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Article

On the identities of *Hypselobarbus pulchellus* (Day, 1870), *H. dobsoni* (Day, 1876), *H. jerdoni* (Day, 1870), and H. *maciveri* Annandale 1919 (Cypriniformes: Cyprinidae), with the description of a new species of *Hypselobarbus* from peninsular India

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Abstract
Recently Knight et al. (2013a, b, 2014) reported *Hypselobarbus pulchellus* as being newly rediscovered from its type locality, but their discovery and report was discovered to be controversial. The examination of those specimens described as *H. pulchellus* by Knight et al. (2013b) revealed that they belonged to *Hypselobarbus bicolor* (Knight et al. 2016). Based on this, we perused his collections from Nethravathi, Thunga and Bhadra rivers and found that there exist seven specimens with standard lengths ranging from 315.85-351.72 mm that all displayed similarities with the original description of *H. pulchellus*. As the identity of *H. pulchellus* was not resolved by Knight et al. (2013b, 2014, 2016), herein we redescribe this species. Moreover, the closely related species *H. jerdoni* and *H. dobsoni* are also described based on specimens collected from their type localities and from a selection of specimens made available at the Zoological Survey of India, Southern Regional Centre, Chennai, India. In addition, the subspecies *Barbus* (=*Hypselobarbus*) *jerdoni maciveri* Annandale 1919 is elevated to *H. maciveri* based on the examination of the holotype and paratypes from ZSI, Kolkatta and from specimens available from the senior author's collections. Finally, another new species is described herein based on collections by the senior author that was wrongly identified as *H. puchellus*.

Keywords: Cyprinidae, *Hypselobarbus pulchellus*, New species, Endemic genus, Southern India.
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Introduction

Species of *Hypselobarbus* are endemic to peninsular India, and have recently undergone some scrutiny following the presentation of the phylogenetic relationships of the currently recognized species by Arunachalam et al. (2012). Knight et al. (2013a) mentioned that they collected a specimen of *H. pulchellus* from Sita River, Karnataka and further stated that they proposed to describe it in a subsequent paper. Later, Knight et al. (2013b) provided four images of *H. pulchellus* of which two were reproduced from their earlier paper (Knight et al. 2013a), the third was from a specimen at ZSI (ZSI/SRC F. 8753 collected by K.C. Jayaram), and the fourth was Day's image of a dry skin (BMNH 1889.2.1.4328). Subsequently, specimens were deposited in the Zoological Survey of India, Southern Regional Centre (ZSI/SRC F. 8737, 3) by Marcus Knight and Ronald de'souza. All the four specimens actually represented an undescribed species that was subsequently described as *H. bicolor* by Knight et al. (2016). The identity of *H. pulchellus* by Knight et al. (2014) was not clear as these authors mentioned that *H. pulchellus* had a lateral-line scale count of 32+1 based on a specimen collected from the Nethravathi River. In their recent paper, Knight et al. (2016, p. 322) stated that the identity of *H. pulchellus* was confirmed with a lateral-line scale count of 31-32 scales on the body and 1 scale on the caudal-fin base. However, in their discussion Knight et al. (2016, p. 324) stated that "The specimen from the Nethravati River (MKC 425, 278 mm SL, pictured in Knight et al. 2014) with 31+1 scales matches the original description of *Barbus pulchellus*, and is also visually identical to Francis Day's dry-skin mount in the Natural History Museum, London (BMNH 1889.2.1.4328)". This implies that there is only one specimen as was stated by Knight et al. (2016). However, the lateral line scale count of 31-32+1 by Knight et al. (2016) clearly indicates that there was more than one

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specimen. Only meristic characters were provided in the discussion and there were no tables showing the meristic and morphometric characters of *H. pulchellus*. It is our opinion that this reveals that Knight et al. (2016) were not confident about their rediscovery of *H. pulchellus*. In the light of the above, we redescribe *H. pulchellus* based on 7 specimens with 50 morphometric characters and 14+1 meristic counts including the character of Ltr (lateral transverse scale rows, Ltr., as per Day, 1889). Moreover, the specimen mentioned as *H. pulchellus* (MKC 425) was 278 mm SL when compared to our specimens (n=7) in the range of 315.85-351.72 mm SL and these specimens are closer to Day's specimen of 17.5 inches (444.5 mm) (Day 1889). Hence we designate a specimen of 323.54 mm SL (MSUMNH78) as neotype. The longer specimen was not considered as neotype as the caudal fin was slightly damaged.

The rediscovery and identity of *H. pulchellus* by Knight et al. (2013a, b) was criticized by Basavaraja (2014) wherein the latter author raised some points that *H. pulchellus* reported by Knight et al. (2013a) have lateral-line scales of 32-37 yet as per Day, *Barbus* (=*Hypselobarbus*) *pulchellus* possessed 30-32 lateral-line scales. Basavaraja (2014) further claimed that the specimens collected by himself through several surveys of the Thunga and Bhadra rivers and the Anjanapura Reservoir (all in southern Karnataka) had lateral-line scales of 30-31. He also expressed that *H. pulchellus* and *H. dobsoni* have identical fin formulae and hence the species referred to as *H. pulchellus* by Knight et al. (2013a, b) was *H. dobsoni*. Basavaraja (2014, p. 5418) also clearly indicated that the lateral band running from the eye/opercle to the caudal fin of his specimens was indicative of *B. pulchellus*. He further quoted that Day's description was authentic and concluded that specimens of Knight et al. (2013b) were not *H. pulchellus*.

In reply to the response given by Basavaraja (2014), Knight et al. (2014) stated that "Day (1878) does not mention whether the specimens were stuffed or not; the original description of Day (1870) was based on a stuffed specimen and scale loss in a stuffed specimen is quite inevitable. However, his specimens had 32 or 33+1-2 lateral-line scales and it is highly probable that one or two scales behind the nape or on the caudal fin base could have fallen off in the specimen that Day (1870) used for original description". Knight et al. (2014) was also of the view that there is a wide range in lateral-line scales in the genus *Hypselobarbus*.

In view of the papers by Knight et al. (2013a, b, 2014) and Basavaraja (2014), we examined the specimens of Knight et al. (2013b) from the Zoological Survey of India. These specimens showed variation with the description of *B. pulchellus* by Day (1870, 1876, 1889) in not only lateral-line scales but in other meristic and morphometric characters as well. The views of Knight et al. (2013a, b, 2014) and Basavaraja (2014) are dealt with in detail below. Further, the image shown in Basavaraja (2014, no figure number) does not represent either *H. pulchellus* or *H. dobsoni*. Moreover, specimens illustrated and discussed by Basavaraja (2014) were not deposited in any state or national institutes, university collections or at Zoological Survey of India where they would be available for examination. Hence, we pursued his collections from rivers of southern Karnataka. This resulted in finding three specimens that looked similar to the specimens discussed and illustrated in Basavaraja (2014). These three specimens were found to represent an undescribed species, and the collections from Bhadra River are herein described as a new species.

Day (1870) described *B. jerdoni* (= *H. jerdoni*) from Mangalore (west coast) as having 28 lateral-line scales, 6/4 lateral transverse scales and four scales rows between the lateral line and pelvic fin; coloration was described as silvery and with fins tipped with black. In the description of *B. dobsoni* (= *H. dobsoni),* Day (1876) stated that *B. dobsoni* possessed 32 lateral-line scales, 5 ½/5 ½ (Ltr.) lateral transverse scale rows, 2½ scales rows between the lateral line and pelvic fin origin, a coloration of bluish above, lighter below, and the fins edged in grey. In the earlier description of *B. jerdoni*, Day (1870) mentioned that it possessed 27-28 lateral-line scales, 6/4 Ltr., and scale rows between lateral line and ventral fin as 4. Furthermore, Day (1889) also described *B. jerdoni* as having the depressed anal fin reaching somewhat beyond the root of the caudal fin. Day (1889) also described the lateral

line as concave with 2½/3½ scales rows between it and the pelvic fin origin, and as having 12 predorsal scales. Coloration was described as silvery and orange fins, tipped with black. The distribution was identified then as occurring from rivers in Canara below the Ghats (maybe in the plains). Based on Day's description of *B. jerdoni* and *B. dobsoni* there was an overlap in the meristic character of scale rows between the lateral line and pelvic fin origin with 2½-3½ rows in *B. jerdoni*. For *B. dobsoni*, Day (1878) mentioned the scale rows between lateral line and pelvic fin origin as 2½ but in 1889, he mentioned the same meristic count as 3½ rows. However, Day was consistent in distinguishing *B. jerdoni* and *B. dobsoni* in lateral-line scale counts as 27-28 for *B. jerdoni* and 30-32 for *B. dobsoni*. Day (1878) was also consistent in the description of the depressed pectoral fin almost reaching the pelvic fin and the anal fin reaching beyond the root of the caudal fin in *B. jerdoni* but not in *B. dobsoni*.

Later, Annandale (1919) described another variety of *B. jerdoni* as *Barbus jerdoni maciveri* from Maharashtra. After Day (1889), neither *B. dobsoni* nor *B. jerdoni* were reported in the literature except in Spence and Prater (1932). However, it was Menon (1999, 2004) who argued that both *B. jerdoni* and *B. dobsoni* were distinct species and placed them in *Hypselobarbus* Bleeker.

The confusion over *B. jerdoni* and *B. j. maciveri* has been mainly due to a similar colour pattern in the dorsal, pectoral, anal, and caudal fins being red and the tip of the upper lobe of the caudal, anal and dorsal fins black both in *B. jerdoni* and *B. j. maciveri*. Recently in a study of the phylogenetic relationships of *Hypselobarbus,* Arunachalam et al. (2012) provided figures (fig. 2c) showing the dorsal fin tipped with black and coloration of the pelvic and caudal fins as reddish, as *H. jerdoni*. However, after thorough examination of all collections of *Hypselobarbus* from southern Karnataka, northern Kerala and Maharashtra, it is certain that populations referred by Arunachalam et al. (2012) as *H. jerdoni* are *H. j. maciveri*. We examined the types of *B. j. maciveri* in Zoological Survey of India, Kolkatta and comparisons were made with specimens available in his collections from peninsular rivers. This thorough comparison resulted in the conclusion that *Hypselobarbus jerdoni maciveri* represents a distinct species. In the present paper, we describe a new species, *Hypselobarbus basavarajai*, from the Bhadra River, remove *H. maciveri* from the synonymy of *H. jerdoni*, and provide redescriptions of both *H. jerdoni* and *H. maciveri,* and redescribe and elevate *H. dobsoni* from synonymy with *H. jerdoni* (Talwar and Jhingran 1991).

Methods

Morphological examinations: 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 meristic and morphometric characters are based on Hubbs and Lagler (1964). Dorsal spinous height is the height of the dorsal fin taken as the length of the last anterior unbranched rays. Morphometric characters from landmarks 9, 18-26, 29-31 and 34-35 (Table 1) were additional truss measurements (Strauss and Bookstein 1982). Preanal scales (Jayaram, 1991) are the scales from the anus to the isthmus. The meristic character of lateral transverse scale (Ltr.) rows described by Day (1889) in his comparisons within *Hypselobarbus* is "number of longitudinal rows of scales between the back and abdomen, usually counted, unless some other part of the side is specified, from the anterior end of the dorsal fin to the ventral". Body measurements are expressed as percentage of Standard Length (%SL); head measurements are expressed as percentage of Head Length (%HL). Total length (TL) was also used for comparison.

Genetic analyses: Concatenated sequences (COI+Cytb) for four species of *Hypselobarbus* were analyzed using *Systomus sarana* as outgroup. Phylogenetic trees were estimated using Maximum Likelihood (ML) in RAxML (Randomized Axelerated Maximum Likelihood, version 7.0.4) (Stamatakis 2006). Inferences included partitions by codon position using the best-fit partitioning schemes based on Partition Finder v1.1.1 (Lanfear et al. 2012). Robustness of the inferred tree was evaluated using bootstrap analysis on 1,000 pseudoreplications and GTR+I+G

model with the mixed model of nucleotide substitution (4 discrete rate categories) in RAxML 7.0.4 (Stamatakis et al. 2008). Resulting trees were imported into PAUP*4.0.b10 (Swofford 2002) to obtain the consensus tree. Observed genetic divergences provided herein are based on uncorrected *p*-distances for COI, Cytb and concatenated genes.

GenBank accession numbers for sequences used herein are identified below in parentheses by species. Cytochrome oxidase (COI) and cytochrome b (cytb) genes were: *H. pulchellus* (KP965421, KP998078), *H. dobsoni* (KP965411, KP998070), *H. jerdoni* (KP965380, KP998093), *H. maciveri* was previously submitted as *Puntius jerdoni* (HM010710, HM010722) and *S. sarana* was previously submitted as *P. sarana* (HM010714, HM010726).

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

Comparative materials: *Hypselobarbus dobsoni:* ZSI/SRC F8738, 1, 145.05 mm SL; Thunga River, Karnataka, A. Rai, 12 May 2013. - MSUMNH79, 1, 182.24 mm SL; N.R. Pura market collection near to Bhadra River, M. Arunachalam, 13 April 2007. - CMA27, 2, 144.91-152.30 mm SL; N.R. Pura market collection near to Bhadra River, M. Arunachalam, 13 April 2007.

Hypselobarbus jerdoni: ZSI/SRC F8739, 1, 165.52 mm SL; Netharavathi River, Karnataka, R. D'souza, 6 January 2013. - MSUMNH80, 1, 65.23 mm SL; Sishila River, tributary of Nethravathi River, 27 March 2002, M. Arunachalam. CMA28, 9, 37.39-116.71 mm SL; Aghanashini River, Karnataka, Eranchipuzha, Kerala, M. Arunachalam, 23 January 2004. - CMA28, 9, 37.39-116.71 mm SL; Aghanashini River, Karnataka, Eranchipuzha, Kerala, M. Arunachalam, 1996 exact date not known for Aghanashini River, Karnataka and Eranjipuzha, Kerala, 23 January 2004.

Hypselobarbus maciveri: ZSI/Kolkatta F9576, 2, Holotype and Paratype, 121.17-123.55 mm SL; Krishna River near Mahuli, 3 km from Satara, N. Annandale, Dates not known. - MSUMNH81, 1, 196.13 mm SL; Thunga River at Sringeri, M. Arunachalam, 19 November 2004. - CMA29, 12, 37.80-88.95 mm SL; Thunga and Aghanashini rivers, M. Arunachalam, 19 November 2004.

Hypselobarbus bicolor: ZSI/SRC F8753, 129.06 mm SL; Thunga River, Karnataka, India, K.C. Jayaram, 11 February 1999. - ZSI/SRC F8737, 3, 108.1-120.37 mm SL; Sita River, Karnataka, India, A. Rai, 20 April 2013.

Results

Hypselobarbus pulchellus (Day, 1870)

(Fig. 1 and Tables 1-2)

Neotype: MSUMNH78, 1, 323.54 mm SL; neotype, Nethravathi River at Nidugal (13°0'50"N, 75°21'22"E) Karnataka, M. Arunachalam, 29 May 2003.

Other materials: CMA26, 6, 315.85-351.72 mm SL; Thunga River, Bhadra River, Karnataka, M. Arunachalam, 29 May 2003.

As per Day's (1876) description, *B. pulchellus* was described as having 30-32 lateral-line scales. In our collections of *H. pulchellus* from Thunga, Bhadra and Nethravathi rivers the specimens have 30(1), 31(4) or 32(2) lateral-line scales. Day (1870) described the lateral transverse (Ltr.) scale rows as 5.5-6/5.5; in our collections of *H. pulchellus* specimens have 6/5.5(7) lateral transverse scale rows. Among the morphometric characters, Day described the head length of *H. pulchellus* as 6-6.5 times in total length; in our specimens (391.71-430.39 mm TL) head length is 5.75(3) or 6.5(4) in TL. Day described length of caudal fin as 4.5 or 5 in TL; in our specimens it is 4.5(4) or 5(3) in TL. Finally, Day's description of body depth in *H. pulchellus* was 4 or 4.5 in TL; in our

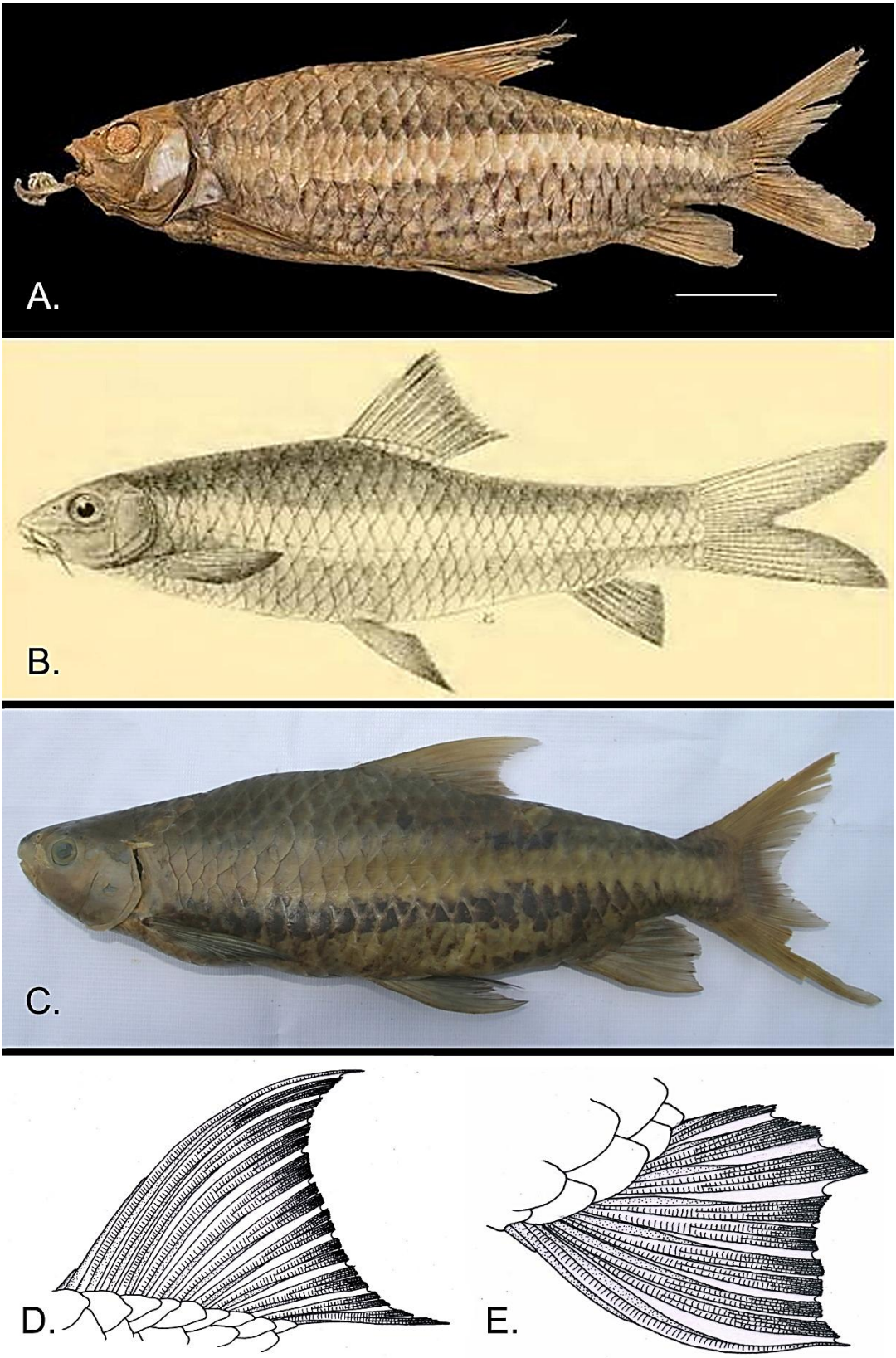

Figure 1. (A) *Barbus* (=*Hypselobarbus*) *pulchellus* collected by Day, (BMNH 1889.2.1.4328) (dry Skin), Canara, from Knight et al. (2013b) with creative Commons Attribution 3.0 Unported License, (B) *Barbus* (=*Hypselobarbus*) *pulchellus*, Day 1878 Plate CXL fig. 3, (C) *Hypselobarbus pulchellus*, MSUMNH78, 1, 323.54 mm SL, neotype, Nethravathi River at Nidugal, Karnataka, M. Arunachalam, (D) Line drawing of dorsal fin of *Hypselobarbus pulchellus* and (E) Line drawing of anal fin of *Hypselobarbus pulchellus*.

specimens it is 4(5) or 4.25(2) in TL. *Hypselobarbus pulchellus* is distinguished from *H. bicolor* Knight et al. (2016) in having fewer lateral-line scales (30-32 vs. 35-37), fewer circumpeduncular scale rows (12 vs. 16) and fewer circumferential scale rows (24 vs. 25-26).

Hypselobarbus basavarajai sp. nov.
(Fig. 2 and Tables 1-2)

Holotype: ZSI/SRC F 8756, 280.9 mm SL; Bhadra River at Bhadravathi, Karnataka, (13°83'N, 75°69'E), M. Arunachalam and team, 10 September 2009.

Paratypes: MSUMNH82, 1, 244.3 mm SL; same data as holotype. - CMA30, 1, 253.71 mm SL, same data as holotype.

Diagnosis: *Hypselobarbus basavarajai* is distinguished from *H. pulchellus* in having more circumpeduncular scale rows (14 vs. 12), more lateral line to pelvic fin scale rows (4.5 vs. 3.5), and the morphometric characters of having a greater length between the dorsal fin origin to pelvic fin insertion (36.70-40.13 vs. 31.64-34.56 %SL), greater body depth (38.34-42.59 vs. 30.88-33.72 %SL) and greater head length (22.56-23.79 vs. 20.55-21.34 %SL). It is distinguished from *H. bicolor* in having fewer lateral-line scales (32-34 vs. 35-37), fewer circumpeduncular scale rows (14 vs. 16), and the morphometric characters of having a greater pre-anal length (79.82-81.86 vs. 67.49-77.86 %SL), greater snout length (36.06-38.61 vs. 32.24-34.53 %HL), and greater interorbital width (45.48-50.06 vs. 38.70-41.21 %HL). It differs from *H. dobsoni* in having more lateral line to pelvic fin scale rows (4.5 vs. 3.5), and the morphometric characters of greater pectoral fin length (20.08-20.49 vs. 18.54-18.90 %SL), greater distance between dorsal fin origin and pectoral fin insertion (36.93-39.09 vs. 32.96-34.66 %SL), greater distance between pectoral fin to pelvic fin insertions (31.87-33.91 vs. 27.92-28.33 %SL), greater pectoral fin insertion to anal fin origin (56.80-60.59 vs. 50.89-54.32 %SL), greater pelvic fin insertion to vent (28.37-31.42 vs. 22.92-26.40 %SL), wider interorbital (45.48-50.06 vs. 38.52-41.80 %HL), wider head (66.78-69.89 vs. 60.17-63.83 %HL), and longer maxillary barbels (23.78-27.27 vs. 19.33-21.44 %HL). It is distinguished from *H. jerdoni* in having more lateral-line scales (32-34 vs. 27-29), more pre-anal scale rows (26-29 vs. 23-24), and shorter caudal fin length (27.58-31.51 vs. 34.96-37.80 %SL). It is distinguished from *H. maciveri* in having more circumpeduncular scale rows (14 vs. 13), fewer circumferential scale rows (24-25 vs. 26), and the morphometric characters of greater pre-anal length (79.82-81.86 vs. 74.69-76.90 %SL), greater distance between pectoral fin insertion to anal fin origin (56.80-60.69 vs. 47.95-51.70 %SL), greater head width (66.78-69.89 vs. 59.44-62.13 %HL), and greater gape width (31.77-34.24 vs. 27.06-30.10 % HL).

Description: Body relatively deep and compressed (38.34-42.59 %SL), dorsal profile more convex than ventral profile. Dorsal fin slightly anterior to vertical from pelvic fin insertion by 1.5 to 2 scales rows; fin base 14.69-17.01 %SL. Predorsal length 49.23-50.85 %SL, prepelvic length 51.82-53.53 %SL, and pre-anal length 79.82-81.86 %SL. Distance between pelvic fin insertion and anal fin origin less than distance between pectoral fin insertion and anal fin origin. Nape convex posterior to concavity at occiput margin; anterior third of predorsal strongly convex. Venter more or less curved and caudal peduncle deep, length of caudal peduncle 12.22-14.86 %SL.

Head and cranium short, 22.56-23.79 %SL and 16.50-18.35 %SL, respectively. Head depth at naris 37.60-39.59 %HL, at pupil 56.90-63.03 %HL, and at occiput 84.17-85.05 %HL. Head slightly compressed, head width at preopercle narrow, 67.77-72.60 %HL; inter-orbital width narrow, 45.48-50.06 %HL. Eyes moderately large, 22.32-26.31 %HL. Snout short, 36.06-38.61 %HL, mouth subterminal and horseshoe shaped. Upper jaw length 29.41-33.50 %HL and gape width 31.77-34.24 %HL. Lower lip not well-developed with a groove separating lip and mandibular sheath continuous and nearly to angles of mouth. Lower jaw with keratinous covering, not sharp. Upper lip distinct from jaw. Barbels long; maxillary barbels 23.78-27.27 %HL and rostral barbels 14.73-15.66

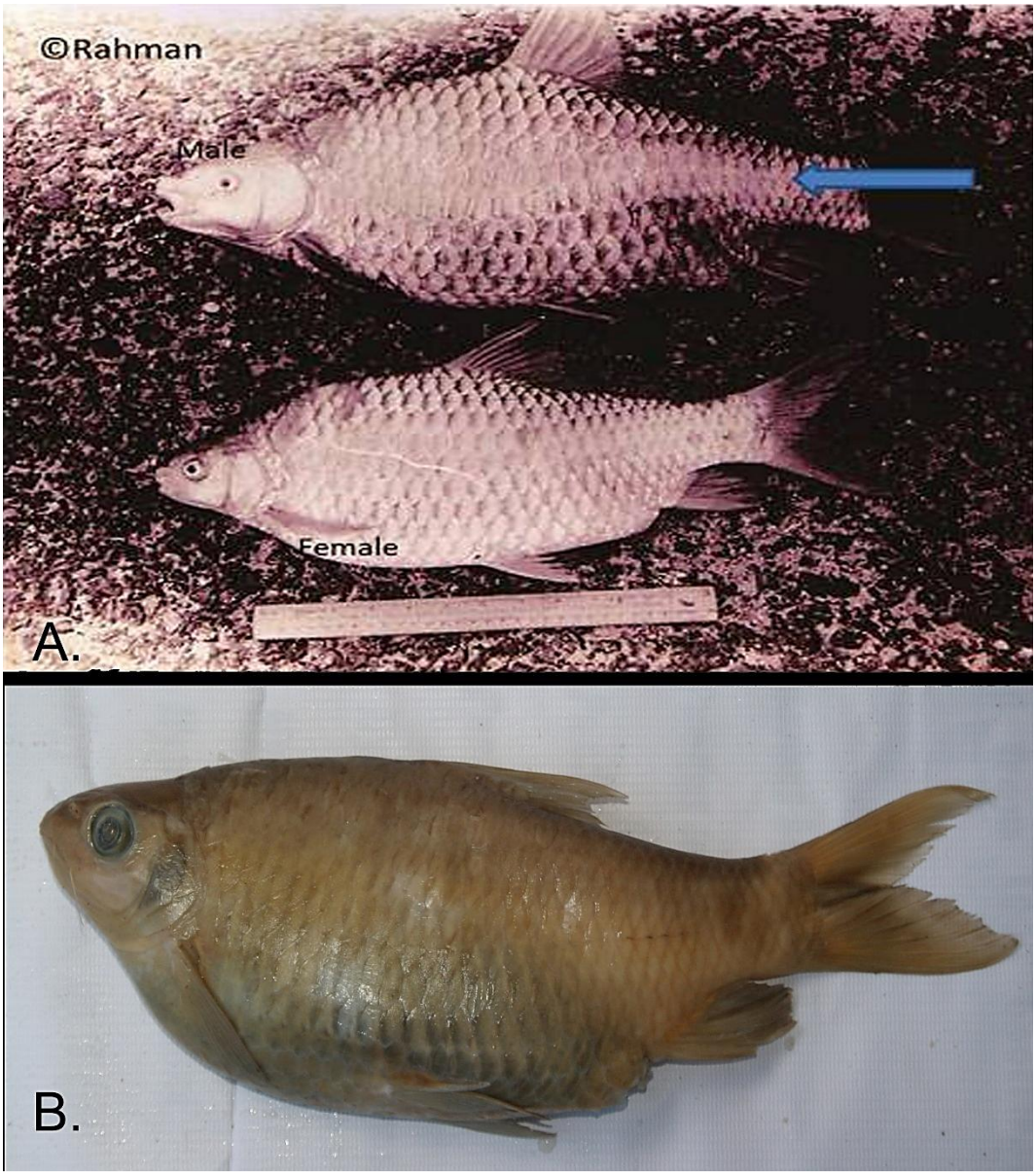

Figure 2. (A) *Hypselobarbus pulchellus* given by Basavaraj (2014) with creative Commons Attribution 3.0 Unported License; blue arrow points to lateral stripe of the species and (B) *Hypselobarbus basavarajai*, ZSI/SRC F 8756, Holotype: 280.9 mm SL, Bhadra River at Bhadravathi, Karnataka, M. Arunachalam and team.

%HL.

Dorsal-fin rays iv-9(3 specimens), anal-fin rays ii(1) or iii-5(2), pelvic-fin rays ii-8(3), pectoral-fin rays i-12(2) or 13(1). Distal margin of the last branched ray of dorsal fin equal in length to spinous ray and the first branched ray. Dorsal fin length 24.69-27.07 %SL, height of spinous dorsal ray 23.88-25.08 %SL, anal fin length 19.46-21.23 %SL, pectoral fin moderate in length, extending 4.5 to 5.5 scale rows anterior to pelvic fin origin, pectoral fin length 20.08-20.49 %SL, and pelvic fin length 19.69-20.58 %SL. Caudal fin deeply forked, length 27.58-31.51 %SL, marginated rays of lower lobe slightly longer relative to upper rays, but 4 times of median rays; marginal rays of both lobes evenly produced.

Lateral-line scales 32(2 specimens) or 34(1), pre-dorsal scales 11(3), upper transverse scale rows 5.5(2) or 6.5(1), lateral line to pelvic fin scale rows 4.5(3), lower transverse scale rows 4.5(3), circumferential scale rows 24(1) or 25(2), circumpeduncular scale rows 14(3), transverse breast scale rows 7(1) or 8(2), and pre-anal scales 26(1), 27(1) or 29(1).

Table 1. Morphometric character variation in *Hypselobarbus pulchellus*, *Hypselobarbus basavarajai* sp. nov., *Hypselobarbus dobsoni*, *Hypselobarbus jerdoni*, and *Hypselobarbus maciveri*. Body character measurements are represented as % standard length and head character measurements are represented as %head length.

Measurements from point to point (identified by numbers and names)	***H. pulchellus***		***H. basavarajai***		***H. dobsoni***		***H. jerdoni***		***H. maciveri***	
	Neotype MSUMNH 78	CMA26 n=6	ZSI/SRC F 8756/1 Holotype	MSUMNH 82 Paratype CMA 30, n=2	ZSI/SRC F 8738/1	MSUMNH79 CMA 27, n=3	ZSI/SRC F873 9/1	MSUMNH 80. CMA 28, n=10	ZSI/Kolkatta F 9576 Holotype and Paratype, n=2	MSUMNH81 CMA 29 n=13
Standard length (mm)	323.5	315.85-351.72	253.71	244.3-280.9	145.05	145.04-182.24	165.52	38.14-116.71	121.17-123.55	37.80-196.13
% of standard length										
Snout to urocentrum	97.64	92.43-97.64	95.48	94.60-97.34	96.39	92.46-96.39	82.78	91.23-93.35	95.01-95.40	94.15-96.46
Preanal length	77.33	75.62-80.79	79.82	79.82-81.86	76.46	75.46-78.25	76.90	76.87-77.27	75.28-76.30	74.69-76.90
Predorsal length	49.57	47.36-50.20	49.37	49.23-50.85	47.20	46.52-48.69	50.72	50.54-54.73	50.61-51.08	50.40-56.65
Prepelvic length	51.61	49.54-53.02	52.82	51.82-53.53	49.96	48.82-51.01	51.20	50.48-57.30	50.83-51.15	50.20-56.30
Prepectoral length	21.60	21.10-22.52	22.89	20.83-22.89	23.10	22.22-23.10	21.53	21.53-28.71	22.34-24.47	22.34-26.62
Preoccipital length	16.29	15.24-16.63	16.50	16.50-18.35	17.87	17.76-18.75	21.51	21.51-25.82	19.34-19.65	19.34-21.17
Caudal peduncle length	11.22	10.71-12.06	12.88	12.22-14.86	13.90	12.86-13.90	10.08	7.01-11.80	12.10-13.08	9.21-13.58
Dorsal origin to pelvic fin insertion	33.92	31.64-34.56	40.13	36.70-40.13	34.26	34.26-36.79	33.24	33.24-35.51	33.30-34.45	33.20-35.51
Dorsal spinous height	23.20	23.20-25.52	24.34	23.88-25.08	28.38	26.43-28.38	27.22	20.68-27.22	no	21.94-26.06
Anal fin height	19.02	17.71-19.78	21.23	19.46-21.23	20.05	20.05-21.60	24.77	17.20-24.77	no	18.21-21.71
Depth of caudal peduncle	12.45	11.01-13.02	13.62	12.84-13.80	12.18	12.18-13.90	12.77	10.79-14.07	11.94-12.50	11.90-13.60
Caudal fin length	27.34	26.73-32.12	31.51	27.58-31.51	27.86	.27.86-29.88	37.80	34.96-37.80	no	26.66-32.32
Dorsal fin height	25.14	24.01-27.32	27.07	24.69-27.07	27.43	27.43-29.58	24.96	19.40-24.96	24.30-29.63	24.28-29.18
Pectoral fin length	19.45	18.55-20.44	20.49	20.08-20.49	19.83	18.54-19.90	20.40	20.40-22.47	18.90-19.69	18.73-23.70
Pelvic fin length	20.47	19.05-22.53	19.69	19.69-20.58	17.86	17.86-19.88	19.43	17.78-22.54	19.05-20.10	17.18-20.29
Pelvic axillary scale length	7.07	5.97-7.95	8.15	8.15-13.03	8.14	7.43-8.14	6.80	5.18-7.72	8.14-8.19	5.69-8.24
Occiput to dorsal fin origin	33.09	31.56-35.79	32.61	31.65-32.61	31.13	29.51-31.43	25.51	25.51-31.28	30.44-31.64	29.50-32.29
Occiput to pectoral fin insertion	19.36	19.36-21.19	22.00	21.31-22.38	21.26	19.63-21.31	18.99	17.17-22.34	20.75-21.30	19.07-22.78
Occiput to pelvic fin insertion	44.89	43.22-47.84	47.70	46.37-48.54	44.01	43.66-45.92	41.76	39.93-45.49	45.80-46.70	40.73-47.16
Dorsal insertion to pelvic fin insertion	29.22	28.73-30.55	33.02	30.70-34.78	27.87	27.87-32.74	28.99	21.12-30.97	29.91-30.50	27.20-30.97
Dorsal origin to pectoral fin insertion	34.47	34.33-43.23	39.09	36.93-39.09	32.96	32.96-34.66	31.86	26.21-34.60	32.50-33.86	33.28-34.55
Dorsal origin to anal fin origin	43.63	40.78-43.63	47.80	42.37-47.80	42.05	41.68-42.24	42.81	42.81-44.54	41.70-42.10	37.21-42.24
Dorsal fin insertion to caudal fin	38.54	33.14-38.54	36.12	34.08-36.12	37.70	33.71-37.70	33.83	26.17-34.28	36.98-37.10	34.21-37.25
Dorsal insertion to anal fin origin	30.70	28.25-30.70	33.88	29.89-33.88	30.53	30.53-31.40	29.07	29.07-31.64	28.43-29.20	28.40-31.32
Dorsal insertion to anal fin insertion	30.46	29.21-31.00	32.56	29.18-32.86	31.59	31.59-33.17	31.70	31.75-37.23	30.98-31.2	28.92-31.78
Dorsal fin base length	15.72	15.10-16.34	17.01	14.69-17.01	15.55	15.50-16.01	16.42	14.85-16.84	15.20-16.15	12.48-16.17
Anal fin base length	9.42	9.02-10.40	9.45	8.76-9.45	8.12	8.04-8.12	7.76	6.39-8.65	7.25-8.10	6.94-8.50
Pectoral fin insertion to pelvic fin insertion	31.50	30.86-33.13	33.51	31.87-33.91	28.33	27.92-28.33	29.55	23.16-29.71	28.60-29.50	25.21-29.56
Pectoral fin insertion to anal fin origin	55.59	50.26-59.42	56.98	56.80-60.59	51.69	50.89-54.32	49.96	43.51-51.22	49.95-51.60	47.95-51.70
Pelvic fin insertion to anal fin origin	22.91	21.88-28.18	25.70	25.70-29.55	23.81	22.86-27.02	22.17	19.21-22.17	20.71-21.60	17.51-22.10
Post-dorsal length	53.85	47.52-53.85	50.87	47.47-50.87	53.57	50.27-53.57	49.44	49.44-53.04	54.11-55.31	53.02-5578
Body depth	32.89	30.88-33.72	42.59	38.34-42.59	33.14	33.14-37.64	35.30	28.42-36.71	35.25-36.60	33.21-36.71
Distance from pectoral fin insertion to vent	56.29	54.30-60.70	58.33	55.69-60.47	53.66	50.98-54.39	50.65	48.20-52.73	51.20-52.25	47.21-52.72
Distance from pelvic fin insertion to vent	27.11	24.99-30.67	30.09	28.37-31.42	25.69	22.92-26.40	24.96	17.60-24.96	22.50-24.10	20.38-24.44
Head length (mm)	21.12	20.55-21.34	22.98	22.56-23.79	22.13	23.11-23.13	24.75	24.75-30.20	23.29-25.51	23.30-26.72
% of head length										
Snout to opercle	78.52	66.81-78.52	67.77	67.77-72.60	72.55	69.01-72.55	74.77	68.20-76.02	71.48-72.06	71.45-76.21
Upper jaw length	33.53	30.17-36.06	33.50	29.41-33.50	31.11	27.27-31.14	28.39	28.39-30.76	31.42-32.10	26.31-32.14
Snout length	37.22	36.58-41.08	37.00	36.06-38.61	35.76	35.57-38.87	34.45	30.58-36.59	35.15-36.12	33.21-37.13
Pre-nasal length	25.63	19.37-28.77	23.30	23.30-25.10	21.86	21.86-26.16	21.25	21.25-25.68	22.98-23.56	18.88-24.34
Orbit width	22.35	19.17-22.35	22.32	22.32-26.31	28.07	24.13-28.07	33.19	28.71-33.19	25.16-29.32	24.56-31.30
Inter-orbital width	45.85	44.51-47.66	50.06	45.48-50.06	41.80	38.52-41.80	41.01	35.73-40.01	40.94-41.20	35.42-41.83
Inter-nasal width	30.65	26.46-30.65	28.98	28.85-30.38	23.37	23.37-27.00	25.29	19.59-25.29	25.66-26.30	25.36-27.69
Head width	64.47	62.09-70.45	67.89	66.78-69.89	62.79	60.17-63.83	57.07	52.05-59.81	61.14-62.13	59.44-62.10

Table 1. Continued.

Measurements from point to point (identified by numbers and names)	***H. pulchellus***		***H. basavarajai***		***H. dobsoni***		***H. jerdoni***		***H. maciveri***	
Gape width	29.40	29.40-36.68	31.77	31.77-34.24	35.23	25.51-35.23	29.53	21.64-29.53	27.06-27.99	27.93-30.10
Lower jaw to isthmus	58.45	53.60-68.36	58.72	57.22-59.08	57.38	57.38-59.41	65.19	65.35-68.19	58.80-60.10	56.21-60.15
Head depth at nostril	43.55	37.23-44.66	37.61	37.60-39.59	39.21	36.36-39.21	35.20	33.63-39.22	35.55-37.30	29.47-36.20
Head depth at pupil	65.10	60.64-67.93	63.03	56.90-63.03	65.11	61.68-65.11	63.45	60.18-63.45	58.99-61.60	57.99-61.66
Head depth at occiput	84.65	77.49-90.56	84.17	84.17-85.05	87.59	83.74-87.59	82.63	82.63-87.23	85.05-86.01	79.21-86.07
Maxillary barbel length	19.98	18.34-33.86	24.43	23.78-27.27	19.35	19.33-21.44	34.41	25.26-34.50	21.29-22.10	19.96-23.34
Rostral barbel length	14.11	8.43-23.93	15.13	14.73-15.66	12.86	12.86-13.75	16.61	16.61-20.11	13.80-13.88	9.03-13.80

Table 2. Meristic characters of *Hypselobarbus pulchellus*, *Hypselobarbus basavarajai*, *Hypselobarbus dobsoni*, *Hypselobarbus jerdoni*, and *Hypselobarbus maciveri*.

Meristic characters	*H. pulchellus*		*H. basavarajai*		*H.dobsoni*		*H. jerdoni*		*H. maciveri*	
	neotype MSUMNH 78	CMA26 n=6	ZSI/SRC F 8756/1 Holotype	MSUMNH 82, CMA 30 Paratypes n=2	ZSI/SRC F 8738/1	MSUMNH 79 CMA 27 n=3	ZSI/SRC F 8739/1	MSUMNH 80 CMA 28 n=10	ZSI/Kolktta F 9576 Holotype and Paratypes n=2	MSUMNH81 CMA 29 n=13
Dorsal fin rays	iv.9	iv.9	iv.9	iv.9	iv.9	iv.9	iv.9	iv.9	iv.9	iv.9
Anal fin rays	iii.5	iii.5	iii.5	ii-iii.5	iii.5	iii.5	iii.5	iii.5	iii.5	iii.5
Pelvic fin rays	ii.8	ii.8	ii.8	ii.8	i.8	ii.9-10	ii.10	ii.8-9	i.8	ii-iii.9
Pectoral fin rays	i.11	i.11-15	i.13	i.12-13	i.14	i.13	i.14	i.12-13	i.12	i.13
Caudal fin rays	10+9	10+9	10+9	10+9	10+9	10+9	10+9	10+9	no	10+9
Upper transverse scale rows	5.5	5.5	5.5	5.5-6.5	5.5	5.5	5.5	5.5	6	6.5
Lower transverse scale rows	4.5	4.5	4.5	4.5	4.5	4.5	4.5	3.5	4.5	4.5
Lateral line to pelvic scale rows	3.5	3.5	4.5	4.5	3.5	3.5	4.5	3.5	4.5	4.5
Lateral line scales	30	31-32	32	32-34	31	31-32	29	27-29	33	32-33
Predorsal scales	11	11-12	11	11	11	10-11	11	11	12	11-12
Circumpeduncular scale rows	12	12	14	14	12	12	12	12	13	13
Circumferential scale rows	24	24	25	24-25	24	24	23	24	26	26
Transverse breast scale rows	8	8-9	8	7-8	9	8-9	8	7	9	9
Pre-anal scale rows	29	29-30	26	26-29	28	26-28	24	23-24	no	29-31

Etymology: Named after Dr. N. Basavaraja who criticized the identity of *Hypelobarbus pulchellus* published by J.D. Marcus Knight (2013a, b, 2014). His criticism led to the idea of searching collections of fishes from the type locality in Karnataka that resulted in the discovery of this new species.

Distribution: This species is known only from Bhadra River at Bhadravathi, Karnataka.

Hypselobarbus dobsoni (Day, 1876)

(Fig. 3 A-B and Tables 1-2)

Diagnosis: *Hypselobarbus dobsoni* is distinguished from *H. pulchellus* (Day) in having fewer preanal scale rows (26-28 vs. 29-30), absence of lateral band (vs. presence), and the morphometric characters of having a shorter preoccipital length (17.76-18.75 vs. 15.24-16.63 %SL), greater anal fin height (20.05-21.60 vs. 17.71-19.78 %SL), shorter anal fin base length (8.04-8.12 vs. 9.02-10.40 %SL), larger orbit width (24.13-28.07 vs. 19.17-22.35 %HL), and narrower interorbital width (38.52-41.80 vs. 44.51-47.66 %HL). It is distinguished from *H. jerdoni* by having more lateral-line scales (31-32 vs. 27-29), more pre-anal scale rows (26-28 vs. 23-24), and the morphometric character of a shorter pre-dorsal length (46.52-48.69 vs. 50.54-54.73 %SL). It is distinguished from *H. bicolor* by the absence of lateral band (vs. presence). *Hypselobarbus dobsoni* is distinguished from *H. maciveri* in having fewer lateral line to pelvic scales rows (3.5 vs. 4.5), fewer circumferential scale rows (24 vs. 26), and a shorter predorsal length (46.52-48.59 vs. 50.40-56.65 %SL).

Description: Body relatively deep and compressed 33.14-37.64 %SL, dorsal fin origin slightly posterior to pelvic fin insertion by width of 1 to 1.5 scales rows, pre-dorsal length 46.52-48.69 %SL and less when compared to pre-pelvic length, 48.82-51.01 %SL. Anal fin distant from snout, preanal length 75.46-78.25 %SL; distance between pelvic fin insertion and anal fin origin less than distance between pelvic fin insertion and anal fin origin, length 22.86-27.02 %SL.

Head and cranium short, 23.11-23.13 %SL and 17.76-18.75 %SL, respectively. Head depth at naris 36.36-39.21 %HL, at pupil 61.68-65.11 %HL, and at occiput 83.74-87.59 %HL. Head slightly compressed, head width at preopercle wide, 69.01-72.55 %HL. Interorbital width narrow, 38.52-41.80 %HL. Eyes moderately large, 24.13-28.07 %HL and snout very short, 35.57 -38.87 %HL. Mouth subterminal and horseshoe shaped. Upper jaw length 27.27-31.14 %HL and gape width 25.51-35.23 %HL. Lower lip not well developed with groove separating lip and mandibular sheath continuous nearly to angles of mouth. Lower jaw with moderate keratinous covering, not sharp. Upper lip distinct from jaw. Barbels long and moderately produced, maxillary and rostral pairs 19.33-21.44 % HL and 12.86-13.75 %HL, respectively.

Dorsal-fin rays iv-9(4 specimens), anal-fin rays iii-5(4), pelvic-fin rays ii-9(2) or 10(2), and pectoral-fin rays i-13(3) or 14(1). Dorsal fin moderately high with a concave distal margin, its length 27.43-29.58 %SL, fourth unbranched, first branched and last branched rays longest, dorsal spine weak and smooth, dorsal spine length 26.43-28.38 %SL, and dorsal fin base length 15.50-16.01 %SL. Pectoral fin moderate in length, 18.54-19.90 %SL, and extending 2 to 4 scale rows anterior to pelvic fin origin, fin tip slightly produced, distal margin nearly straight when fin is erect; pelvic fin length 17.86-19.88 %SL. Caudal fin deeply forked, length 27.86-29.88 %SL, marginated rays of lower lobe slightly longer relative to upper rays, but 3.5 times of median rays; marginal rays of both lobes evenly produced.

Lateral-line scales 31(2) or 32(2), predorsal scales 10(2) or 11(2), upper transverse scale rows 5.5(4), lateral line to pelvic fin scale rows 3.5(4), circumferential scale rows 24(4), circumpeduncular scale rows 12(4), transverse breast scale rows 8(2) or 9(2), and preanal scale rows 26(1), 27(1) or 28(2). Squamation of upper trunk and caudal peduncle composed of nearly diamond shaped scales that become rounded below the lateral line. Scales of trunk oblique with slight posterior inclination.

Distribution. This species is currently known only from Thunga and Bhadra rivers, Karnataka, India.

Hypselobarbus jerdoni (Day, 1870)

(Fig. 3 C-D and Tables 1-2)

Diagnosis: *Hypselobarbus jerdoni* is distinguished from *H. maciveri* in having fewer lateral-line scale rows (27-29 vs. 32-33), fewer circumferential scale rows (23-24 vs. 26), and a greater caudal fin length (34.96-37.80 vs. 26.66-32.32 %SL).

Description: Body strongly compressed, with some enlargement of predorsum; dorsal profile much more convex than the ventral profile of the lateral aspect. Dorsal fin slightly posterior to pelvic fin insertion by 1 to 1.5 scale rows. Predorsal length 50.54-54.73 %SL. Prepelvic length 50.48-57.30 %SL. Anal fin distant with pre-anal length 76.87-77.27 %SL. Distance between pelvic and pectoral fin insertions 23.16-29.71%SL, and greater than distance between pelvic fin insertion and anal fin origin, 19.21-22.17 %SL. Nape convex posterior to occiput, and anterior third of predorsum strongly convex. Dorsal fin base decreasing sharply from the insertion posteriorly towards the caudal peduncle. Venter more or less curved and rising sharply at the end of anal fin base and from where more inclined along caudal peduncle. Caudal peduncle depth 10.79-14.07 %SL; caudal peduncle length 7.01-11.80 %SL.

Head short, 24.75-30.20 %SL, and cranium moderately long, 21.51-25.82 %SL. Head depth 33.63-39.22, 60.18-63.45 and 82.63-87.23 %HL at nostril, pupil and occiput, respectively. Head narrow and compressed; head


A.
B.
C.
D.
E.

Figure 3. (A) *Hypselobarbus dobsoni*, ZSI/SRC F8738, 145.05 mm SL, Thunga River, Karnataka, A. Rai, (B) *Hypselobarbus dobsoni*, MSUMNH 79, 182.24 mm SL, N.R. Pura market collection from Bhadra River, Karnataka, M. Arunachalam and team, (C) *Hypselobarbus jerdoni*, ZSI/SRC F8739, 165.52 mm SL, Nethravathi River, Karnataka, R. D'souza, (D) *Hypselobarbus jerdoni*, MSUMNH 80, 65.23 mm SL, Sisila River, tributary of Nethravathi River, Karnataka, M. Arunachalam and team and (E) *Hypselobarbus maciveri*, MSUMNH 81, 196.13 mm SL, Thunga River at Sringeri, Karnataka, M. Arunachalam and team.

width at preopercle narrow 68.20-76.02 %HL and interorbital width 35.73-40.01 %HL. Eyes moderately large from 28.71-33.19 %HL. Snout short, 30.58-36.59 %HL, with mouth subterminal at lateral aspect. Upper jaw length 28.39-30.76 %HL and gape width 21.64-29.53 %HL. Lower lip moderately deficient with groove supporting lip and mandibular sheath passing nearly to angles of mouth. Lower jaw without keratinous covering but not sharp, upper lips close to jaw. Barbels long; maxillary barbels 25.26-34.50 %HL and rostral barbels 16.61-20.11 %HL.

Dorsal-fin rays iv-9(11 specimens), anal-fin rays iii-5(11), pelvic-fin rays ii-8(5), 9(5) 10(1), and pectoral-fin rays i-12(5) or 13(5), 14(1). Dorsal fin originating slightly behind the vertical from origin of pelvic fins. Distal margin of dorsal fin strongly concave; length of dorsal fin base 14.85-16.84 %SL. Anal fin, when depressed, reaching caudal fin; anal fin length 17.20-24.77 %SL, fin deep, extending when depressed vertically crossing the lateral line of the caudal peduncle to the second unbranched caudal fin ray. Distal margin of the anal fin strongly concave when fin is erect; last three posterior rays of anal fin equal in length. Anal fin base length 6.39-8.65 %SL. Pelvic fin extending to 1 to 1.5 scales to anal fin origin; pelvic fin length 17.78-22.54 %SL. Pectoral fin moderately long and falcate, extending 2 to 3 scale rows anterior to pelvic fin; pectoral fin length 20.40-22.54 %SL. Caudal fin long and deeply forked 34.96-37.80 %SL; caudal rays 3 times as long as middle rays; upper and lower lobes nearly equal.

Lateral-line scales 27(2) or 29(9), predorsal scales 11(11), upper transverse scale rows 5.5(11), lateral line to pelvic scale rows 3.5(10) or 4.5(1), lower transverse scale rows 3.5(10) or 4.5(1), circumpeduncular scale rows 12(11), circumferential scale rows 23(3) or 24(8), transverse breast scale rows 7(8) or 8(3), and preanal scale rows 23(8) or 24(3). Scales of breast region regular nearly to pectoral fin insertion with few irregularly inserted scales in the anterior most rows along gill membrane.

Distribution: This species is currently known from Sishila River, tributary of Nethravathi River, Aghanashini River and Nethravathi River, Karnataka and Eranchipuzha, Kerala.

Hypselobarbus maciveri (Annandale, 1919)

(Figs. 3E, 4A-B and Tables 1-2).

Diagnosis: *Hypselobarbus maciveri* is distinguished from *H. dobsoni* in having more lateral line to pelvic scales rows (4.5 vs. 3.5), more circumferential scale rows (26 vs. 24), and a greater predorsal length (50.40-56.65 vs. 46.52-48.59 %SL). *Hypselobarbus maciveri* is distinguished from *H. jerdoni* in having more lateral-line scales (32-33 vs. 27-29), fewer circumferential scale rows (23-24 vs. 26), and a greater caudal fin length (34.96-37.80 vs. 26.66-32.32 %SL).

Description: Body moderately deep, 33.21-36.71 %SL, and strongly compressed. Dorsal-fin origin anterior to pelvic fin insertion by a distance of 2.5 scale rows. Predorsal length 50.40-56.65 %SL in comparison with pre-pelvic length of 50.20-56.30 %SL. Anal fin not distant from snout; pre-anal fin length 74.69-76.90 %SL. Distance between pelvic fin insertion and anal fin origin 17.51-22.10 %SL, a length slightly more than the distance between pectoral and pelvic fin insertions, 25.21-29.56 %SL. Predorsal profile smoothly rounded with no concavity at nape. Caudal peduncle fairly short, 9.21 -13.58 %SL, and moderately deep, 11.90-13.60 %SL.

Head short, 23.29-26.72 %SL, with a moderately long cranium, 19.34-21.17 %SL. Head depth at naris 29.47-37.30 %HL, at pupil 57.99-61.66 %HL, and at occiput 79.21-86.07 %HL. Head width at preopercle narrow,

Figure 4. Types of *Hypselobarbus maciveri*, ZSI/Kolkatta F 9576/2. (A) Holotype, 123.55 mm SL and (B) Paratype, 121.17 mm SL, Krishna River near Mahuli 3 km from Satara, N. Annandale.

71.45-76.21 %HL, and moderate to narrow at interorbital, 35.42-41.83 %HL. Eyes smaller than other species, 24.56-31.30 %HL. Mouth subterminal and horseshoe shaped with lower jaw equal and contained when mouth is closed. Snout blunt, length 33.21-37.13 %HL. Upper jaw length 26.31-32.14 %HL and gape width 27.06-30.10 %HL. Barbels moderate in length, maxillary and rostral barbels 19.96-23.34 %HL and 9.03 -13.88 %HL, respectively.

Dorsal-fin rays iv-9(15 specimens), anal-fin rays iii-5(15), pelvic-fin rays i-8(2), ii-9(5) or iii-9(8), pectoral-fin rays i-12(5) or 13(10). Dorsal fin moderately high and with a concave distal margin, its length 24.28-29.63 %SL. Fourth unbranched, first branched and last branched dorsal fin rays longest, dorsal spine smooth but not weak, length of dorsal spine 21.94-26.06 %SL. Anal fin deep 18.21-21.71 %SL, and when depressed extends to caudal peduncle and almost to procurrent rays. Distal margin of fin strongly concave when the fin is erect. Pelvic fin long, extending to 1.5 to 2.5 scale rows before vent; pelvic fin length 17.18-20.29 %SL. Pectoral fin moderately long and falcate, extending to a distance of 3-3.5 scale rows anterior to pelvic fin origin; pectoral fin length 18.73-23.70 %SL. Caudal fin large and deeply forked, with a length of 26.66-32.32 %SL; outer rays 2.5 times length of middle rays. Upper and lower lobes of caudal fin equal.

Lateral-line concave, scales 32(8) or 33(7), predorsal scales 11(5) or 12(10), upper transverse scale rows 6(2) or 6.5(13), lateral line to pelvic fin scale rows 4.5(15), lower transverse scale rows 4.5(15), circumpeduncular scale rows 13(15), circumferential scale rows 26(15), transverse breast scale rows 9(15), and pre-anal scale rows 29(12), 30(2) or 31(1). Scales on breast region regularly shaped, like predorsal scales, and with few to no irregularly inserted scales in the anterior-most rows along gill membranes.

Distribution: This species is currently known from Krishna River near Mahuli, Maharashtra state, Thunga River at Sringeri, Aghanashini River both from Karnataka state.

Discussion

While ascertaining the identity of *H. pulchellus*, Knight et al. (2014) emphasized that Day's stuffed specimen had

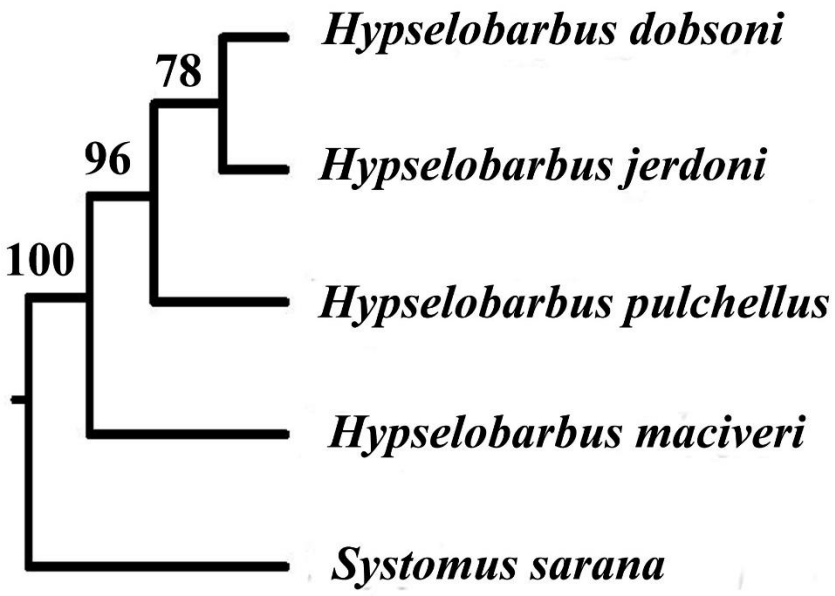

Figure 5. Maximum likelihood majority-rule consensus tree of relationships of some species of *Hypselobarbus.*

Table 3. Uncorrected ("p") distance matrix derived from concatenated COI+Cytb sequences (1827 characters).

No.	Species	1	2	3	4	5
1	*Systomus sarana*	-				
2	*Hypselobarbus pulchellus*	0.13156	-			
3	*Hypselobarbus dobsoni*	0.13301	0.02414	-		
4	*Hypselobarbus jerdoni*	0.12886	0.02673	0.01667	-	
5	*Hypselobarbus maciveri*	0.13317	0.05945	0.06215	0.05943	-

more than 32 lateral-line scales when it was alive. If this is true, Day would have described the lateral line scales as more than 32. Moreover, both Basavaraja (2014) and Knight et al. (2014) said that there are two characters that distinguish Day's *Barbus pulchellus* from *H. dobsoni*; one is the lateral line count and another is the lateral band. Basavaraja (2014) mentioned that *H. pulchellus*, *H. jerdoni,* and *H. dobsoni* have 27-32 lateral-line scales, and hence it would be difficult to distinguish these three species with this character. Devi and Ali (2011) shared this view. Basavraja (2014) noted that he examined several specimens but none of his voucher specimens are available. He argued that *H. pulchellus* possessed a lateral band as in *H. dobsoni* and there is overlap in the lateral line scale counts of *H. pulchellus* and *H. dobsoni.* Hence, he concluded that *H. pulchellus* as described by Knight et al. (2013b) did not represent *H. pulchellus.* It is worth mentioning that Day's line drawings and the stuffed specimen (BMNH 1889.2.1.4328) showed variation in the shape of the anal fin, which is round in Day's stuffed specimen but pointed in his figure (Day, 1878 plate CXL, fig. 3). In this circumstance, it is essential to ascertain the identity of *H. pulchellus* Day. Since the holotype of *Barbus* (*Barbodes*) *pulchellus* Day 1870 (ZSI 3136) was lost (see Catalogue of fishes, Eschmeyer et al. 2016, Electronic version accessed 01.11.2016, http://research archive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp) and the other specimens are not in a syntypical series (Whitehead and Talwar 1976), the specimen bearing the number MSUMNH78, 323.54 mm SL is designated herein as the neotype of *H. pulchellus.*

The taxonomic ambiguity raised by both Basavaraja (2014) and Knight et al. (2014) are derived from their limited meristic and morphometric data used, and inadequacies that clearly led them to incorrect conclusions. These authors never included circumpeducular scales, circumferential scales, and scales from the anus to isthmus, all major distinguishing features now used for the big-sized barbs of India. However, the species referred to by

both Basavaraja and Knight et al. (2014) represent two species, *H. bicolor* Knight et al., 2016 and *H. basavarajai* (described herein).

The identities of *H. dobsoni, H. jerdoni,* and *H. maciveri* are worthy of discussion. Day (1870) described *Barbus (Barbodes) jerdoni* as a new species based on notes of some fishes from the west coast of India and Mangalore, stating that *B. jerdoni* have "28 lateral line scales, scales between lateral line and the ventral fin as four rows, a compressed body, a considerable rise to the base of dorsal fin, a dorsal arising midway between the snout and the base of the caudal, colour as silvery, and fins tipped with black". Subsequently, Day (1871) provided the same description except the habitat that this species was recorded from rivers in Canara below the Ghats, and the description was based on a specimen given to him by H.E. Thomas. Day (1878, 1889) identified the lateral-line scale count of this species as 27-28 and the scale rows being 2 ½-3 ½ between the lateral line and the base of the caudal fin. Furthermore, it was consistently identified in both descriptions that the lateral line was concave, the pectoral fin nearly reached the ventral fin, and a depressed anal fin reached somewhat middle to the caudal fin. In one specimen collected from Sishila in Nethravathi River, one specimen collected from Eranjipuzha in north Kerala, and 6 specimens from Aghnashini River, Uttar Kannada (north Canara), the lateral-line scales were 27-29 and rows of scales from the lateral line to the pelvic fin insertion were 3.5 in 8 specimens. But in all populations represented as *H. jerdoni*, the pectoral fin nearly reaches the pelvic fin, with a distance of 2 to 3 scales, and the anal fin reaches to the 2nd or 3rd branched caudal fin rays. This characteristic feature is diagnostic in distinguishing *H. jerdoni* and *H. dobsoni*. *H. jerdoni* can be distinguished from *H. maciveri* in lateral-line scales of 27 to 29 whereas in *H. maciveri* the lateral-line scales are 32 to 33. The population identified by Arunachalam et al. (2012) from Thunga River clearly belongs to *H. maciveri*. Thus, it now seems probable that the distribution of *H. jerdoni* is confined to only west flowing rivers (Nethravathi, Aghnashini in Karnataka and Eranjipuzha in Kerala), while the distribution of *H. maciveri* as by original description by Annandale (1919) was from Krishna River in Maharashtra part but now extends to Thunga River, a tributary of Krishna River from Karnataka part, and Eranjipuzha in Kerala. There is another report of *H. jerdoni* as *P. jerdoni* from Achankoil River (Sanal Kumar et al. 2013) but this requires confirmation.

The diagnostic features between *H. jerdoni* and *H. maciveri* include circumferential scale rows (23-24 vs. 26) and preanal scale rows 23-24 (vs. 29-31). The color pattern is similar between *H. jerdoni* and *H. maciveri* except that *H. jerdoni* from the Sisila and Aghnashini rivers display a red colouration in almost all fins, while in *H. maciveri* only the pelvic, dorsal and caudal fins are reddish. *Hypselobarbus maciveri* is distinguished from *H. dobsoni* by lateral line to pelvic fin scale rows (4½ vs. 3½) and circumferential scale rows (26 vs. 24). In the Aghnashini River both *H. jerdoni* and *H. maciveri* occur sympatrically, clearly supporting the hypothesis of two evolutionary lineages recognized by these names. Moreover, the distinction between *H. jerdoni* and *H. dobsoni* was not clear from Day's descriptions except that the anal fin reached beyond the caudal fin base in *H. jerdoni* but was separate from the caudal fin by 2 scale rows in *H. dobsoni*.

Molecular phylogenetic analysis (Fig. 5) and genetic distances (Table 3) also confirm the distinctiveness of these species in that *H. jerdoni* and *H. dobsoni* are sister taxa and *H. maciveri* and *H. pulchellus* are clearly distinct. *Hypselobarbus maciveri* and *H. jerdoni* are distantly related and have a genetic distance of 5.9%, greater than any comparisons within the species of *Hypselobarbus*. Other distances range from 2.4% between *H. dobsoni* and *H. pulchellus* to 6.2% between *H. dobsoni* and *H. maciveri*. The relationships of the taxa and these genetic distances confirm their distinctiveness as independent evolutionary lineages to be recognized as species. This pattern of differentiation is also shown in comparisons of both meristic and morphometric characters.

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