Species
International Daily Journal for Species
ISSN 2319 – 5746 EISSN 2319 – 5754

ANALYSIS

On the identities of *Cyprinus* (=*Hypselobarbus) curmuca* Hamilton, *Barbus* (=*Hypselobarbus) kolus* Sykes, and *Hypselobarbus kurali* Menon and Rema Devi (Cypriniformes: Cyprinidae), with descriptions of three new species of *Hypselobarbus* from peninsular India

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Publication History
Received: 20 September 2014
Accepted: 21 October 2014
Published: 30 November 2014

Citation
Arunachalam M, Chinnaraja S, Chandran A, Richard L Mayden. On the identities of *Cyprinus* (=*Hypselobarbus) curmuca* Hamilton, *Barbus* (=*Hypselobarbus) kolus* Sykes, and *Hypselobarbus kurali* Menon and Rema Devi (Cypriniformes: Cyprinidae), with descriptions of three new species of *Hypselobarbus* from peninsular India. *Species*, 2014, 11(31), 72-94

ABSTRACT

Hypselobarbus kolus is considered a synonym of *H. curmuca,* as both species possess a single pair of maxillary barbels. However, specimens collected from the type locality of *H. kolus* can be distinguished from *H. curmuca* using multiple characters. *Hypselobarbus kolus* differs from *H. curmuca* in having fewer circumferential scale rows (35-37 vs. 39-40), more transverse breast scale rows (12-14 vs. 10-11) and fewer preanal scale rows (34-37 vs. 38-41). *Hypselobarbus kurali,* described by Menon and Rema Devi, is a complex of species within which three additional species are described herein as new. *Hypselobarbus tamiraparaniei* is diagnosed from *H. kurali* in having fewer lateral line scale rows (38-40 vs. 42-43), fewer predorsal scale rows (10-11 vs. 13-14), fewer upper transverse scale rows (6.5 vs. 7.5-8), fewer transverse breast scale rows (8-10 vs. 21-23), and fewer preanal scale rows (25-29 vs. 43-46). *Hypselobarbus vaigaiensis* is currently known to occur in the Periyar Tiger Reserve, Achankoil River, and Kallar River, Kerala. This new species is diagnosed from *H. kurali* in having, fewer circumferential scale rows (29-30 vs. 32-33), fewer transverse breast scale rows (14-16 vs. 21-23), and fewer preanal scale rows (35-37 vs. 43-46). Finally, close examination of the types of *H. kurali* reveals that the paratype designated by Menon and Remadevi 1995 from Periyar River at Mleppara, inside Periyar Tiger Reserve, is a distinct species clearly diagnosable from *H. kurali.* This new species, *Hypselobarbus menoni,* is distinguished from *H. kurali* in having fewer lateral-line scale rows (40 vs. 42-43), fewer circumferential scale rows (28 vs. 32-33), and fewer transverse breast scale rows (12 vs. 21-23).

Key words: Cyprinidae, Hypselobarbus, H. curmuca, H. kolus, H. kurali, three new species

Abbreviations: ZSI/SRC- Zoological Survey of India, Southern Regional Centre, Chennai,
MSUMNH- Manonmaniam Sundaranar University Museum of Natural History,
CMA- Collections of M. Arunachalam

1. INTRODUCTION

Taxonomic History

Colonel W.H. Sykes read a paper before the Zoological Society of London (1838) entitled "On the Fishes of Deccan in which he described three new species of *Barbus, Barbus mussullah*, *B. khudree* and *B. kolus.* Of these three species, *B. kolus,* the species possessing a single pair of barbels, has been recognized as valid by Day (1871,1873,1877,1878), Annandale (1919), Spence and Prater (1932), Fraser (1942), Hora and Misra (1942), Silas (1953), David (1963), Jayaram (1981), Yazdani and Singh (1989) and Arunachalam et al. (2002). This species has a widespread distribution outside of its type locality in streams and rivers of Kerala (Hora and Law, 1941, Vairavel et al. 1998, Gopalakrishnan and Ponniah (2000), Shaji et al. 2000, Kurup et al. 2004), Karnataka (Chacko and Kurian 1948;, Chandrashekariah et al. 2000), and Tamil Nadu (Rema Devi and Indra 2000). Jayaram (1999) recognized *Barbus* (=*Hypselobarbus*) *kolus* as *Gonoproktopterus kolus* as he claimed that *Barbus* (=*Hypselobarbus*) *mussllah* was a species of the genus *Tor* Gray and *B. mussllah* was the type species of the genus *Hypselobarbus*. The type species of *Gonoproktopterus is B. kolus* (Bleeker 1860). If *B. mussllah* does in fact belong to the genus *Tor* then the genus *Hypselobarbus* would be a subjective synonym of *Tor* and *Gonoproktopterus* (Jayaram, 1999) would be the available genus name for the large-sized barbs from peninsular India. Menon and Rema Devi (1995) described *Hypselobarbus kurali* from Kumaradhara River, a tributary of the Nethravathi River basin. These authors also considered *H. kolus* to be a synonym of *H. curmuca* as they share the character of having a single pair of barbels. *Cyprinus curmuca* has one pair of barbels as described and figured by Hamilton (1807) from Vedavathi River of Thugabahadra drainage. However, Hora (1942), also opined that *Barbus curmuca* had two pairs of barbels as pointed out by Day and also stressed that the lower barbels are shorter and therefore liable to be missed, especially when hidden in the maxillary grooves. Since then *Barbus (=Hypselobarbus) curmuca* has been considered to be a species with two pairs of barbels. Jerdon (1849) assigned *Cyprinus curmuca* Hamilton to *Gobio curmuca* as its caudal fin lobe was tipped with black but mentioned that it had one pair of barbels.

Day (1878, 1889) described *Barbus curmuca* and noted four barbels on the maxillaries and none on the snout. He described the color pattern of juveniles as having an orange caudal fin lobe tipped with black. Further, Jerdon (1849) described *Gobio canarensis* and considered the species to be similar to *G. curmuca* (*sensu* Day 1878) from Kerala where the tails of specimens were orange with a broad fringe of black on both the upper and lower lobes. However, in Day's description of *Barbus curmuca* (1878) from south Canara it was stated that "young specimens having the middle third of the caudal as orange and tip was black".

Recently, Knight et al. (2013b) stated that "*Gobio canarensis* (type locality Canara), a species has long been treated *incertae sedis,*" As the type of *Gobio canarensis* is missing, these authors designated a neotype for *Gobio canarensis* (ZSI/SRC F 4003, 270 mm SL) and stated "This specimen is also the name-bearing type of *H. kurali* (type locality- Kumaradhara River), which now becomes a junior objective synonym of *H. canarensis,* thus synonymizing *Hypselobarbus kurali* Menon and Rema Devi 1995. Specimens of *Gobio canarensis* Jerdon 1849 were destroyed as per Jerdon. Jerdon also mentioned in his description that "my specimens correspond so exactly with Buchanan's figure that I cannot doubt their identity: but I imagine that he has either made some error about its locality, or has confounded with two allied species, my specimens are from the rivers of Palghat and Arriacode in south Malabar" (p. 306). However, this species was described by Menon and Rema Devi (1995) as *Hypselobarbus kurali*, which is now, according to Knight et al. (2013c), a junior objective synonym of *H. canarensis.* Further, Knight et al. (2013c) mentioned that *H. canarensis,* once thought to be restricted to the west flowing rivers of the southern Western Ghats (Abraham 2011b), is known from the east-flowing Cauvery River drainage (Rajan 1955 as *H. curmuca sensu* Day 1878, from the Tamiraparani River as *H. kurali* (Rema Devi et al. 1999, Rema Devi and Indra 2000), and from the Deccan Plateau as *H.curmuca sensu* Day 1878 (Sarwade and Khillak, 2010, Chandra and Sharma 2012).

Arunachalam et al. (2012) earlier predicted that, based on ongoing sampling and examination of specimens of *Hypselobarbus,* there may be more undescribed species from peninsular India. Based on our examination of the holotype and the paratypes of *Hypselobarbus kurali* and populations of *H. kurali* from Kerala possessing two pairs of barbels and with orange caudal fins tipped with black, it has become clear that different species of *Hypselobarbus* currently masquerade under *H. kurali* as a species complex. In this paper, the population referred by Rema Devi et al. (1999) and Rema Devi and Indra (2000) from Tamiraparani River system in southern Tamil Nadu as *H. curmuca = H. kurali* is described herein as a new species. Also another species known from three populations, one near the origin of Vaigai River in Periyar Tiger Reserve, one from Achankoil River and another from Kallar River, tributary of Vamanapuram River basin, Kerala is described as new species. Further, on closer examination of the paratype of *H. kurali* Menon and Remadevi 1995 deposited in the Zoological Survey of India, Southern Regional Centre, Chennai, Tamil Nadu which was collected from the Periyar River at Mleppara inside Periyar Tiger Reserve also represents a new species.

2. MATERIALS AND METHODS

Fish collections were made between 1996-2005 by earlier workers led by M. Arunachalam at river sites, from nearby fishermen and from fish markets. Measurements were made point to point using digital calipers. Methods used for the meristic and morphometric data are based Hubbs and Lagler (1964). Morphometric characters from 18 to 31 are the additional truss measurements (Strauss and Bookstein 1982). We also provide one meristic character, pre–anal scales (Jayaram, 1991) which 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).

Comparative materials

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 Chalakudi River, collected by M. Arunachalam. 23 March 2001. CMA 34, 3ex, 121.44-158.27 mm SL, Sholaiyar 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, 2 ex, 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, Data same as above.

Hypselobarbus dubius: MSUMNH 96, 14ex, 128.85-254.24 mm SL. Pillur dam, Bhavani River, Tamil Nadu, collected by M. Arunachalam and team. 29 January 2001 MSUMNH 97. 8ex, 106.34-260.10 mm SL. Bhavani River (Cauvery River basin) at Nellithurai village, Tamil Nadu, collected by M. Arunachalam and team. 12 October 2001. MSUMNH 98, 24ex, 136.19-301.68 mm SL. Bhavani River (Cauvery River basin) at Athikadavu, Tamil Nadu, collected by M. Arunachalam and team. 28 January 2002.

Hypselobarbus micropogon: MSUMNH 99, 10ex, 124.44-192.36 mm SL. Bhavani River at Athikadavu, Tamil Nadu, collected by M. Arunachalam and team. 3 February 2001. MSUMNH 100, 20ex, 106.34-260.10 mm SL. Pillur dam, Bhavani River, Tamil Nadu, collected by M. Arunachalam and team. 10 May 2001. MSUMNH 101, 10ex, 40.94-232.95 mm SL. Noolpuzha, a tributary of Kabini River, (Cauvery River basin), Kerala, collected by M. Arunachalam and team. 17 September 2001. MSUMNH 102, 16ex, 119.43-178.75 mm SL, Bhavani River at Nellithurai, Tamil Nadu, collected by M. Arunachalam and team. 30 May 2002.

Hypselobarbus pulchellus: CMA 26. 6 ex, 323.54-348.26 mm SL, Thunga and Bhadra rivers, Karnataka, collected by M. Arunachalam. 29 May 2003.

H. periyarensis MSUMNH 103. 1 ex, 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.

3. DESCRIPTIONS

3.1. *Hypselobarbus curmuca* (Hamilton, 1807)

Diagnosis

Hypselobarbus curmuca is distinguished from *H. kolus* in having more predorsal scale rows (14 vs. 13), more circumferential scale rows (39-40 vs. 35-37), fewer transverse breast scale rows (10-11 vs. 12-14), and more preanal scale rows (38-41 vs. 34-37).

H. curmuca is distinguished from *H. kurali* in having a single pair of barbels vs. two pairs of barbels, more upper transverse scale rows (9.5-10 vs. 7.5-8), more lower transverse scale rows (7.5-8 vs. 6.5), more circumpeduncular scale rows (20-21 vs. 18), more circumferential scale rows (39-40 vs. 32-33), fewer transverse breast scale rows (10-11 vs. 21-23), and fewer preanal scale rows (38-41 vs. 43-46), as well as morphometric characters involving longer pelvic fin (17.58-20.16 vs. 14.64-16.19%SL), and longer dorsal fin base length (14.88-17.48 vs. 12.55-14.57 %SL).

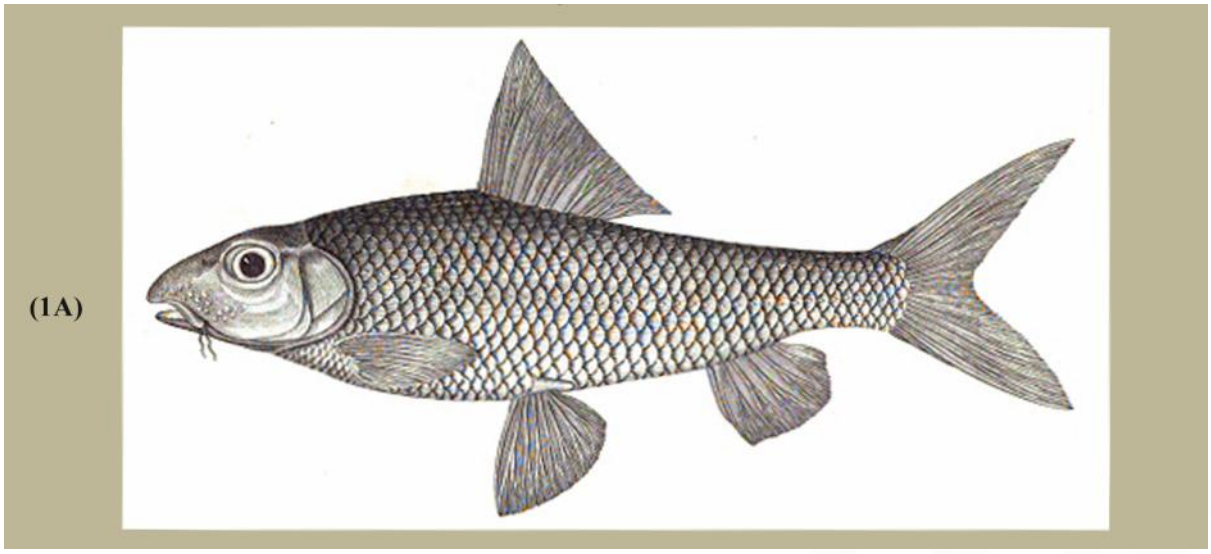

Figure (1A)

Drawing of *Cyprinus curmuca* from Hamilton (1807: pl. 30)

Figure (1B)

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

Figure (1C)

Hypselobarbus curmuca, MSUMNH 83, 1ex, 219.52 mm SL, Sholaiyar dam, Chalakudy River collected by M. Arunachalam, 23 March 2001

Description

Body moderately deep 25.53-28.46 % of SL. Dorsal and ventral margins more or less equally convex (Figs. 1A-1C). Dorsal fin slightly anterior to pelvic fin insertion by the width 1 to 1.5 scale rows; predorsal length 45.62-46.42 %SL as compared to pre-pelvic length 47.39-50.71 %SL; anal fin distant with the preanal length of 73.15- 77.97 % of SL. Distance between pelvic and pectoral fin insertion 24.08-26.76 %SL; distance between pelvic fin insertion less than distance between pelvic fin insertion and anal fin origin, 21.06-26.46 %SL. Nape convex behind occiput; predorsum strongly convex in the anterior third. Dorsal fin base decreasing sharply from insertion to the caudal peduncle. Venter more or less curved and rising sharply at the end of anal fin base and from where more inclined to caudal peduncle. Caudal peduncle moderately deep, 9.56-10.80 %SL.

Head long, 24.54-27.14 %SL, with moderately long cranium, 20.70-23.54 %HL; head depth 36.18-46.92, 53.61-61.69 and 65.05-73.66 %HL at nostril, pupil and occiput, respectively. Head more compressed, width at preopercle narrow 70.07-78.30 %HL; interorbital width narrow 34.74-43.38 %HL. Eyes moderately large, 24.29-29.81 %HL; snout long 38.85-43.05 %HL; mouth oblique and subterminal with rostral cap overhanging the upper lip. Upper jaw length 26.72-33.96 %HL; gape width 13.23-22.85 %HL. Orbit width 16.33-24.22 %HL. One pair of maxillary barbels extending beyond middle of orbit.

Dorsal-fin rays iv-9(8), anal-fin rays iii- 5(8), pelvic-fin rays ii-9(8), and pectoral-fin rays i-14(2)-15(6). Last unbranched (spinous) ray of dorsal fin weak; length of dorsal ray 21.77-25.23 %SL. Dorsal fin moderately tall, 23.84-29.02 %SL, and with a fairly curved distal margin; fin height about three-fourth body depth.. Anal fin longer, extending beyond base of caudal; anal fin length 18.53-25.77 %SL. Distal margin convex, three unbranched rays not equal in length. Height of anal fin base 7.84-9.77 %SL. Pelvic fin long,17.58-20.16 %SL or a 8-9 scale rows from its origin; distal fin margin concave near tip and convex towards other edge. Pectoral fins long, 15.77-20.34 %SL, and moderately falcate, extending 3-4 scales rows anterior to pelvic fin insertion. Caudal fin long and deeply forked 24.13-33.19 %SL; upper and lower fin lobes nearly equal and rays 3.5 times as long as median rays.

Scales relatively small. Lateral-line scale rows 42(7)-43(1), predorsal scale rows 14(8), upper transverse scale rows 9.5(3)-10(5), scales from lateral line to pelvic fin insertion 5(4)-5.5(4), Lower transverse 7.5(7)-8(1), circumpeduncular scale rows 20(3)-21(5), circumferential scale rows 39(3)-40(5), transverse breast scale rows 10(6)-11(2), and preanal scale rows 38(1)-39(3)-40(2)-41(1).

3.2. *Hypselobarbus kolus* (*Sykes,* 1841)

Diagnosis

H. kolus is distinguished from *H. kurali* in having a single pair of maxillary barbels (versus two pair of barbels), more upper transverse scale rows (9.5-10 vs. 7.5-8), more lateral line to pelvic fin scale rows (6-7 vs. 4.5-5), more circumpeducular scale rows (20-21 vs. 18), more circumferential scale rows (35-37 vs. 32-33), fewer transverse breast scale rows (12-14 vs. 21-23), and fewer preanal scale rows (34-37 vs. 43-46); diagnostic morphometric characters; pelvic fin length (16.93-19.88 vs. 14.64-16.19 %SL) and length of dorsal fin base (14.76-18.19 vs. 12.55-14.57 %SL).

Figure (2A)

Barbus kolus Sykes 1841; 357, pl, LXII (fig 1); copy of original figure

Figure (2B)

Hypselobarbus kolus, ZSI/SRC F. 8057/1, 120 mm SL, Holebagilu, Sharawathi River, Karnataka, collected by Sreekantha. 15 September 2002

Figure (2C)

Hypselobarbus curmuca (Neotype), ZSI/SRC F. 8748/1, 145 mm SL, Holehoddu, Thunga River, collected by Aswin Rai , 16 May 2013

Figure (2D)

Hypselobarbus kolus, CMA 38, 1ex, 127.24 mm SL. Moola Mutta River (Pune), collected by M. Arunachalam, 12 June 1998

Figure (3A)

Hypselobarbus kolus, CMA 47. 1ex, 186.40 mm SL, Basavanahalli, Cauvery River, collected by M. Arunachalam, 11 May 2001

Figure (3B)

Hypselobarbus kolus, CMA 34, 1ex, 186.51 mm SL, Sholaiyar dam, Chalakudy River, collected by M. Arunachalam. 23 March 2001

Figure (3C)

Hypselobarbus kolus, CMA 37, 1ex, 131.85 mm SL, Thunga River at Shimoga, collected by M. Arunachalam. 20 November 2004

Figure (3D)

Hypselobarbus kolus, CMA 36, 1ex, 180.94 mm SL, Krishna River at Sakthi Nagar, collected by M. Arunachalam. 16 October 2004

Description

Body moderately deep, 24.25-30.11 %SL, Dorsal and ventral margins more or fewer equally convex. (Figs.2A to 2D, and Figs.3A to 3D). Dorsal fin is slightly anterior to pelvic fin insertion by the width 1.5 to 2 scale rows, with the predorsal length 42.59-47.04 %SL, compared to pre-pelvic length 46.83-49.70 %SL, anal fin is distant with the preanal length of 73.03 – 75.95 % of SL. Distance between pelvic and pectoral fin insertion 24.68-27.39 %SL. Nape convex behind the occiput and pre dorsum strongly convex in the anterior third. Dorsal fin base is decreasing sharply from the insertion to the peduncle. Venter more or less curved and rising sharply at the end of anal fin base and from where more inclined towards peduncle and peduncle is moderately deep with 9.53-10.99 %SL.

Head is long with 23.57-26.20 %SL, and moderately long cranium of 20.35-22.84 %HL, head depth 34.43-43.33, 55.31-62.47 and 67.11-74.74 %HL at nostril, pupil and occiput respectively. Head more compressed with at pre opercle narrow 70.53-79.29 %HL, inter orbital width narrow 34.34-47.10 %HL. Eyes are moderately large from 24.44-34.22 %HL, snout long 34.30-42.76 %HL, with mouth oblique and sub terminal with rostral cap overhanging the upper lip, upper jaw length is 23.17-33.13 %HL and gape width is 14.16-25.52 %HL. One pair of maxillary barbels extend beyond mid orbit 17.32-25.13 %HL.

Fins long; dorsal-fin rays iv-9(23), anal-fin rays iii- 5(23), pelvic-fin rays i-9(4), ii-8(4), ii-9(15), and pectoral-fin rays i-14(5)-15(12)-16(6). Dorsal fin origin anterior to pelvic fin insertion; fin moderately tall, 20.75-27.17 %SL and with a fairly curved (concave) distal margin, its height about three-fourth of depth of body, its last unbranched (spinous) ray is weak. Length of dorsal spine is 19.14-28.90 %SL it has the longer anal fin, it extend beyond the caudal base, and it is length 17.84-25.49 %SL. Distal margin convex, three unbranched rays not equal in length. Length of anal fin base 7.119.59 %SL. Pelvic fin long 16.93-19.88 %SL by a distance of 8-9.5 scale rows from its origin and its distal margin concave near tip and convex towards other edge. Pectoral fins long, 18.33-28.89 %SL, and moderately falcate, extending 2.5-3 scale rows anterior to pelvic fin insertion. Caudal fin is long and deeply forked 24.67-33.14 %SL, with rays 3.5 times as long as middle rays upper and lower lobes nearly equal.

Scales are relatively small. Lateral-lines scales 42(7)-43(15)-44(1) predorsal scale rows 13(23), upper transverse scale rows 9.5(13)-10(10), scale rows from lateral line to pelvic fin insertion 6(15)-6.5(8), lower transverse scale rows 8(6)-8.5(13)-9(4), circumpeduncular scale rows 20(14)-21(9), circumferential scale rows 35(7)-36(8)-37(8), transverse breast scale rows 12(8)-13(12)-14(3), and preanal scale 34(5)-35(10)-36(4)-37(4).

3.3. *Hypselobarbus kurali* Menon and Rema Devi, 1995

Diagnosis

Hypselobarbus kurali is distinguished from *H. dubius* by a weaker versus stronger dorsal spine in having fewer lower transverse scale rows (6.5 vs. 7-8), fewer circumpeducular scale rows (18 vs. 19-21), and the morphometric characters such as post dorsal length (46.66-52.25 vs. 34.56-39.69 %SL), lower jaw to isthmus (60.55-66.61 vs. 68.33-72.97 %HL). *H. kurali* is distinguished from *H. micropogon* by a weaker versus stronger dorsal spine, in having more circumferential scale rows (32-33 vs. 26-30), more transverse breast scale rows (21-23 vs. 8-11), and the following morphometric characters such as dorsal fin height (17.86-23.93 vs. 29.12-35.27 %SL) and post dorsal length (46.66-52.25 vs. 31.70-38.71 %SL). *H. kurali* is distinguished from *H. periyarensis* by a weaker versus stronger dorsal spine, in having fewer predorsal scale rows (13-14 vs. 17-18), more transverse breast scale rows (21-23 vs. 10-13), and the morphometric character such as occiput to dorsal fin origin length (22.44-26.21 vs. 30.12-34.75 %SL).

Figure (4A)

Hypselobarbus kurali, ZSI/SRC F4003/1 270.00 mm SL, Kumaradhara River near Nettana, Dakshin Kanada, collected by A.G.K. Menon. 07 January 1992

Figure (4B)

Hypselobarbus kurali, ZSI/SRC F4003/1 258.66 mm SL. Kumaradhara River near Nettana, Dakshin Kanada, collected by A.G.K. Menon. . 07 January 1992

Figure (4C)

Hypselobarbus kurali, MSUMNH 88**,** 1ex, 166.83 mm SL, Rosemala, collected by M. Arunachalam. 23 January 2003

Description

Body moderately deep 24.11-26.93 % of SL, dorsal and ventral margins more or less equally convex (Figs. 4A to 4C). Dorsal fin slightly anterior to pelvic-fin rays origin by the width 2 scale rows, with the predorsal length of 45.53-47.43 %SL, when compared to pre-pelvic length 49.07-52.64 %SL, anal fin is distant with the preanal length of 72.87- 78.77 % of SL. Distance between pelvic and pectoral fin insertions 24.76-28.12

%SL; distance between pelvic fin insertions less distance of pelvic fin insertion and anal fin origin 21.72-26.60 %SL; nape convex behind the occiput and pre-dorsum strongly convex in the anterior third. Dorsal fin base is decreasing sharply from the insertion to the peduncle. Venter more or less curved and rising sharply at end of anal fin base and where more inclined to peduncle; its depth 9.19-10.29 %SL.

Head long 26.28-27.95 %SL, with moderately long cranium of 22.78-24.63 %SL, head depth 36.30-41.86, 54.05-59.19, and 60.69-69.72 %HL at nostril, pupil and occiput respectively. Head more compressed with at pre opercle narrow 73.69-78.58 %HL, inter orbital width narrow33.71-36.86 %HL. Eyes are moderately large from 24.29-28.92 %HL, snout long 43.09-45.59 %HL, with mouth oblique and sub terminal with rostral cap overhanging the upper lip. Upper jaw length is 27.76-32.37 %HL and gape width is 18.71-22.99 %HL. Barbels longer, the maxillary one from 16.65-23.58, and the rostral pair is from 9.41-13.54 %HL,

Fins are long, counts are dorsal-fin rays iv-9(9), anal-fin rays iii- 5(9), pelvic-fin rays ii-8(2), i-9(7), and pectoral-fin rays i-14(9). Dorsal fin origin anterior to pelvic fin insertion; dorsal fin moderately high, 17.86-23.93 %SL, and with a fairly curved distal margin; last unbranched (spinous) ray weak and articulated Length of dorsal spine 20.08-22.30 %SL Anal fin long, extending beyond base of caudal, and its height 17.39-25.76 %SL. Distal margin convex, three unbranched rays not equal in length. Length of base of anal fin 7.25-8.49 %SL. Pelvic fin long 14.64-16.19 %SL; distal margin of fin concave near tip and convex towards other edge. Pectoral fin long (16.47-20.29 %SL) and moderately falcate, extending to 3 scales anterior to pelvic fin. Caudal fin long and deeply forked, 27.73-32.49 %SL. Upper and lower lobes nearly equal dorsal and distal rays of lobes 3.5-4 times as long as median rays.

Lateral-line scale rows 42(6)-43(3), predorsal scale rows 13(5)-14(4), upper transverse scale rows 7.5(6)-8(3), scales from lateral line to pelvic fin insertion 4.5(7)-5(2), lower transverse scale rows 6.5(9), circumpeduncular scale rows 18(8), circumferential scale rows 32(7)-33(2), transverse breast scale rows 21(4)-22(2)-23(3), and preanal scale rows 43(5)-45(2)-46(2).

Coloration

Dorsal half of body greyish; lighter on flanks and venter; deep black bar posterior to opercular opening; bases of scales above and below lateral line with dark spot; tips of caudal fin tinged black, most prominent in smaller specimens.

3.4. *Hypselobarbus tamiraparaniei* sp. nov.

Figure 5B

Holotype: ZSI/SRC F8758/1, 196.31 mm SL, Manimuthar River, a tributary of Tamiraparani drainage at Aladiyur, before confluence with Tamiraparani River, south Tamil Nadu, collected by M. Arunachalam and team. 6 May 1998.

Paratypes: MSUMNH 89, 1 ex, 200.20 mm SL, same data as holotype. CMA 40. 9ex, 157.70-199.31 mm SL. same data as holotype. MSUMNH 90, 1ex, 195.26 mm SL. Manimuthar River, a tributary of Tamiraparani drainage at Aladiyur before the confluence with Tamiraparani River, collected by M. Arunachalam, 6 September 2002.

CMA 41, 5ex, 152.26-193.23 mm SL. Manimuthar River, a tributary of Tamiraparani drainage at Aladiyur before the confluence with Tamiraparani River collected by M. Arunachalam. 6 September 2002.

Diagnosis

Hypselobarbus tamiraparaniei sp. nov. is distinguished from *H. kurali* in having fewer lateral-line scale rows (38-40 vs. 42-43), fewer predorsal scale rows (10-11 vs. 13-14), fewer upper transverse scale rows (6.5 vs. 7.5-8), fewer circumpeducular scale rows (15-16 vs. 18), fewer circumferential scale rows (24-26 vs. 32-33), fewer transverse breast scale rows (8-10 vs. 21-23), fewer preanal scale rows (25-29 vs. 43-46), as well as a greater pelvic fin length (16.70-20.92 vs. 14.64-16.19 %SL). It is distinguished from *H. dubius* in having fewer lateral-line scale rows (38-40 vs. 43-45), fewer upper transverse scale rows (6.5 vs. 8-9), fewer lateral line to pelvic fin scale rows (3.5-4 vs. 6-7), fewer circumpeducular scale rows (15-16 vs. 19-21), fewer circumferential scale rows (24-26 vs. 33-36), and the morphometric characters such as pre occipital length (21.40-25.60 vs. 95.69-99.86 %SL) and occiput to pelvic insertion length (38.74-41.27 vs. 31.8-36.71 %SL). The species is distinguished from *H. micropogon* in having fewer predorsal scale rows (10-11 vs. 12-14), fewer scale rows between to lateral line and pelvic fin insertion (3.5-4 vs. 5-6), and the morphometric characters such as pre -occipital length (21.40-25.60 vs. 89.70-99.81 %SL) and dorsal fin height (23.01-27.56 vs. 29.12-35.27 %SL). It can be distinguished from *H. periyarensis* in having fewer lateral-line scale rows (38-40 vs. 43-44), fewer predorsal scale rows (10-11 vs. 17-18), fewer upper transverse scale rows (6.5 vs. 8-9), fewer circumferential scale rows (24-26 vs. 32-34), and the morphometric characters such as pectoral insertion to anal origin (42.75-49.66 vs. 53.12-57.68 %SL) and maxillary barbel length (14.03-21.49 vs. 26.50-29.68 %HL). From *H. curmuca* it is distinguished in having fewer lateral-line scale rows (38-40 vs. 42-43), fewer upper transverse scale rows (6.5 vs.9.5-10), fewer circumferential scale rows (24-26 vs. 39-40), fewer preanal scale rows (25-29 vs. 38-41), and predorsal scale rows (10-11 vs. 14). It is distinguished from *H. kolus* in having fewer lateral-line scale rows (38-40 vs. 42-44), fewer upper transverse scale rows (6.5 vs.9.5-10), fewer circumferential scale rows (24-26 vs. 35-37), fewer circumpeducular scales (15-16 vs. 20-21), fewer preanal scale rows (25-29 vs. 34-37), and predorsal scale rows (10-11 vs. 13). *H. tamiraparaniei* sp. nov. is distinguished from *H. pulchellus* in having more lateral-line scale rows (38-40 vs. 30-32), more upper transverse scale rows (6.5 vs. 5.5), more circumpeducular scale rows (15-16 vs. 12), more lower transverse scale rows (5.5-6 vs. 4.5). *H. tamiraparaniei* sp. nov. is distinguished from *H. vaigaiensis* sp.nov. in having fewer lateral-line scale rows (38-40 vs. 41-43), fewer upper transverse scale rows (6.5 vs.7.5-8), fewer circumferential scale rows (24-26 vs. 29-30), fewer transverse breast scale rows (8-10 vs.14-16), fewer preanal scale rows (25-29 vs. 35-37), and the morphometric characters such as dorsal origin to pelvic insertion (25.04-28.66 vs. 22.11-24.93 %SL) and peduncle depth (10.02-12.6 vs. 8.63-9.98 %SL).

(5A)

Figure (5A)

Hypselobarbus tamiraparaniei, CMA 40, 1ex, 199.31 mm SL, Manimuthar River , collected by M. Arunachalam. 06 May 1998

(5B)

Figure (5B)

Hypselobarbus tamiraparaniei: ZSI/SRC F 8758, 1ex, 196.31. mm SL, Manimuthar River, collected by M. Arunachalam; 06 September 2002

Description

Head and body physiognomy provided in Figs. 5A and 5B. Body moderately deep 25.90-28.68 %SL, dorsal margin convex; ventral margin nearly horizontal. Nape slightly convex behind a concavity after the occiput. Dorsal fin origin anterior to pelvic fin insertion of 1.1 times with predorsal length (44.61-51.74 %SL), when compared to pre-pelvic length (47.46-52.13 %SL); anal fin distant 72.89-76.17 %SL. Distance between pelvic fin insertion to anal fin origin equal to distance between pectoral fin insertion to pelvic fin insertion. Distance between pectoral fin to pelvic fin 22.85-27.00 %SL; pelvic fin to anal fin distance 19.54-23.08 %SL. Caudal peduncle moderately deep 10.02-12.76 %SL at its narrowest region and moderate in length 12.02-15.50 %SL..

Head long, length 25.67-31.28 %SL, and with moderately long cranium, 21.40-25.60 %SL. Head depth 36.80-44.35, 52.66-61.84 and 62.84-71.76 %HL at nostril, pupil and occiput, respectively. Head compressed width at preopercle narrow, being 69.43-77.30 %HL; interorbital space transversely concave and 32.71-38.86 %HL. Eye large, 21.48-26.54 %HL. Mouth subterminal; snout conical and long, 41.23-47.11 %HL. Upper jaw 25.79-31.14 %HL and gape width 15.93-22.38 %HL; lower jaw keratinous but not sharp. Two pairs of barbels, maxillary pair from 14.03-21.49 %HL; rostral pair from 7.41-10.89 %HL, which is 1.5 times orbit width.

Fins long. Dorsal-fin rays iv-9(17), anal-fin rays ii-5(2), iii- 5(15), pelvic-fin rays i-9(16), ii-9(1), and pectoral-fin rays i-14(10), i-15(7), Dorsal fin moderately tall, 23.01-27.56 %SL, and with straight distal margin. Last unbranched (spinous) dorsal ray weak and osseous; length of spine 21.57-27.74 %SL. Depressed anal fin long, extending beyond caudal base, its height 18.06-33.11 %SL. Distal margin convex, three unbranched rays not equal in length. Length of anal fin base 7.31-10.01 %SL. Pelvic fin long, 16.70-20.92 %SL, extending 10-10.5 scale rows from its insertion; distal margin concave near tip and convex towards other edge. Pectoral fin long, 18.27-25.07 %SL; depressed fin reaching to pelvic fin insertion. Caudal fin long, 13.95-32.35 %SL; fin deeply forked, upper and lower lobes nearly equal with rays of lobes 3.5 times greater than median branched rays,.

Scales small, lateral- lines scales 38 (12), 39(1), 40(4), predorsal scale rows 10(13)-11(4), upper transverse scale rows 6(1)-6.5(16), scales from lateral line to pelvic fin insertion 3.5(3)-4(14), lower transverse scale rows 5.5(2)-6(15), circumpeduncular scale rows 15(4)-16(13), circumferential scale rows 24(4)-26(13), transverse breast scale rows 8(4)-9(5)-10(8), preanal scales 25-(2), 28(8) or 29(7).

Coloration

In life, silvery, lightly colored laterally and ventrally, tips of the caudal fin blackish. In young specimens the middle third of the caudal fin orange and tipped with black.

Etymology: Named after the Tamiraparani River, south Tamil Nadu, where the species was discovered.

3.5. *Hypselobarbus vaigaiensis* sp. nov.

Figure 5D

Holotype: ZSI/SRC F8757/1, Holotype, 150.26 mm SL, Periyar Tiger Reserve, collected by M. Arunachalam and team, 24 July 2011

Paratypes: MSUMNH 91, 1ex, 157.88 mm SL, data same as Holotype. CMA 42. 2ex, 141.61-154.18 mm SL, Kallar River (Kerala), collected by M. Arunachalam. 7 October 1999. CMA 43. 6ex, 130.01-153.13 mm SL, data same as Holotype. MSUMNH 92, 1ex, 106.01 mm SL, Achankovil, Kerala, collected by Dr. A. Chandran. 23 April 2014. ZSI/SRC F.4008 label bearing the name *Hypselobarbus kurali*, Periyar River of Periyar Tiger Reserve at Thannikudy, collected by Menon and Rema Devi, 13 December 1990.

Diagnosis

Hypselobarbus vaigaiensis sp. nov. is distinguished from *H. kurali* in having fewer lower transverse scale rows (5.5-6 vs. 6.5), fewer scale rows between lateral- line and pelvic fin insertion (3.5-4 vs. 4.5-5), fewer circumferential scale rows (29-30 vs. 32-33), fewer transverse breast scale rows (14-16 vs. 21-23), fewer preanal scales (35-37 vs. 43-46), and a distance between dorsal fin origin and pectoral fin insertion (22.54-24.98 vs. 25.24-26.90 %SL). *H. vaigaiensis* sp. nov. is distinguished from *H. dubius* in having fewer lower transverse scale rows (5.5-6 vs. 7-8), fewer lateral- line to pelvic fin scale rows (3.5-4 vs. 6-7), fewer circumpeducular scale rows (17-18 vs. 19-21), fewer circumferential scale rows (29-30 vs. 33-36), as well as shorter preoccipital length (21.61-24.22 vs. 95.69-99.86 %SL) and longer post-dorsal length (51.02-59.54 vs. 34.56-39.69 %SL). The species is distinguished from *H. micropogon* in having fewer scale rows between lateral line and pelvic fin insertion (3.5-4 vs. 5-6), more transverse breast scale rows (14-16 vs. 8-11), shorter dorsal fin height (22.45-26.15 vs. 29.12-35.27 %SL), shorter distance between dorsal fin insertion and pelvic fin insertion (17.07-21.22 vs. 23.00-31.19 %SL) and narrower head (47.41-53.58 vs. 56.19-62.32 %HL). The species is distinguished from *H. periyarensis* in having fewer predorsal scale rows (12-13 vs. 17-18), fewer scale rows between lateral line and pelvic fin insertion (3.5-4 vs. 5-6), fewer circumferential scale rows (29-30 vs. 32-34), shorter occiput to dorsal origin length (22.39-24.96 vs. 30.12-34.75 %SL) and narrower head width (47.41-53.58 vs. 61.25-65.01 %HL). The new species is distinguished from *H. curmuca* in having fewer predorsal scale rows (12-13 vs. 14), fewer upper transverse scale rows (7.5-8 vs.9.5-10), fewer circumferential scale rows (29-30 vs. 39-40), fewer circumpeducular scale rows (17-18 vs. 20-21), more transverse breast scale rows (14-16 vs. 10-11) and fewer preanal scale rows (35-37 vs. 38-41). From *H. kolus* the new species differs in having fewer upper transverse scale rows (7.5-8 vs. 9.5-10), fewer circumferential scale rows (29-30 vs. 35-37), fewer circumpeduncular scale rows (17-18 vs. 20-21), fewer lower transverse scale rows (5.5-6 vs. 7.5-9), and fewer scale rows between lateral line and pelvic fin insertion (3.5-4 vs. 6-7). The species is distinguished from *H. pulchellus* in having more lateral-line scale rows (41-43 vs. 30-32), more upper transverse scale rows (7.5-8 vs.5.5), more circumpeduncular scale rows (17-18 vs. 12), and lower transverse scale rows (5.5-6 vs. 4.5).

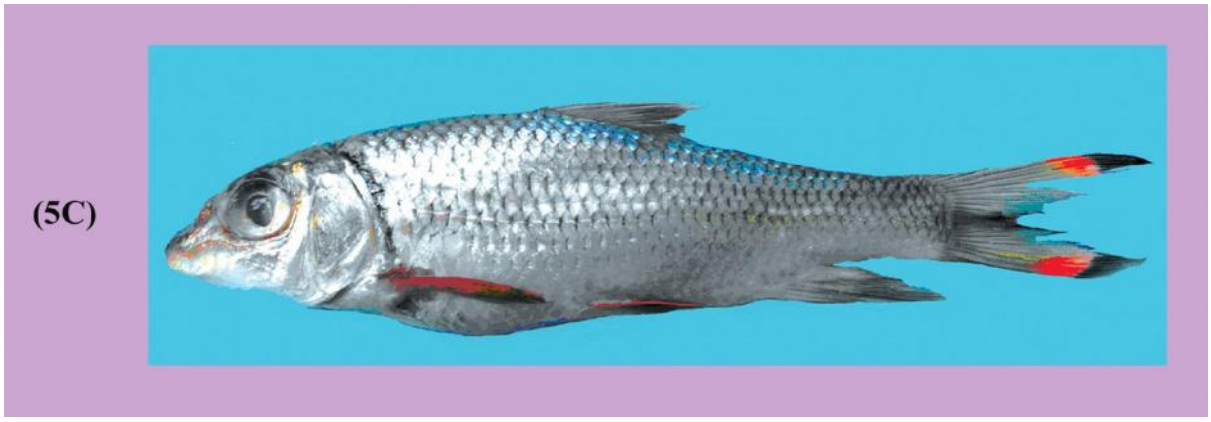

Figure (5C)

Hypselobarbus vaigaiensis, CMA 43, 1ex, 153.13 mm SL, Periyar Tiger Reserve, collected by M. Arunachalam and team. 24 July 2011

Figure (5D)

Hpselobarbus vaigaiensis: ZSI/SRC F 8757, 1ex, 150.27 mm SL, Near Moolavaigai, Periyar Tiger Reserve; collected by M.Arunachalam and team. 24 July 2011

Description

Head and body physiognomy provided in Figs. 5C and 5D. Body moderately deep 21.52 %SL. Dorsal and ventral margins more or less equally convex. Dorsal fin origin anterior to pelvic fin insertion by 1.5-2 scale rows; predorsal length of 43.92-46.00 %SL; pre-pelvic length 47.52-50.83 %SL. Distance between pelvic and pectoral fin insertions 20.71-26.47 %SL; between pelvic fin insertions less than distance between pelvic fin insertion and anal fin origin 19.21-24.31 %SL. Nape convex posterior to occiput; anterior third of predorsum strongly convex. Dorsal fin base sharply decreases from the origin to caudal peduncle. Venter more or less curved and rising sharply at posterior terminus of anal fin base and inclined to caudal peduncle; caudal peduncle depth 8.63-9.98 %SL.

Head long, 25.80-27.91 %SL, and with moderately long cranium, 21.61-24.22 %SL. Head depth 35.34-45.46, 50.28-59.08, and 61.63-71.31 %HL at nostril, pupil and occiput, respectively. Head more compressed; preopercle narrow, 70.84-81.87 %HL, interorbital width narrow, 30.91-37.88 %HL. Eyes moderately large 24.24-29.59 %HL. Snout long 39.00-48.59 %HL, mouth subterminal. Upper jaw length 23.38-31.01 %HL; gape width 16.24-25.42 %HL. Barbels long, maxillary pair 18.06-27.79 %HL, rostral pair 7.40-11.68 %HL.

Fins long. Dorsal-fin rays iv-9(10), anal-fin rays iii- 5(10), pelvic-fin rays i-9(10), and pectoral-fin rays i-14(9)-15(1). Dorsal fin moderately tall, 22.45-26.15 %SL and with fairly concave distal margin; last unbranched (spinous) ray weak and articulated. Length of dorsal spine 21.58-25.26 %SL. Depressed anal fin extending beyond base of caudal fin; dorsal fin length 17.54-28.94 %SL. Distal margin convex, three unbranched rays not equal in length. Length of anal fin base 7.36-9.47 %SL. Pelvic fin long 15.93-19.44 %SL by a distance of 9.5-10 scale rows from its origin; distal margin of fin concave near tip and convex towards other edge. Pectoral fin long,18.34-22.19 %SL, and moderately falcate, extending to 1-1.5 scale rows anterior to pelvic fin insertion. Caudal fin long and deeply forked, length 27.43-31.67 %SL; upper and lower caudal fin lobes nearly equal and with rays 4-4.5 times as long as median branched rays. .

Lateral-line scale rows 41(4), 42(5), 43(1), predorsal scale rows 12(6)-13(4), upper transverse scale rows 7.5(8)-8(2), scales from lateral line to pelvic fin insertion 3.5(3)-4(7), lower transverse scale rows 5.5(3)-6(7), circumpeduncular scale rows 17(3)-18(7), circumferential scale rows 29(2)-30(8), transverse breast scale rows 14(5), 15(2) or 16(3) and preanal scales 35(6), 36(1) or 37(3).

Coloration:

Body uniformly silvery. Patches of yellowish-red tinge seen along the snout and around orbit. Pectoral and pelvic fins blood red. Dorsal and anal fins tipped with black. Upper and lower edges of caudal fin with red and black; middle portion of caudal fin black. A few of the upper and lower principal caudal fin rays with yellowish streaks.

Etymology: Name derived from Mulavaigai (origin of Vaigai) inside Periyar Tiger Reserve, Kerala, the location where the species was first collected.

3.6. *Hypselobarbus menoni* sp. nov.

Figure 5E

Holotype: ZSI/SRC F4011. 1ex. 145.82 mm SL, Periyar River at Mleppara, 12 km east of Thannikudy Forest Inspection Bungalow, Periyar Tiger Reserve, collected by A.G.K. Menon and Rema Devi. 14 December 1990.

Paratype: ZSI/SRC F4011. 2ex. 110.34-145.82 mm SL, same data as holotype.

Diagnosis

H. menoni sp. nov. is diagnosed from *H. dubius* in having fewer lateral-line scale rows (40 vs. 43-45), fewer lateral line to pelvic fin scale rows (4 vs. 6-7), fewer circumpeduncular scale rows (16-17 vs. 19-21), fewer circumferential scale rows (28 vs. 33-36), shorter preoccipital length (22.72-25.31 vs. 96.69-99.86 %SL), greater post-dorsal-fin length (46.19-50.92 vs. 34.56-39.69 %SL), shorter distance between lower jaw and isthmus (22.37-33.26 vs. 68.33-72.97 %SL.). *H. menoni* sp.nov. is distinguished from *H. micropogon* in having fewer lateral line to pelvic fin scale rows (4 vs. 5-6), more transverse breast scale rows (12 vs. 8-11), shorter predorsal length (44.62-45.80 vs. 46.02-52.60 %SL), shorter preoccipital length (22.72-25.31 vs. 89.70-99.81 %SL), shorter dorsal fin height (23.84-25.67 vs. 29.12-35.27 %SL) and shorter distance between insertion of pelvic fin to origin of anal fin (20.75-21.59 vs. 23.56-30.43 %SL). The new species is distinguished from *H. periyarensis* in having fewer lateral-line scale rows (40 vs. 43-44), fewer predorsal scale rows (13 vs. 17-18), fewer circumferential scale rows (28 vs. 32-34), shorter distance from occiput to origin of dorsal fin (21.76-22.66 vs. 30.12-34.75 %SL), shorter distance from dorsal fin origin and insertion of pectoral fin insertion (19.60-21.21 vs. 33.25-37.45 %SL), and shorter base of dorsal fin (12.78-14.79 vs.16.46-19.75 %SL). The species is distinguished from *H. kurali* in having fewer lateral-line scale rows (40 vs. 42-43), fewer lower transverse scale rows scale rows (5.5 vs. 6.5), fewer circumferential scale rows (28 vs. 32-33), fewer transverse breast scale rows (12 vs. 21-23), narrower caudal peduncle (7.87-8.53 vs. 9.19-10.29 %SL), longer pelvic fins (17.75-19.26 vs. 14.64-16.19 %SL) and shorter distance from origin of dorsal and anal fins (19.04-22.66 vs. 23.00-26.83 %SL). It is distinguished from *H. curmuca* in having two pairs of barbels vs. single pair, fewer lateral line scale rows (40 vs. 42-43), fewer upper transverse scale rows (7.5 vs.9.5-10), fewer circumferential scale rows (28 vs. 39-40), shorter distance between the origin of dorsal fin and insertion of pelvic fin (14.48-15.51 vs. 20.20-24.89 %SL) and narrower body (body depth 19.26-20.23 vs. 25.53-28.46 %SL). *H. menoni* sp.nov is distinguished from *H. kolus* in having two pair of barbels vs. single pair, fewer lateral-line scale rows (40 vs. 42-44), fewer upper transverse scale rows (7.5 vs. 9.5-10), fewer circumpeduncular scale rows (16-17 vs. 20-21), fewer circumferential scale rows (28 vs. 35-37), shorter distance from origin of dorsal fin to insertion of pelvic fin (14.48-15.51 vs. 19.93-25.81 %SL), shorter distance between origin of dorsal fin and insertion of pectoral fin (19.60-21.21 vs. 24.09-29.97 %SL) and narrower body (body depth 19.26-20.23 vs. 24.25-30.11 %SL). *H. menoni* sp.nov. is distinguished from *H. pulchellus* in having more lateral-line scale rows (40 vs. 30-32), more upper transverse scale rows (7.5 vs.5.5), more circumpeduncular scale rows (16-17 vs. 12) and more lower transverse scale rows (5.5 vs. 4.5) The species is distinguished from *H. tamirabaraniei* sp.nov. in having more predorsal scale rows (13 vs. 10-11), more upper transverse scale rows (7.5 vs. 6.5), more circumferential scale rows (28 vs. 24-26), shorter distance between origin of dorsal fin and insertion of pelvic fin (19.39-22.13 vs. 25.04-28.66 %SL), narrower caudal peduncle (depth 7.87-8.53 vs. 10.02-12.76 %SL) and narrower (body depth 19.26-20.23 vs. 25.90-28.68 %SL). The species can be distinguished from *H. vaigaiensis* sp.nov. in having fewer lateral-line scale rows (40 vs. 41-43), fewer circumferential scale rows (28 vs. 29-30), fewer transverse breast scale rows (12 vs. 14-16), more preanal scale rows (39-40 vs. 35-37), shorter distance between origin of dorsal fin and insertion of pelvic fin (14.48-15.51 vs. 17.07-21.22 %SL), shorter post dorsal length (46.19-50.92 vs. 51.02-59.54 %SL) and shorter distance between lower jaw and isthmus (22.37-33.26 vs. 58.82-71.51 %HL).

Figure (5E)

Hypselobarbus menoni, ZSI/SRC F. 4011, 1ex, 145.82 mm SL, Periyar River at Mleppara, 12 km east of Thannikudy Forest Inspection Bungalow, Periyar Tiger Reserve, collected by A.G.K. Menon and Rema Devi. 14 December 1990

Description

Head and body physiognomy provided in Fig. 5E. Body moderately deep (19.26-20.23 %SL). Dorsal and ventral margins more or less equally convex. Dorsal fin origin anterior to pelvic fin insertion by 2-2.5 scale rows; predorsal length 44.62-45.80 %SL and pre-pelvic length of 49.92-51.61 %SL. Distance between pelvic and pectoral fin insertions 23.21-24.51 %SL; distance between pelvic fin insertion to anal fin origin 20.75-21.59 %SL. Nape convex posterior to the occiput, but pre dorsum strongly convex in the anterior third. Dorsal fin base decreasing sharply from origin to caudal peduncle. Venter more or less curved and rising sharply at the end of anal fin base where more inclined to caudal peduncle; caudal peduncle depth 7.87-8.53 %SL.

Head long 27.56-29.13 %SL, with moderately long cranium of 22.72-25.31 %SL, Head depth 33.32-40.11, 49.32-53.18 and 58.33-63.61 %HL at nostril, pupil and occiput respectively. Head more compressed at preopercle with 72.48-77.85 %HL; interorbital width 31.56-47.67 %HL. Eyes moderately large, 28.67-33.45 %HL. Snout long, 38.46-40.23 %HL. Upper jaw length 17.80-21.91 %HL and gape width 23.48-26.70 %HL. Barbels long, maxillary and rostral barbels 24.86-30.48 and 9.37-10.13 %HL, respectively.

Fins long. Dorsal-fin rays iv-9(3), anal-fin rays iii- 5(3), pelvic-fin rays ii-9(3) and pectoral-fin rays i-14(3). Dorsal fin moderately tall, 19.39-22.13 %SL; fin with a fairly concave distal margin and last unbranched (spinous) ray weak and articulated; length of dorsal spine 22.99-24.37 %SL. Anal fin long, extending beyond base of caudal fin, and height 19.26-25.06 %SL. Distal margin convex with three unbranched rays not equal in length. Length of anal fin base is 8.21-8.87 %SL. Pelvic fin 17.75-19.26 %SL and longer by a distance of 4-5 scale rows from its origin. Distal margin of pelvic fin concave near tip and convex towards other edge. Pectoral fin long, 20.79-22.95 %SL and moderately falcate, extending to 2-2.5 scales anterior to pelvic fin insertion. Caudal fin long and deeply forked, 28.90-31.82 %SL,

Lateral- lines scales 40(3), predorsal scale rows 13(3), upper transverse scale rows 7.5(3), scale rows from lateral line to pelvic fin insertion 4(3), lower transverse scale rows 5.5(3), circumpeduncular scale rows 16(2)-17(1), circumferential scale rows 28(3), transverse breast scale rows 12(3), and preanal scale rows 39(1)-40(2).

Etymology: Named after the eminent Indian Ichthyologist Dr. A.G.K. Menon who had much interest on the genus *Hypselobarbus* and he only resurrected the genus.

Figure 6

Figure 6

Hypselobarbus mussullah: ZSI/SRC F8750, Uppinangudi Nethravathi . (Collected by: Ashwin Rai). 07 April 2013

4. DISCUSSION

The taxonomy of some species of *Hypselobarbus* has recently become a subject of some confusion, especially with respect to *H. kolus* and *H. curmuca*. While some authors have commented on and made taxonomic changes regarding these species (Knight et al. 2013a,b, c) there remain a number of unresolved issues as to the diversity and taxonomy in the genus. Herein, our analyses of specimens of multiple species of *Hypselobarbus*, type specimens, and other specimens from a broad geographic range reveals new and critical information on patterns of diversity resolving multiple confusing interpretations of taxonomy and proper identification of critical specimens.

According to Hora (1943) both *Barbus kolus* and *B. curmuca* have snouts produced and covered with a series of breeding tubercles. However, *Cyprinus* (=*Barbus*) *curmuca* was described and figured by Hamilton (Journey from the Madras through the countries of Mysore, Canara and Malabar, 1807) with 2 barbels, while Day (1878) described this same species as having four maxillary barbels.

Recently Knight et al. (2013c) argued that *H. curmuca* from Thunga River in Karnataka and *H. kolus* from Mula Muta River, Pune, Maharashtra are one and the same species of *Hypselobarbus*. Further, these authors stated that specimens from Pennar River, Andhra Pradesh have a marked high back and deep body. These authors also concluded that they provisionally treat *H. kolus* a synonym of *H. curmuca,* and the examination of a larger series of specimens may show the two species to be distinct.

We studied topotypes of *Hypselobarbus kolus* from Mula Muta River, Pune, Maharashtra, as well as specimens from the Thunga and Bhadra rivers (tributary of Krishna River basin), specimens from lower part of Krishna River (Krishna River at Sakthi Nagar at the border of the states of Karnataka and Andra Pradesh), from the east flowing Cauvery river at Basavanahalli (Karnataka) and from a west flowing river in Karnataka (Sharavathi River) and another from Kerala (Chalakudy). Based on the examination of all of these samples and meristic, morphometric, and coloration characters *Hypselobarbus kolus* and *H. curmuca* are clearly distinct species. This is most notable in the scale counts, circumferential scale rows (*H. kolus* with 35-37 vs. 39-40 in *H. curmuca)*, transverse breast scale rows (*H. kolus* has 12-14 vs. 10-11 in *H. curmuca)* and preanal scale rows (34-37 in *H. kolus* vs. 38-41 in *H. curmuca).* Two species occur together in the Thunga River. As the senior author started collecting freshwater fishes from 1994 onwards in various streams and rivers in peninsular India it is of the strong perception

that *Hypselobarbus curmuca* has two pairs of barbels while *H. kolus* has a single pair of barbels. Hence, given these factors almost all *Hypselobarbus* with a single pair of barbels were considered *H. kolus*. Following our thorough examination and re-examining all collections of *Hypselobarbus* the genus contains several species from streams and rivers of peninsular India that have remained undescribed.

Thorough earlier study reveals that *H. curmuca* from Tamiraparani River basin (Arunachalam et al. 2000, 2012, Raja, 2010) possessing two pairs of barbels represents a new species, *Hypselobarbus tamiraparaniei.* Specimens referred to *H. kurali* from the Moolavagai region of Periyar Tiger Reserve and a population from Achankoil River and Kallar River in South Kerala also represent a new species, *H. vaigaiensis*. Furthermore, our observations and analyses revealed that the original population from Kumaradhara River in Karnataka that was collected and described by Menon and Rema Devi (1995) as *H. kurali* were exactly similar to populations from Rosemalai, upstream of Kallada River in South Kerala and also Kallar River near Ponmudi, Trivandrum (a tributary of Vamanapuram River). It is very important to note here that Menon and Rema Devi (1995) strongly believed that there were many species within *H. kurali* and in that paper they included several populations from west flowing rivers of Karnataka and Kerala but never examined populations from the east flowing rivers such as the Thunga and Bhadra Rivers in Karnataka and the Tamiraparani River at the extreme south of the country. Subsequently, Rema Devi (1999) and Rema Devi and Indra (2000) identified populations from Tamirparani drainage as *H. kurali* = *H. curmuca*. Furthermore, several authors viewed *H. curmuca* as a widely distributed species in east and west flowing rivers of peninsular India. However, the record of *H. curmuca* from parts of Madhya Pradesh and Chattisgarh (Beavan 1877) needs to be confirmed but not available for examination and it may be *B. curmuca* (*sensu* Day 1878) with two pairs of barbels. It should also be noted that *Hypselobarbus kurali* (Menon and Rema Devi 1995) designated as holotype (1995) from Kumaradhara River of Nethravathi drainage and that is a valid species and not a synonym of *Gobio canarensis* Jerdon as claimed by Knight et al. (2013c). Jerdon (1849) clearly mentioned that the genus *Gobio* possessed either no or one pair of barbels and the species described by him as *Gobio curmuca, G. canarensis* had one pair of barbels. Day (1871, 1873) in his earlier studies also described *Barbus* (=*Hypselobarbus*) *curmuca* as having one pair of barbels.

Knight et al. (2013c) designated a neotype with the name bearing *Hypselobarbus kurali* Menon and Rema Devi 1995 (ZSI/SRC F4003) as *Gobio canarensis* Jerdon, 1849. In a subsequent paper (Knight et al, 2014) they considered *Hypselobarbus kurali* as a valid name. It is relevant to mention here that *Gobio canarensis* and *Hypselobarbus kurali* are not comparable because the former species can be diagnosed from the latter species by the presence of one pair of barbels, as also identified by Jerdon, versus two pairs of barbels. *Hypselobarbus kurali* was first described by Menon and Rema Devi (1995) and consisted of a species complex. Basically they described *H. kurali* from three populations. One population represented as holotype (270 mm SL, ZSI/SRC F.4003) and paratypes from population A Kumarathara River, Behinilae, near Nettana and also from Uppinangudi, both from the west flowing river, Nethravathi, Karnataka. Population B, with black caudal tips from Kerala with 2 lots, one from the Achankoil River, Kallar River near Pullikkayam and the another from the Periyar River at Neriyamangalam, Idukki district and also from Manimalai River at Mundakayam. Population C was described as having a caudal fin having plain tips and was collected from Kerala with two lots, one from Periyar River at Thannikudi near Thekkady and from Idukki Reservoir and another one from Cherrukotta Oda, a tributary of Periyar River at Cheruthony of Periyar Tiger Reserve, as well as one lot from Mleppara, 12 km east of Thannikudy Forest Inspection bungalow. These latter lots, designated as paratypes by Menon and Rema Devi (1995), are diagnosably different from the other paratypes and are described herein as a new species, *Hypselobarbus menoni* from Periyar Tiger Reserve. .

The senior author has examined all of the types that Menon and Rema Devi deposited in Zoological Survey of India, Southern Regional Centre at Chennai, Tamil Nadu on two separate occasions, once in February 2003 and a second time in May 2014. Based on examination of all types we conclude that the Holotype (ZSI/SRC F4003, 270 mm SL) examined in the earlier occasion in 2003 had been replaced by a different specimen of 258 mm SL but with the older original label. Through our studies, this replaced holotype now represents the new species described herein, *Hypselobarbus vaigaiensis,* based on populations from both the tributaries of Periyar River in Periyar Tiger Reserve and those collected by senior author from a population in the Moolavaigai region where the Vaigai River takes its origin and flows east. Collections from senior author from Kallar River, Kerala (Vamanapuram River basin), and also one population collected by the co- author (A.C.) from Achankoil River belongs to *H. vagaiensis*.

Finally, it is noteworthy to mention that the replaced holotype of *Hypselobarbus kurali* had the same label of ZSI/SRC F4003 of Menon and Rema Devi. This specimen was examined by Knight et al. (2013c, p. 205, fig.4) and was published in Zootaxa but immediately after that this specimen went missing in Zoological Survey of India. In the jar there now exists a specimen 258 mm SL that belongs to paratypes of *H. vaigaiensis*. Examination of the holotype of *H. kurali* as collected and deposited by Menon and Rema Devi (1995) by the senior author was carried out during 18 February 2003 and an image of the specimen is provided in in Figure 4A. There are several irregularities in the description of the published paper of Knight et al. (2013c) and additional inconsistencies and irregularities are coming to limelight on their descriptions of the species of *Hypselobarbus*. Hence the specimens, numbers and the details of missing/replaced are given in a table. It is also to be noted that *Hypselobarbus curmuca* (ZSI SRC F 8749), published by Knight et al. (2013c) was examined by two of the authors during February, 4-5, 2014; this specimen was found to be missing during our attempted subsequent examination on May 16, 2014. It belongs to *H. curcuma*. However, the image is produced here in Figure 1B is based on the specimen of our earlier examination. Thus, the neotype (ZSI/SRC F 8748) of *Hypselobarbus curmuca* designated by Knight et al. (2013c, p. 205) is a specimen *H. kolus* as it has all the characteristic features of the species, including 37circumferential scale rows, 13 transverse breast scale rows, and 37 preanal scale rows.

Furthermore, the specimen (ZSI/SRC F 8751) from Moola Mutta River, Maharashtra. collected by Hemant Ghate, which was unregistered during the senior author's examination on 18 February 2003 is also *H. kolus*. As it is topotypic material and possesses 44 lateral line scale rows, 36 circumferential scale rows, and 13 transverse breast scale rows, the specimen is certainly *H. kolus*. This specimen also went missing after the

publication of Knight et al. (2013c) entitled "On the identities *Barbus mussullah* Sykes, *Cyprinus curmuca* Hamilton with notes on the status of *Gobio canarensis* Jerdon (Teleostei: Cyprinidae)."

Further, in Knight et al. (2013c) the specimen figured on pg. 207 in figure 8B, and as *Hypselobarbus curmuca* lacks a voucher. Hence, it has no validity. Also, for *H. canarensis* the images in Figures fig. 6B and fig.10B also lack vouchers. This will obviously only add to the confusion of readers of this convoluted and bizarre taxonomy and replacement of types. In addition, the specimen labeled as 8750 (ZSI/SRC) in Knight et al. (2013c, p. 204, fig. 2B) illustrating gill rakers and pharyngeal teeth is referred to as *Hypselobarbus canarensis* and identified as such in the materials examined (p. 212) but in the ZSI/SRC system the specimen is identified and labeled as *H. mussullah* (Figure 6).

SUMMARY POINTS

1. *Hypselobarbus kolus* is distinct from *H. curmuca* though *H.curmuca* was thought to be in the group of other *Hypselobarbus* species with two pairs of barbels.
2. *Hypselobarbus kurali* Menon and Rema Devi 1995 consists of multiple species.
3. Three new species were described from the *Hypselobarbus kurali* species complex.

FUTURE ISSUES

1. The freshwater fish order Cypriniformes is the most diverse monophyletic group in the world with an expected 5,000+ species.
2. The taxonomic study on the genus *Hypselobarbus* has a good beginning and reports are coming on this genus.
3. Increasing interests in the taxonomy of big sized barbs of peninsular India is a good indication in the field of fish taxonomy.

ACKNOWLEDGMENTS

This research was supported in part by the Sri Paramakalyani Centre for Environmental Sciences, (DST- Government of India-S/FST/ESI-101/2010), Manonmaniam Sundaranar University, Saint Louis University and the USA National Science Foundation Grants EF-0431326, DEB-1021840 and DBI-0956370 to RLM. This work was initiated, intended and completed as part of collaborative international initiatives to develop infrastructure in the taxonomy and systematics of Cypriniformes, likely the most diverse group of freshwater fishes in the world. The two initiatives Cypriniformes Tree of Life and All Cypriniformes Global Biodiversity In itiative (www.cypriniformes.org) have aided in this mission.

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Table 1

Meristic characters of *Hypselobarbus curmuca, H. kolus, H. kurali, H. tamiraparaniei* sp.nov., *H. vagaiensis* sp.nov, *H. menoni* sp. nov.

Meristic characters	***H. curmuca*** ZSI/SRC F 8749/1 MSUMNH 83. CMA, 32,33. n=8	***H. kolus*** ZSI/SRC F 8748, F 8057, F 8751. MSUMNH 84,85,86, 87. CMA, 34, 35,36,37, 38,47. n=23	***H.kurali***		***H. tamiraparaniei* sp.nov.**		***H. vaigaiensis* sp.nov.**		***H.menoni* sp.nov.**	
			ZSI/SRC F. 4003/1 Holotype	MSUMNH 88 CMA, 39. n=8	ZSI/SRC F 8758/1 Holotype	MSUMNH 89,90. CMA, 40,41. n=16	ZSI/SRC F 8757/1 Holotype	MSUMNH 91,92. CMA, 42,43. n=9	ZSI/SRC F.4011/1 Holotype	ZSI/SRC F. 4011/2 Paratype n=2
1. Dorsal fin rays	iv.9	iv.9	iv.9	iv.9	iv.9	iv.8-9	iv.9	iv.9	iv.9	iv.9
2. Anal fin rays	iii.5	iii.5	iii.5	iii.5	iii.5	ii-iii.5	iii.5	iii.5	iii.5	iii.5
3. Pelvic fin rays	ii.-9	i.8-ii.9	i.9	i.8-ii.9	ii.9	i-ii.9	1.9	i.9	ii.9	ii.9
4. Pectoral fin rays	i.14-15	i.14-16	i.14	i.14	i.14	i.14-15	i.14	i.14	i.14	i.14
5. Caudal fin rays	10+9	10+9	10+9	10+9	10+9	10+9	10+9	10+9	10+9	10+9
8. Upper transverse scale rows	9.5-10	9.5-10	8	7.5-8	6.5	6.5	7.5	7.5-8	7.5	7.5
9. Lower transverse scale rows (anus)	7.5-8	7.5-9	6.5	6.5	6	5.5-6	5.5	5.5-6	5.5	5.5
10. Lateral line to pelvic scale rows	5-5.5	6-7	5	4.5-5	4	3.5-4	4	3.5-4	4	4
11. Lateral line scale rows	42-43	42-44	42	42-43	38	38-40	42	41-43	40	40
12. Predorsal scale rows	14	13	14	13-14	10	10-11	13	12-13	13	13
13. Circumpeduncular scale rows	20-21	20-21	18	18	16	15-16	18	17-18	16	16-17
14. Circumferential scale rows	39-40	35-37	32	32-33	24	24-26	30	29-30	28	28
15. Transverse breast scale rows	10-11	12-14	23	21-23	8	8-10	16	14-16	12	12
16. Preanal scale rows	38-41	34-37	Absent	43-46	25	25-29	37	35-37	39	39-40

Table 2

Morphometric characters of *Hypselobarbus curmuca*, *H. kolus*, *H. kurali*, *H. tamiraparaniei* sp. nov., *H. vagaiensis* sp. nov, *H. menoni* sp. nov.

Morphometric data (body characters in % standard length, head characters in %head length	***H. curmuca*** ZSI/SRC F 8749, MSUMNH 83 CMA 32, 33 (n=8)	***H. kolus*** ZSI/SRC F 8748, F 8057, F 8751. MSUMNH 84, 85, 86, 87 CMA 34, 35, 36, 37, 38, 47 (n=23)	***H. kurali***		***H. tamiraparaniei*** **sp. nov.**		***H. vaigaiensis*** **sp.nov.**		***H. menoni*** **sp.nov.**	
			ZSI/SRC F.4003/1 Holotype	MSUMNH 88 CMA 39 (n=8)	ZSI/SRC F8758/1 Holotype	MSUMNH 89, 90 CMA 40, 41 n=16	ZSI/SRC F 8757/1 Holotype	MSUMNH 91, 92 CMA 42, 43 (n=9)	ZSI/SRC F. 4011/1 Holotype	ZSI/SRC F.4011 n=2
1. Standard length	118.15-219.52	101.86-190.83	270.00	144.55-166.83	196.31	152.26-200.20	150.26	106.01-157.88	145.82	110.34-145.82
	% of Standard Length									
2. Snout to urocentrum	92.03-96.89	90.29-97.60	94.94	90.92-94.94	92.12	90.82-96.70	93.43	91.32-94.79	95.57	91.98-95.57
3. Pre anal length	73.17-77.97	73.03-75.95	76.67	72.87-78.77	76.16	72.89-76.17	74.99	70.89-75.92	74.58	74.07-78.22
4. Pre dorsal length	45.62-46.42	42.59-47.04	47.43	45.53-47.43	50.59	44.61-51.74	45.89	43.92-46.00	45.10	44.62-45.80
5. Pre pelvic length	47.39-50.71	46.83-49.70	52.64	49.07-52.64	51.39	47.76-52.13	47.52	47.52-50.83	49.92	49.92-51.61
6. Pre pectoral length	24.05-27.19	22.83-25.10	27.19	25.94-28.19	26.47	24.02-30.25	24.38	24.29-28.50	26.56	25.90-26.98
7. Pre occipital length	20.70-23.54	20.35-22.84	24.63	22.78-24.63	24.65	21.40-25.60	22.41	21.61-24.22	25.31	22.72-25.31
8. Caudal peduncle length	12.11-14.51	11.40-19.97	15.04	12.70-15.04	13.59	12.02-15.50	14.24	11.64-16.62	11.53	11.53-15.84
9. Dorsal-fin origin / Pelvic-fin Insertion	23.77-27.98	22.21-29.58	25.16	21.99-26.13	26.71	25.04-28.66	22.17	22.11-24.93	19.39	19.39-22.13
10. Height of dorsal spine	21.77-25.23	19.14-28.90	21.16	20.08-22.30	24.54	21.57-27.74	22.69	21.58-25.26	22.99	22.99-24.37
11. Anal fin height	18.53-25.77	17.84-25.49	25.16	17.39-25.76	31.32	18.06-33.11	26.83	17.54-28.94	25.06	19.26-25.06
12. Depth of caudal peduncle	9.56-10.80	9.53-10.99	10.29	9.19-10.29	11.01	10.02-12.76	8.63	8.63-9.98	7.87	7.87-8.53
13. Caudal fin length	24.13-33.19	24.67-33.14	32.49	27.73-32.49	29.20	13.95-32.35	30.33	27.43-31.67	30.52	28.90-31.82
14. Dorsal fin height	23.84-29.02	20.75-27.17	23.93	17.86-23.93	25.08	23.01-27.56	22.45	22.45-26.15	23.84	23.84-25.67
15. Pectoral fin length	15.77-20.34	18.33-28.89	20.29	16.47-20.29	22.42	18.27-25.07	19.51	18.34-22.19	22.01	20.79-22.95
16. Pelvic fin length	17.58-20.16	16.93-19.88	15.19	14.64-16.19	18.77	16.70-20.92	15.93	15.93-19.44	17.75	17.75-19.26
17. Pelvic auxiliary scale Length	5.53-7.39	5.70-9.61	7.50	6.02-7.50	6.65	6.11-9.34	7.17	7.11-10.08	9.14	8.82-9.14
18. Occiput to dorsal fin origin	23.70-26.04	21.09-26.06	25.20	22.44-26.21	27.02	23.46-27.88	24.12	22.39-24.96	21.88	21.76-22.66
19. Occiput to pectoral fin insertion	18.01-19.70	17.16-20.24	18.20	17.69-18.85	21.33	18.49-22.23	25.69	16.57-25.69	16.76	16.76-18.50
20. Occiput to pelvic fin insertion	32.69-40.32	36.82-41.24	38.95	36.43-39.04	39.45	38.74-41.27	33.38	33.38-38.72	35.63	34.49-36.38
21. Dorsal origin to pelvic fin insertion	20.20-24.89	19.93-25.81	22.09	20.22-22.89	23.59	20.97-28.76	19.66	17.07-21.22	15.51	14.48-15.51
22. Dorsal origin to pectoral fin insertion	25.36-28.58	24.09-29.97	26.20	25.24-26.90	28.57	25.90-29.02	25.92	22.54-25.98	21.21	19.60-21.21
23. Dorsal origin to anal fin origin	36.60-40.84	36.10-40.76	37.18	34.76-37.18	38.59	36.06-39.73	36.76	33.19-37.62	35.09	33.06-35.09
24. Dorsal insertion to caudal fin	33.80-39.20	31.30-41.28	37.12	32.78-37.49	30.90	13.97-39.34	34.76	34.53-41.25	39.58	37.93-39.94

base										
25. Dorsal insertion to anal fin origin	22.20-26.48	20.91-25.69	25.18	23.00-26.83	26.91	23.16-28.24	24.80	23.27-26.47	22.66	19.04-22.66
26. Length of dorsal fin base	14.88-17.48	14.76-18.19	14.12	12.55-14.57	15.98	13.62-15.99	13.94	13.10-15.54	12.78	12.78-14.79
27. Length of anal fin base	7.84-9.77	7.11-9.56	8.10	7.25-8.49	8.66	7.31-10.01	9.43	7.36-9.47	8.21	8.21-8.87
28. Pectoral fin insertion to pelvic fin insertion	24.08-26.76	24.68-27.39	28.12	24.76-28.12	23.71	22.85-27.00	20.71	20.71-26.47	23.21	23.21-24.51
29. Pectoral fin insertion to anal fin origin	45.51-52.39	45.39-51.75	51.20	46.47-52.21	45.07	42.75-49.66	48.24	41.68-48.24	42.61	42.61-45.77
30. Pelvic fin insertion to anal fin origin	21.06-26.46	20.40-24.21	26.12	21.72-26.60	20.45	19.54-23.08	24.31	19.21-24.31	20.75	20.75-21.53
31. Post-dorsal length	49.26-56.53	41.87-57.03	50.25	46.66-52.25	47.57	44.94-54.53	51.02	51.02-59.54	46.19	46.19-50.92
32. Body depth	25.53-28.46	24.25-30.11	26.20	24.11-26.93	27.98	25.90-28.68	21.52	21.52-25.27	19.52	19.26-20.23
33. Pectoral fin origin to vent	43.95-53.44	40.06-52.13	52.20	48.15-54.00	45.19	44.56-51.51	48.46	43.30-50.87	43.38	43.38-46.33
34. Pelvic fin origin to vent	19.67-26.01	18.89-26.66	26.90	22.82-27.97	22.48	19.60-24.90	24.82	22.02-27.06	19.16	19.16-21.25
35. Head length	24.54-27.14	23.57-26.20	27.90	26.28-27.95	29.12	25.67-31.28	25.88	25.80-27.91	29.13	27.56-29.13

Table 2

Morphometric characters of *Hypselobarbus curmuca*, *H. kolus*, *H. kurali*, *H. tamiraparaniei* sp. nov., *H. vagaiensis* sp. nov, *H. menoni* sp. nov. (Contd.)

Morphometric data (body characters in % standard length, head characters in %head length	***H. curmuca*** ZSI/SRC F 8749, MSUMNH 83 CMA 32, 33 (n=8)	***H. kolus*** ZSI/SRC F 8748, F 8057, F 8751. MSUMNH 84, 85, 86, 87 CMA 34, 35, 36, 37, 38, 47 (n=23)	***H. kurali***		***H. tamiraparaniei*** **sp. nov.**		***H. vaigaiensis*** **sp.nov.**		***H. menoni*** **sp.nov.**	
			ZSI/SRC F.4003/1 Holotype	MSUMNH 88 CMA 39 (n=8)	ZSI/SRC F8758/1 Holotype	MSUMNH 89, 90 CMA 40, 41 (n=16)	ZSI/SRC F 8757/1 Holotype	MSUMNH 91, 92 CMA 42, 43 (n=9)	ZSI/SRC F. 4011/1 Holotype	ZSI/SRC F.4011 n=2
Head Length	% of Head Length									
36. Snout to opercle	70.07-78.30	70.53-79.29	78.50	73.69-78.58	74.84	69.43-77.30	74.20	70.84-81.87	77.85	72.48-77.85
37. Upper jaw length	26.72-33.96	23.17-33.13	32.37	27.76-32.37	27.41	25.79-31.14	23.38	23.38-31.01	17.80	17.80-21.91
38.Snout length	38.85-43.05	34.30-42.76	45.50	43.09-45.59	46.54	41.23-47.11	42.90	39.00-48.59	40.23	38.46-40.23
39. Pre nasal length	26.57-31.48	22.61-33.18	31.20	28.72-31.47	33.61	28.92-36.75	28.37	24.27-36.39	30.39	28.01-30.87
40. Orbit width	24.29-29.81	24.44-34.22	28.92	24.29-28.92	22.31	21.48-26.54	24.97	24.24-29.59	28.67	28.67-33.45
41. Inter orbital width	34.74-43.38	34.34-47.10	33.75	33.71-36.86	36.30	32.71-38.86	32.84	30.91-37.88	47.67	31.56-47.67
42. Inter nasal width	23.46-29.81	23.95-28.55	29.90	22.82-30.00	24.39	23.94-26.74	24.00	23.13-25.45	28.04	23.51-28.04
43. Head width	52.45-59.80	53.62-62.06	56.02	50.71-56.08	54.58	51.92-59.46	48.89	47.41-53.58	47.46	47.46-51.58
44. Gape width	13.23-22.85	14.16-25.52	22.90	18.71-22.99	16.97	15.93-22.38	18.11	16.24-25.42	24.69	23.45-26.70
45. Lower jaw to isthmus	58.07-64.78	48.90-71.35	66.20	60.55-66.61	64.43	57.80-67.99	62.42	58.82-71.51	30.56	22.37-33.26
46. Head depth at nostril	36.18-46.92	34.63-43.33	41.20	36.30-41.86	43.72	36.80-44.35	39.79	35.34-45.46	40.11	33.32-40.11
47. Head depth at pupil	53.61-61.69	55.31-62.47	59.12	54.06-59.19	58.47	52.66-61.84	56.33	50.28-59.08	49.32	49.32-53.18
48. Head depth at occiput	65.05-73.66	67.11-74.74	69.20	60.69-69.72	68.82	62.84-71.76	65.33	61.63-71.31	58.33	58.33-63.61
49. Maxillary barbel Length	16.33-24.22	17.32-25.13	23.50	16.65-23.58	16.72	14.03-21.49	23.82	18.06-27.79	24.86	24.86-30.48
50. Rostral barbel length	Absent	Absent	13.51	9.41-13.54	7.94	7.41-10.89	10.88	7.40-11.68	9.37	9.37-10.13

Table 3

List of missing/destroyed/not traceable/replaced type specimens in ZSI/SRC, Chennai

1.	***Hypselobarbus kurali*** **Menon and Rema Devi (1995)** Holotype – ZSI/SRC F4003, 270 .00 mm SL. Kumaradhra near Nettana Dakshin Kannada collected by A.G.K. Menon 07 January 1992 was given in fig,4 p.205 in Knight et al. (2013c)	The original holotype was missing after the publication of Knight et.al. (2013c) but now it was replaced with a specimen of 258.0 mm SL. However, the same label as holotype was in the jar. This replaced specimen is now belongs to paratype of *H. vaigaiensis*. It was examined by the senior author during 18 February 2003 and during 4-5 February 2014.
2.	Paratypes - ZSI/SRC F4006, 2ex. 81.0-120.0 mm SL, Achencoil, Quilon District, Kerala. 06.11.1989. 3ex.106.0-175.0 mm SL, Kallar River near Pulikkayam. collected by A.G.K. Menon 07 November 1989	Missing 106.0-175.0 mm SL, 3ex. Kallar River near Pulikkayam are dried up and unable to examine
3.	Paratypes - ZSI/SRC F 4007, 5ex., 112.0-148.0 mm SL. Periyar River at Neriyamangalam Iddukki District collected by A.G.K. Menon 03 October 1990, F 4007, 9ex, 78.0-143.0 mm SL, Manimala River at Mundakayam. Collection same as above, collected by A.G.K. Menon 12 September 1991	All specimens are missing
4.	Paratypes - ZSI/SRC F 4009, 4ex.,165.0-190.0 mm SL. Iddukki reservoir collection collected by A.G.K. Menon 28 September 1990	All specimens are missing
5.	Paratypes - ZSI/SRC F 4010,4ex.,151.0-196.0 mm SL,Cheruthony Oda, a tributary of Periyar River at Cheruthony, Periyar Tiger Reserve, Thekkady. collected by A.G.K. Menon 13 December 1990	All specimens are missing
6.	ZSI/SRC F 8749 as mentioned in Knight et al. (2013c) is missing	Senior author examined the specimen during a visit on 4-5 February 2014. But could not be traced on subsequent visit on ZSI/SRC on 16 May 2014.
7.	*Hypselobarbus curmuca* ZSI/SRC F 8751 as published in p. 203 in Knight et al. (2013c)	Now after the publication it is missing
8.	ZSI/SRC F 8750 is designated as *Hypselobarbus canarensis* as published in p.204 Knight et al. (2013c)	In the jar it is labeled as ZSI/SRC F 8750 3examples belong to *H. mussullah*