19.43-23.03
Dorsal origin to pectoral fin insertion	28.74	26.37	26.37-29.32
Dorsal origin to anal fin origin	39.56	37.71	33.50-39.48
Dorsal-fin origin to Caudal fin	38.51	34.41	33.46-43.23
Dorsal origin to anal fin origin	25.57	24.56	23.05-25.93
Dorsal origin anal fin insertion	27.88	27.24	26.07-29.39
Dorsal-fin base length	15.65	13.22	13.22-15.17
Anal-fin base length	8.52	9.50	7.76-9.84
Pectoral-fin insertion to pelvic fin insertion	23.12	25.50	23.99-26.80
Pectoral fin insertion to anal fin origin	43.70	48.01	43.48-49.24
Pelvic fin insertion to anal fin origin	20.77	23.36	18.37-23.36
Post-dorsal length	55.60	51.20	47.91-58.42
Body depth	26.53	23.81	23.81-38.02
Distance from pectoral fin insertion to vent	46.24	50.91	45.20-50.91
Distance from pelvic fin insertion to vent	22.74	24.61	20.40-25.30
Head length	26.03	26.83	24.44-31.22
% Head Length			
Snout to opercle	74.77	74.33	70.90-85.86
Snout length	47.62	44.54	41.42-47.83
Upper jaw length	25.59	29.55	19.97-38.51
Prenasal length	35.62	30.25	28.12-37.64
Orbit width	20.87	26.53	19.63-32.19
Interorbital width	40.34	37.55	31.31-39.42
Internasal width	24.99	25.49	21.18-26.81
Head width	55.03	52.61	47.61-58.21
Gape width	21.20	24.90	10.90-26.75
Lower jaw to isthmus	63.93	70.50	62.23-75.97
Head depth at nostril	43.87	41.39	35.71-45.32
Head depth at pupil	57.73	54.30	48.40-65.14
Head depth at occiput	69.02	63.58	56.15-77.17
Maxillary barbel length	23.83	12.95	12.95-23.91
Rostral barbel length	18.19	6.54	6.54-10.93

Chalakudi River, collected by M. Arunachalam, 23 March 2001. CMA 34, 3ex, 121.44-158.27 mm SL, Sholayar Dam of Chalakudi River, collected by M. Arunachalam, 23 March 2001. MSUMNH 85, 1ex, 116.46 mm SL, Sharavathi River, Karnataka, collected by M. Arunachalam, 30 May 2003. CMA 35, 2ex, 101.86-105.9 mm SL, Sharavathi River, Karnataka, collected by M. Arunachalam, 30 May 2003. MSUMNH 86, 1ex, 190.83 mm SL, Krishna River at Sakthi Nagar, collected by M. Arunachalam, 16 October 2004. CMA 36, 2ex, 177.71-180.94 mm SL, Krishna River at Sakthi Nagar, collected by M. Arunachalam, 16 October 2004. MSUMNH 87, 1ex, 139.16 mm SL, Thunga River at Shimoga, collected by M. Arunachalam, 20 November 2004. CMA 37, 3ex, 112.16-131.85 mm SL, Thunga River at Shimoga, collected by M. Arunachalam, 20 November 2004. CMA 38, 5ex, 121.75-144.05 mm SL, Mutta River (Pune), collected by M. Arunachalam, 12 June 1998. CMA 47, 1ex, 186.40 mm SL, Cauvery River at Basavanahalli village, Karnataka, collected by M. Arunachalam, 11 May 2001.

Hypselobarbus kurali: ZSI/SRC F4003/1, Holotype, 270.00 mm SL, Kumaradhara River, near Nettana, Dakshin Kannada, collected by A.G.K. Menon, 7 January 1992. ZSI/SRC F4003/1, 258.66 mm SL, Kumaradhara River, near Nettana, Dakshin Kannada, collected by A.G.K. Menon, 7 January 1992. MSUMNH 88, 1ex, 166.83 mm SL, Kallada River at Rosemala village, Kerala, collected by M. Arunachalam, 23 January 2003. CMA 39, 7ex, 144.55-160.55 mm SL, Kallada River at Rosemala village, Kerala, collected by M. Arunachalam, 23 January 2003.

Hypselobarbus dubius: MSUMNH 243, 1ex, 168.32 mm SL, Bhavani River at Athikadavu, collected by M. Arunachalam and team, 03 February 2001. CMA 246, 6ex, 105.09-135.10 mm SL, Pillur Dam, Bhavani River, collected by M. Arunachalam and team, 30 March 2002. CMA 247, 1ex, 115.08 mm SL, Bhavani River at Nellithurai, collected by M. Arunachalam and team, 30 March 2002. CMA 248, 3ex, 215.92-264.09 mm SL, Bhavani River at Athikadavu, collected by M. Arunachalam and team, 03 March 2001. CMA 250, 2ex, 195.62-215.02 mm SL, Bhavani River at Athikadavu, collected by M. Arunachalam and team, 28 January 2002. CMA 251, 3ex, 166.03-197.66 mm SL, Pillur Dam, Bhavani River, collected by M. Arunachalam and team, 18 April 2002. CMA 252, 5ex, 128.44-153.49 mm SL, Pillur Dam, Bhavani River, collected by M. Arunachalam and team, 20 September 2002.

Hypselobarbus micropogon: MSUMNH 244, 1ex, 136.95 mm SL, Pillur Dam, Bhavani River, collected by M. Arunachalam and team, 10 March 2001. CMA 253, 2ex, 130.78-171.35 mm SL, Pillur Dam, collected by M. Arunachalam and team, 10 March 2001. CMA 254, 2ex, 138-139.88 mm SL, Bhavani River at Athikadavu, collected by M. Arunachalam and team, 03 February 2001. CMA 255, 2ex, 106.77-130.61 mm SL, Bhavani River at Athikadavu, collected by M. Arunachalam and team, 27 March 2001. CMA256, 2ex, 104.84-138.17 mm SL, Bhavani River at Chengal, collected by M. Arunachalam and team, 21 November 2001. CMA 257, 3ex, 105.69-146.08 mm SL, Bhavani River at Nellithurai, collected by M. Arunachalam and team, 08 March 2002. CMA 258, 2ex, 113.39-117.45 mm SL, Bhavani River at Nellithurai, collected by M. Arunachalam and team, 11 October 2001. CMA 259, 4ex, 111.94-122.15 mm SL, Pillur Dam, Bhavani River, collected by M. Arunachalam and team, 16 March 2003.

Hypselobarbus periyarensis: MSUMNH 103, 1ex, 264.56 mm SL, Periyar River, Bharathapuzha River basin, Kerala, collected by M. Arunachalam and team, 13 September 2002. CMA 117, 9 ex, 219.86-260.45 mm SL, Periyar River, Bharathapuzha River basin, Kerala, collected by M. Arunachalam and team, 13 September 2002.

Tor mussullah: MSUMNH 104, 1ex, 515 mm, Sholayar Dam, Chalakudi River basin, collected by M. Arunachalam, 23 March 2001.

Results

Hypselobarbus mussullah Sykes 1838

(Fig. 1A-D)

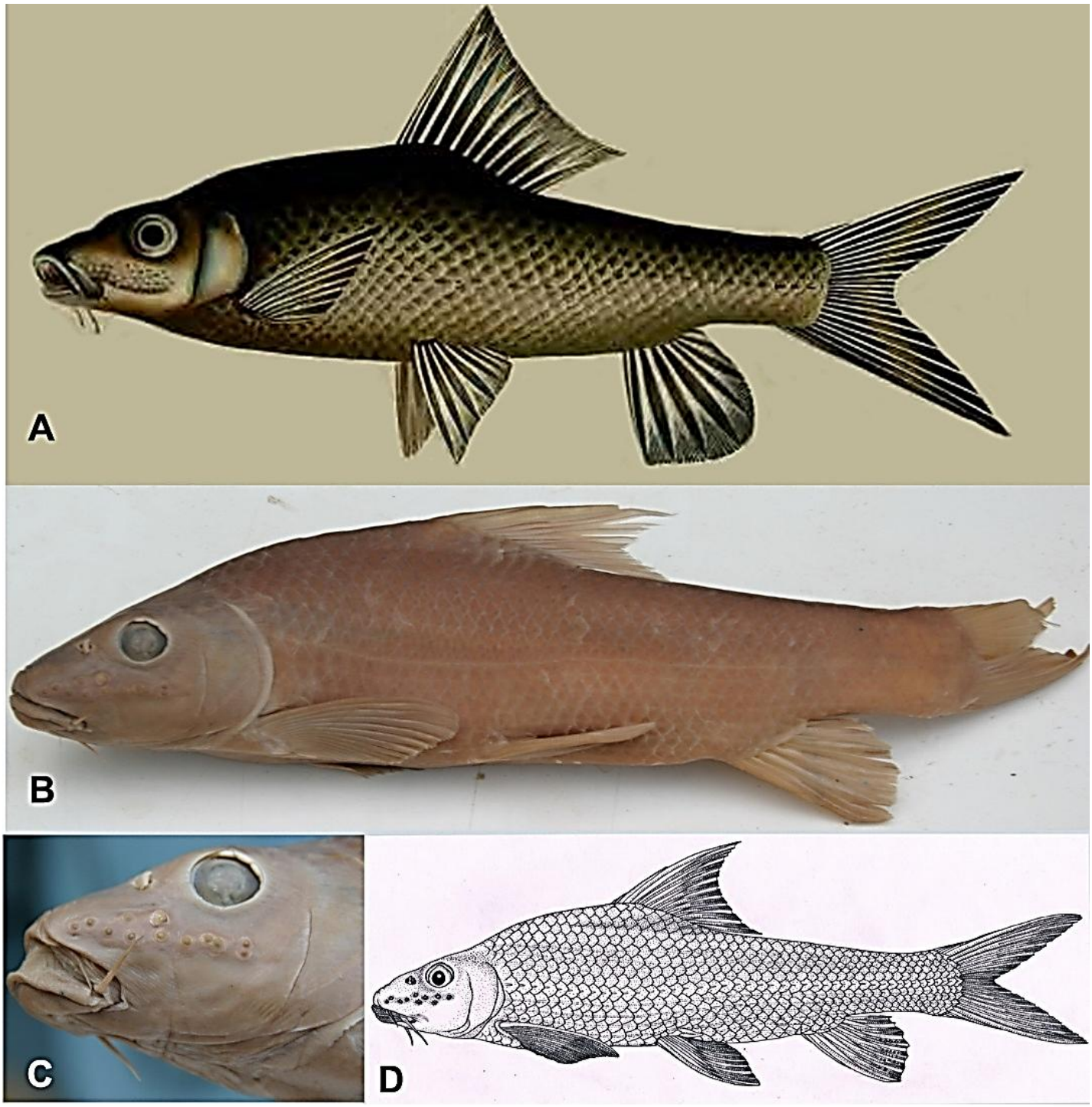

Figure 1. *Hypselobarbus mussullah.* (A) *Barbus mussullah* from Sykes 1841; 356, pl, 61, original illustration, (B) *Hypselobarbus mussullah* MSUMNH 93, 258.08 mm SL, Krishna River at Wai, Satara collected by M. Arunachalam, (C) Head of *Hypselobarbus mussullah* MSUMNH 93 and (D) Line drawing of *Hypselobarbus mussullah* MSUMNH 93.

Barbus mussullah Sykes, 1839: 159-Goreh (Ghod) River (Krishna basin).

Barbus mussullah Sykes, 1841: 356, pl.6 (fig. 4)-Groeh (Ghod) River (Krishna basin).

Neotype: *Hypselobarbus mussullah* MSUMNH 93, 258.08 mm SL, Krishna River (Wai), collected by M. Arunachalam, 24 November 1998.

Diagnosis: *Hypselobarbus mussullah* is distinguished from *H. dubius* in having a weaker dorsal spine (vs. strong), more transverse breast scale rows (14 vs. 9-11) and more pre-anal scale rows (40 vs. 34-38). It is distinguished

Table 2. Meristic characters of *Hypselobarbus mussullah* and *Hypselobarbus pseudomussullah* sp. nov.

Meristic characters	*H. mussullah* MSUMNH 93. Neotype n=1	*H. pseudomussullah* sp. nov.	
		MSUMNH 94. Holotype n=1	ZSI/SRC F.8750; ZSI/SRC F8759; CMA, 44. paratype n=7
Dorsal fin rays	iv.9	iv.9	iv.9
Anal fin rays	iii.5	iii.5	iii.5
Pelvic fin rays	i.9	ii.9	ii.9
Pectoral fin rays	i.15	i.14	i.14
Caudal fin rays	10+9	10+9	10+9
Upper transverse scale rows	8.5	8	8-8.5
Lower transverse scale rows	7.5	6	5.5-6
Lateral line to pelvic scale rows	5	4	4-4.5
Lateral line scale rows	44	41	41-42
Predorsal scale rows	14	13	12-13
Circumpeduncular scale rows	18	18	18
Circumferential scale rows	36	30	30-31
Transverse breast scale rows	14	12	11-12
Pre anal scale rows	40	41	39-44

from *H. micropogon* in having a weaker spine (vs. strong), more lateral-line scale rows (44 vs. 36-41), and more circumferential scale rows (36 vs. 26-29). This species is distinguished from *H. periyarensis* in having a weaker dorsal spine (vs. strong), fewer pre-dorsal scale rows (14 vs. 17-18), more circumferential scale rows (36 vs. 32-34), and the morphometric characters occiput to dorsal-fin origin (25.75 vs. 30.12-34.75 %SL), pelvic insertion to anal-fin origin (20.77 vs. 26.43-29.78 %SL), post-dorsal length (55.60 vs. 31.88-39.66 %SL), and pre-nasal length (35.62 vs. 21.17-24.13 %HL). It is distinguished from *H. kurali* in having more lower transverse scale rows (7.5 vs. 6.5), more circumferential scale rows (36 vs. 32-33), fewer transverse breast scale rows (14 vs. 21-23), fewer pre-anal scale rows (40 vs. 43-46), and the morphometric characters pre-pectoral length (23.55 vs. 25.94-28.19 %SL) and caudal peduncle length (16.10 vs. 12.70-15.10 %SL). It is distinguished from *H. curmuca* in having two pairs of barbels (vs. single pair), fewer upper transverse scale rows (8.5 vs. 9.5-10), fewer circumpeduncular scale rows (18 vs. 20-21), and fewer circumferential scale rows (36 vs. 39-40). It is distinguished from *H. kolus* in having two pairs of barbels (vs. single pair), fewer upper transverse scale rows (8.5 vs. 9.5-10), fewer circumpeducular scale rows (18 vs. 20-21), more pre-anal scale rows (40 vs. 34-37), and fewer lateral line to pelvic scale rows (5 vs. 6-7).

Description: Meristic and morphometric features of the species are provided in Tables 1 and 2, respectively. Body moderately deep, 26.53% of SL, dorsal margin convex, ventral margin nearly straight (Figs. 1A-D). Dorsal fin origin anterior to the pelvic fin insertion by three scale rows and pre-dorsal and post-dorsal lengths 45.67 and 55.60 %SL, respectively. Nape slightly convex posterior to slight concavity posterior to occiput, providing a "roman-nose" appearance laterally. Lateral line concave, caudal peduncle moderately deep 10.98 %SL, and scales with small tubercles. Anal fin distant, pre-anal fin length 73.26 %SL, prepelvic length 47.37 %SL, distance between pelvic fin and anal fin 20.77 %SL, distance between pectoral and pelvic fins 23.12 %SL.

Head long and laterally compressed, 26.03 %SL, with moderately long cranium, length 21.71 %SL, length of preopercle is 74.77 %HL, head depth 43.87 %HL at nostril, 57.73 %HL at pupil and 69.02 %HL at occiput. Interorbital space concave, distance between orbits 40.34 %HL. Eyes large, 20.87 %HL, snout conical and long, length 47.62 %HL, mouth subterminal. Upper jaw 25.59 %HL, gape width 21.20 %HL, lower jaw not keratinous and not sharp. Barbels in two pairs, the visible maxillary barbel as long as orbit; upper barbel under maxillary grove almost 2/3 eye diameter.

Dorsal-fin rays IV-9, anal-fin rays III-5, pelvic-fin rays I-9, and pectoral-fin rays I-15. Anal-fin length 19.24 %SL, pelvic-fin length, 18.78 %SL, pectoral-fin length 20.27 %SL, length of caudal fin 29.06 %SL. Dorsal fin

straight with concave distal margin, unbranched spinous ray weak and articulated, its length 25.23 %SL. Anal fin rounded and with small tubercles. Distal margin convex; first, second and third unbranched ray unequal in length. Length of anal fin base 8.52 %SL. Pectoral fin moderately falcate, depressed fin extending 1.5 scales anterior to pelvic fin insertion. Pelvic auxilliary scales well developed, length equal to eye diameter. Caudal fin long, deeply forked and with small tubercles on rays, median caudal rays 4.5 times smaller, relative to upper and lower lobes that are nearly equal.

Scales small, lateral-line scale rows 44, pre-dorsal scale rows 14, upper transverse scale rows 8.5, lateral line to pelvic scale rows 5, lower transverse scale rows 7.5, circumpeduncular scale rows 18, circumferential scale rows 36, transverse breast scale rows 14, and pre-anal scale rows 40.

***Hypselobarbus pseudomussullah* sp. nov.**

(Fig. 2B)

Holotype: *Hypselobarbus pseudomussullah* sp. nov., MSUMNH 94, 222.69 mm SL, Thunga River, (13º55'213"N, 75º26'426"E) collected by M. Arunachalam, 20 November 2004.

Paratypes: *Hypselobarbus pseudomussullah* sp. nov., ZSI SRC F. 8750, 2ex, 169-185 mm SL, Uppinangudi Nethravathi River, collected by Aswin Rai, 07 April 2013. ZSI/SRC F. 8759, 1ex, 240.57 mm SL, Bhira Dam at Koland, Maharashtra, India, collected by J.D. Marcus Knight, 2014. CMA 44, 4ex, 146.39-207.06 mm SL, Thunga River, (13º55'213"N, 75º26'426"E) collected by M. Arunachalam, 20 November 2004.

Diagnosis: *Hypselobarbus pseudomussullah* is distinguished from *H. mussullah* in having fewer lateral-line scale rows (41-42 vs. 44), fewer pre-dorsal scale rows (12-13 vs. 14), fewer lower transverse scale rows (5.5-6 vs. 7.5), fewer circumferential scale rows (30-31 vs. 36), fewer transverse breast scale rows (11-12 vs. 14), and the morphometric characters of a greater pre-pelvic fin length (51.16-53.56 vs. 47.37 %SL) and a shorter rostral barbel (6.54-10.93 vs. 18.19 %HL). The species is distinguished from *H. dubius* in having weaker dorsal spine (vs. strong), fewer pre-dorsal scale rows (12-13 vs. 14), and more pre-anal scale rows (39-44 vs. 34-38). It is distinguished from *H. micropogon* in having a weaker dorsal spine (vs. strong), more pre-anal scale rows (39-44 vs. 31-34) and more circumferential scale rows (30-31 vs. 26-29). The species is distinguished from *H. periyarensis* in having fewer pre-dorsal scale rows (12-13 vs. 17-18), fewer circumferential scale rows (30-31 vs. 32-34), and the morphometric characters of shorter distance between occiput to dorsal-fin origin (22.93-27.05 vs. 30.12-34.75 %SL), shorter distance between pectoral-fin insertion to anal-fin origin (43.48-49.24 vs. 53.12-57.68 %SL), a greater post-dorsal length (47.91-58.42 vs. 31.88-39.66 %SL) and shorter maxillary barbels (12.95-23.91 vs. 26.50-29.68 %HL). The new species is distinguished from *H. kurali* in having fewer circumferential scale rows (30-31 vs. 32-33), and fewer transverse breast scales (11-12 vs. 21-23). It is distinguished from *H. curmuca* in having two pairs of barbels (vs. single pair), fewer upper transverse scale rows (8-8.5 vs. 9.5-10), fewer circumferential scale rows (30-31 vs. 39-40), fewer circumpeduncular scale rows (18 vs. 20-21), fewer pre-dorsal scale rows (12-13 vs.14), and fewer lower transverse scale rows (5.5-6 vs. 7.5-8). It is distinguished from *H. kolus* in having two pairs of barbels (vs. single pair), fewer upper transverse scale rows (8-8.5 vs. 9.5-10), fewer circumpeduncular scale rows (18 vs. 20-21), more pre-anal scale rows (39-44 vs. 34-37), and fewer circumferential scale rows (30-31 vs. 35-37).

Description: Meristic and morphometric features of the species are provided in Tables 1 and 2, respectively. Body moderately deep, its depth 23.81-38.02 %SL (Fig. 2A, C). Nape slightly convex behind a concavity posterior to occiput. Dorsal fin origin anterior to pelvic fin insertion by 1.5 scale rows, pre-dorsal length 45.51-50.42 %SL, pre-pelvic length 51.16-53.56 %SL, and pre-anal length 74.94-77.16 %SL. Pre-pectoral length 25.85-29.16 %SL, pelvic fin insertion to anal origin 18.37-23.36 %SL. Caudal peduncle moderately deep, depth at narrowest part 9.16-11.07 %SL; caudal peduncle length 11.52-19.01 %SL.

Figure 2. *Hypselobarbus mussullah* and *H. pseudomussullah*. (A) *Hypselobarbus mussullah* ZSI/SRC F8750, Uppinangudi Nethravathi, (collected by Ashwin Rai), (B) *Hypselobarbus pseudomussullah* sp. nov. MSUMNH 94, 222.69 mm SL, Thunga River (collected by M. Arunachalam), and (C) *Hypselobarbus mussullah*, neotype, ZSI/SRC F 8759, 240.57 mm SL, Bhira Dam at Koland, Maharashtra, India, collected by J.D. Marcus Knight.

Head long 24.44-31.22 %SL, with long cranium of 22.43-25.04 %SL, head depth at nostril 35.71-45.32 %HL, at pupil 48.40-65.14 %HL and at occiput 56.15-77.17 %HL. Preopercle straight and 70.90-85.86 %HL. Interorbital concave, interorbital distance 31.31-39.342 %HL. Eyes large, 19.63-32.19 %HL. Snout long, length 41.42-47.83 %HL, mouth subterminal. Upper jaw length 19.97-38.51 %HL, gape width 10.90-26.75 %HL, lower jaw keratinous but not sharp. Two pairs of barbels; hidden second barbel 1.3 times shorter than orbit width.

Dorsal-fin rays IV-9(8), anal-fin rays III-5(8), pelvic-fin rays II-9(8), and pectoral-fin rays I-14(8). Dorsal fin moderately high, 23.05-24.84 %SL, with straight distal margin, and spine weak and articulated. Length of dorsal spine 14.90-24.17 %SL. Depressed anal fin extending beyond caudal fin base, its length 16.62-27.69 %SL. Distal margin of anal fin convex, first, second and third unbranched rays not equal in length. Length of anal fin base 7.76-9.84 %SL. Pelvic fin long, length 15.64-18.37 %SL. Pectoral fin long, length 19.92-20.63 %SL; fin

Figure 3. *Hypselobarbus dubius*, *H. kolus*, and *Tor mussullah sensu* Hora. (A) *Hypselobarbus dubius* MSUMNH 243, 168.32 mm SL, Bhavani River at Athikadavu (collected by Dr. M. Arunachalam and team), (B) *Hypselobarbus kolus* CMA 47, 186.82 mm SL, Basavanahalli, Cauveri River basin (collected by M. Arunachalam), and (C) *Tor mussullah sensu* Hora MSUMNH 104, 515 mm SL, nearly 4.5 kg. Sholayar Dam, Chalakudi River basin, collected by M. Arunachalam.

moderately falcate, extending to 1.5-2 scale rows anterior to pelvic fin insertion. Caudal fin deeply forked 25.03-32.60 %SL, upper and lower lobes 5 times longer than middle rays.

Scales small. Lateral-line scale rows 41(5) or 42(3), pre-dorsal scale rows 12(4) or 13(4), upper transverse scale rows 8(4) or 8.5(4), lateral line to pelvic scale rows 4(4) or 4.5(4), lower transverse scale rows 5.5(4) or 6(4), circumpeduncular scale rows 18(8), circumferential scale rows 30(5) or 31(3), transverse breast scale rows

11(3) or 12(5), and pre-anal scale rows 39(1), 40(3), 41(2), 43(1) or 44(1).

Coloration: Formalin-fixed, alcohol-preserved specimens dark grey dorsally and progressively lighter ventrally to abdomen; fins hyaline; posterior margin of each scale densely speckled with melanophores. Black vertical bar present posterior to opercle.

Etymology: The name pseudomussullah is a noun in apposition referring to the false or pseudo- similarity to the species that it most resembles *Hypselobarbus mussullah*.

Distribution: This species is currently endemic to the Nethravathi and Thunga rivers, Karnataka and from Krishna River, Maharashtra.

Discussion

Jayaram's (1997) concept of treating *B. mussullah* as a mahseer was based on writings Annandale (1919) and Hora (1943). Subsequently, Jayaram (1999) considered *Hypselobarbus* as *Gonoproktopterus* (type species: *Barbus kolus* Sykes). The identity of *B. musssullah* as a species of genus *Tor* was later followed by others (Suter 1944; Silas 1953; David 1953; Manimekalan 1998; Shaji and Easa 2003; Jayaram 2005; Shahnawaz and Venkateswarlu 2009; Ambili et al. 2014). Knight et al. (2013) attempted to resolve this issue with a limited number of specimens. These authors compared *H. mussullah* with *H. canarensis* with the view that both of these species possess two pairs of barbels.

Knight et al. (2013) considered *Cyprinus curmuca* (Hamilton) (=*H. curmuca*) to have a single set of barbels. If true, then it must also be true that the genus *Gobio* (Jerdon, 1849) is characterized as having no barbels or only a single pair. In the description of *Gobio canarensi* Jerdon mentioned that this species has only single pair of barbels. Thus, the synonymy of *H. canarensis* (Jerdon 1849) with *H. kurali* Menon and Rema Devi 1995 is debatable. *Hypselobarbus canarensis* was described by Jerdon as having a single pair of barbels, as in *H. curmuca*. However, in reality *H. kurali* has two pairs of barbels. Knight et al. (2014) retained *H. kurali* as a valid species because it was the name used by more than 25 authors since its description. However, the holotype and paratypes described by Menon and Rema Devi (1995) consisted of two morphotypes as mentioned by the authors themselves. In addition, comparisons by Knight et al. (2013) of *Barbus mussullah* with *B. kolus*, with respect to the shape of the anal fin and that from Sykes (1841), are not in agreement with the original figure by Sykes. In *B. kolus*, as per the figure in Sykes (1841; Fig. 1), the second, third and fourth branched rays are longer than the first branched ray. These diagnostic features are in agreement with specimens of *H. kolus* collected since the description of the species. In *H. mussullah*, the first and second branched rays are longer and the third and fourth branched rays are smaller, giving an appearance of a rounded fin. Hence, in the original description by Sykes, it was described as the posterior angle of the anal fin was rounded off in *B. kolus* but in *B. mussullah*, it was described as "anal fin with posterior angle bluntly rounded off". The image of a purported specimen of *H. canarensis* provided by Knight et al. (2013; Fig.10) actually represents a specimen with an anal fin described for *H. kolus* and not one fitting the diagnosis or description of *H. mussullah*.

Annandale (1919) treated *B. mussullah* as the Mahseer, and Hora (1943a, b) believed that *mussullah* was also of a mahseer type. However, Hora (1942) mentioned that "*Barbus* (=*Hypselobarbus*) *mussullah* was similar to *B. kolus* and the only difference was the number of barbels four in the former and two in the latter and also the form of body". This misled the senior author and the hidden barbel was unnoticed; hence it was labelled as *H. kolus* since 1998. After the publication of Knight et al. (2013, 2014), this specimen was taken back for thorough examination and it was revealed that it has two pairs of barbels, with one hidden in the maxillary groove. In Hora's (1942) paper he further mentioned that *mussullah* is quite distinct from the mahseer and also described it as a long fish with large scales and with a long head, and the mouth being higher. This feature corresponds to Sykes's remark about the fish possessing a "Roman nosed". Further, Sykes described *B. mussullah* as resembling

kolus when small. Hora (1942) explained that the illustration of *B. mussullah* in Sykes was correct, as mentioned by Sykes (1838) himself. The presence of tubercles on the sides of snout, anal fin and in the lower half of caudal fin in *B. kolus* was noted by Hora and Misra (1938) and this pattern of tuberculation is similar to that of *B. mussullah* described herein. The description and drawing of *B. mussullah* in Sykes (1838, 1841) are sufficient to identify the species with scales on horizontal and transverse rows. Our specimen has 44 lateral-line scale rows as mentioned by Hora (1942) and 7.5 lower transverse row scales, the same as per the illustration of the species as in Sykes (1841). The specimens designated by Knight et al. (2013, 2014) as *H. mussullah* have 5.5-6 lower transverse scale rows, clearly demonstrating that the specimens they refer to do not belong to *H. mussullah* but to *H. pseudomussullah*.

As fresh specimens were not received from the type locality, Hora considered *B. mussullah* as a species of *Tor* in his subsequent papers (1943). For example, he described a species from Bhavani River (Fig. 2, p. 4) as *Barbus* (*Tor*) *mussllah* and also mentioned that it was distributed in the rivers of Western Ghats.

The senior author also collected a specimen *Tor* from Sholayar Dam of Chalakudi River, Kerala (MSUMNH 104, 1 ex, 515 mm SL) nearly weighing 4.5 kg. This specimen (Fig. 3C) showed more resemblance with *Tor mussullah sensu* Hora. This specimen also possesses a rounded anal fin as is present in *H. kolus* (Fig. 3B). However, this specimen belongs to the genus *Tor* with lateral line scales of 26 and possesses a median fleshy lobe and uninterrupted lower labial fold in its mouth. It is also evident that this specimen didn't have tubercles as in *H. kolus* or *H. mussullah*. Furthermore, a relatively larger specimen of *Hypselobarbus dubius* collected from the type locality of Bhavani River of Cauvery basin (168.32 mm SL, MSUMNH 243) (Fig. 3A) possesses a round anal fin.

In conclusion, Sykes' illustration is accurate for *B. mussullah*, a species clearly belonging to the genus *Hypselobarbus* Bleeker. The concept of a blue colour in all fins is common to carps in the family Cyprinidae when specimens exceed than about 690 mm SL. Also, the absence of a rounded anal fin in any mahseer from the Indian subcontinent, as quoted by Rainboth (1989), is, as discussed above, not correct. Furthermore, large-sized carps in peninsular India such as *Puntius carnaticus* and species of *Hypselobarbus*, *Neolissochilus*, and *Tor* display varied shapes in anal fin as they increase in body size (M. Arunachalam, pers. obs.).

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