VERTEBRATE ZOOLOGY

70 (2): 207–233
2020

SENCKENBERG

Three new species of filament barbs of the genus *Dawkinsia* (Teleostei: Cyprinidae) from the Western Ghats of India

Unmesh Katwate[1,2], J.D. Marcus Knight[3,†], V.K. Anoop[2], Rajeev Raghavan[4] & Neelesh Dahanukar[5,6,*]

[1] Freshwater Research Unit, Bombay Natural History Society (BNHS), Mumbai 400 001, Maharashtra, India — [2] School of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi 682 506, Kerala, India — [3] Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, Indira Paryavaran Bhawan, Jorbagh Road, New Delhi 110 003, India — [4] Department of Fisheries Resource Management, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi 682 506, Kerala, India — [5] Indian Institute of Science Education and Research (IISER), G1 Block, Dr. Homi Bhabha Road, Pashan, Pune 411 008, India — [6] Systematics, Ecology and Conservation Laboratory, Zoo Outreach Organization (ZOO), Coimbatore, Tamil Nadu 641 035, India — * Corresponding author: n.dahanukar@iiserpune.ac.in

Submitted April 1, 2020.
Accepted May 4, 2020.
Published online at www.senckenberg.de/vertebrate-zoology on May 8, 2020.
Published in print Q2/2020.

Editor in charge: Ralf Britz

Abstract

Fishes of the genus *Dawkinsia* (Teleostei: Cyprinidae) endemic to peninsular India and Sri Lanka, are reviewed, recognising three new species. Molecular phylogenetic analysis based on mitochondrial cytochrome oxidase subunit 1 and cytochrome *b* gene sequences, delineated species of *Dawkinsia* into two distinct monophyletic lineages, representing two different species groups, viz., the 'assimilis' and 'filamentosa' species groups. Within the 'assimilis' group we describe two new species, *Dawkinsia apsara* and *D. austellus*, designate a neotype to establish the identity of *D. assimilis*, and revalidate *Puntius* (*Capoeta*) *lepidus* (hereafter *D. lepida*). Within the 'filamentosa' group, we describe a new species, *Dawkinsia crassa,* and consider *D. singhala* as a junior synonym of *D. filamentosa*.

Key words

Dawkinsia filamentosa, *Dawkinsia assimilis,* freshwater fish, 'species-groups' systematics.

Introduction

In a comprehensive revision of the tropical Asian barbs of the "catch-all" genus *Puntius*, Pethiyagoda *et al.* (2012) established the new genus *Dawkinsia* to accommodate the filament barbs. Fishes of the genus *Dawkinsia* (Cyprinidae: Smiliogastrinae) have an adult size of 80 – 120 mm SL, and are characterised by having the last unbranched dorsal-fin ray smooth; 4 unbranched and 8 branched dorsal-fin rays; 3 unbranched and 5 branched anal-fin rays; a complete lateral line with 18 – 22 scales; juvenile (< 50 mm SL) colour pattern consisting of three black bars on body, retained in adults of some species; and a black, horizontally elongate blotch on the caudal peduncle in adults (Pethiyagoda *et al.*, 2012). Species of *Dawkinsia* comprise some of the most common cyprinid fishes inhabiting the rivers, floodplains, brackish water lakes and reservoirs of peninsular India, where they form the basis of an important local fishery (Pethiyagoda, 1991; Maitra *et al.*, 2018). Several species of

[†] The views expressed in this article are those of the author and not the institution he represents.

Dawkinsia are also popular as aquarium fishes, owing to their strikingly beautiful coloration, and are referred to in the aquarium hobby commonly as 'filament barbs' due to the elongate extensions of the dorsal-fin rays of mature males (Collins *et al*., 2012).

Currently, the genus comprises nine valid species endemic to peninsular India and Sri Lanka, viz. *Dawkinsia arulius* (Jerdon, 1849), *D. assimilis* (Jerdon, 1849), *D. exclamatio* (Pethiyagoda & Kottelat, 2005), *D. filamentosa* (Valenciennes, 1844), *D. rohani* (Rema Devi, Indra & Knight, 2010), *D. rubrotincta* (Jerdon, 1849), *D. singhala* (Duncker, 1912), *D. srilankensis* (Senanayake, 1985) and *D. tambraparniei* (Silas, 1954) (Pethiyagoda *et al*., 2012; Fricke *et al*., 2020). While two species, *D. filamentosa* and *D. singhala*, are known to have a wide distribution in the westward and eastward-flowing rivers and their backwaters in peninsular India (Dahanukar *et al*., 2004) and low-country rivers and reservoirs throughout Sri Lanka (Pethiyagoda & Kottelat, 2005a), respectively, most other species are distributed over only a small range. Six species of *Dawkinsia* are confined to one river system either in peninsular India or Sri Lanka (*D. arulius* and *D. rubrotincta* – Cauvery, India; *D. exclamatio* – Kallada, India; *D. rohani* – hill streams of Kanyakumari District, India; *D. srilankensis* – Mahaweli River, Sri Lanka; *D. tambraparniei* – Tambraparniei River, India), while only one species, *Dawkinsia assimilis*, exhibits a disjunct distribution, occurring in the Nethravati River in Karnataka and Chalakudy and Kallada Rivers in Kerala, India (Pethiyagoda & Kottelat, 2005a).

In what is the most comprehensive review of the genus, Pethiyagoda & Kottelat (2005a) suggested the presence of undescribed diversity within the group; but their study had minimal representation of specimens from rivers in the peninsular Indian states of Karnataka and Tamil Nadu, and areas north of it, i.e. in the states of Goa and Maharashtra, where no studies have been conducted previously on *Dawkinsia*. Access to new collections of *Dawkinsia* from a wide distributional range in the Western Ghats prompted us to undertake a taxonomic revision of this genus, resulting in the descriptions of three new species, and establishing the identity of *D. assimilis* and *D. lepida*.

Materials and methods

Study site, sampling and voucher details

Specimens used in this study were collected from east and west flowing rivers of peninsular India (Fig. 1). While most live specimens were photographed in the field, some were photographed immediately after capture, and some in captivity. Photographs were captured using a Canon Digital Single-Lens Reflex (DSLR) camera system and 100mm macro lens following methods described by Sabaj-Pérez (2009). Representative specimens collected were anesthetized using clove oil, fixed in 10% formalin and transferred to 70% ethanol for permanent voucher storage in the museum collections of the Bombay Natural History Society (BNHS), Mumbai, India. Comparative material from the collections of the Natural History Museum (BMNH), London; Zoological Survey of India, Southern Regional Centre (ZSI-SRC), Chennai, India; and photographs of specimens in the collection of Wildlife Heritage Trust (WHT) of Sri Lanka now at the National Museum of Sri Lanka, Colombo, were also examined. Collection and voucher details of the type series are provided in the species descriptions, and details of the additional and comparative materials used are mentioned under 'Materials Examined' section.

Morphology and morphometry

Measurements were taken point to point to the nearest 0.1 mm using Mitutoyo® CD-15CPX dial callipers. Methods of measurements and counts follow Katwate *et al.* (2018). Measurements for the paratype (WHT 296) of *Dawkinsia austellus* has been extracted from the reference image using an image processing program, imagej (Schneider *et al.*, 2012). We observed that the last two branched fin rays in the dorsal and anal fin were anatomically distinct; however, they are articulated with the same pterygiophore and are here counted as a single unit/ray. A diagrammatic representation of principal colour pattern and prominent taxonomic characters used in descriptions are provided in Figure 2. The broad black blotch on the lateral side of the head, covering infraorbital and opercular bones, is referred to as the 'kaadige blotch', the specific epithet is derived from Kannada word 'kaadige' / 'ಕಾಡಿಗೆ' which refers to kohl, ancient eye cosmetic used as eyeliner. Characters distinguishing 'assimilis' and 'filamentosa' groups within *Dawkinsia* are provided in Figure 2B–C. In species descriptions, values in parentheses after a count represent the frequency of that count.

Genetic analysis

Gill tissues were obtained from fresh specimens and preserved in absolute ethanol. Details of specimens used for genetic analysis are provided in Table 1. DNA extraction, PCR amplification for mitochondrial cytochrome oxidase subunit 1 (cox1) and cytochrome *b* (cyt *b*) genes, and sequencing protocols follow Ali *et al.* (2013) and Katwate *et al.* (2013) respectively. Sequences were checked in BLAST (Altschul *et al.*, 1990) to find the closest sequences available in GenBank. We generated 43 sequences of cox1 and 39 sequences of cyt *b* in the current study. Sequences generated as part of the study are deposited in GenBank under accession numbers MT329023–MT329065 for cox1 and MT334785–MT334823 for cyt *b* genes (Table 1). Additional comparative sequences were retrieved from Gen-

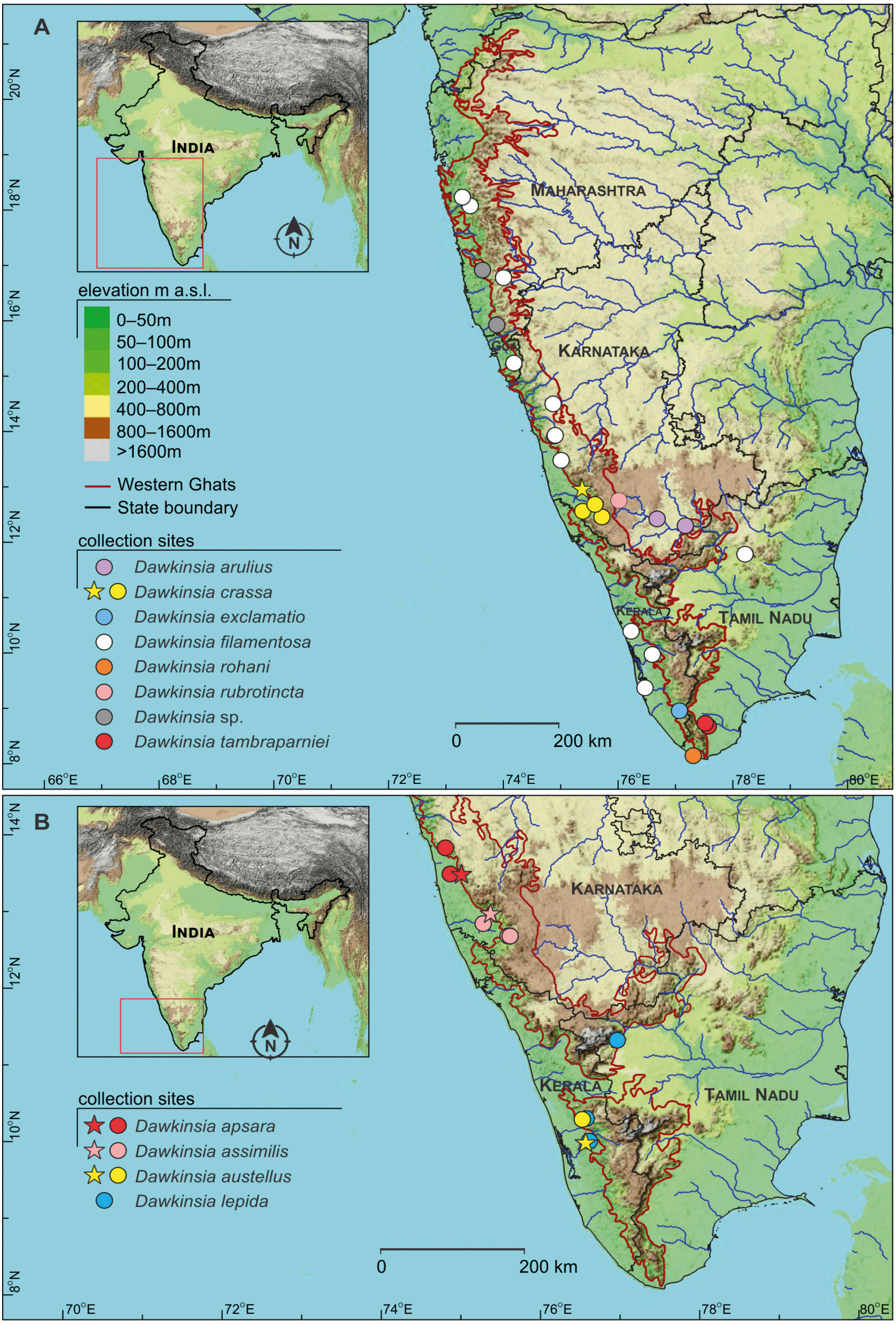

Fig. 1. Map of sampling locations for (A) 'filamentosa' group and (B) 'assimilis' group samples used in this study. Star indicates type locality.

Table 1. Specimen details for sequences generated in current study, and additional sequences downloaded from GenBank.

Species	Voucher	Location / River	Latitude (ºN)	Longitude (ºE)	cox1	cyt *b*	Source
Dawkinsia apsara	BNHS FWF 758	Mookambika River	13.830	74.804	MT329023	MT334785	Current study
Dawkinsia apsara	BNHS FWF 1025	Sita River	13.489	74.864	MT329024	MT334786	Current study
Dawkinsia apsara	KUFOS.19.06.21	Sita River	13.479	75.005	MT329025	-	Current study
Dawkinsia arulius	BNHS FWF 1026	Srirangapattanam	12.421	76.678	MT329026	MT334787	Current study
Dawkinsia arulius	--	Western Ghats	—	—	KJ683752	—	GenBank
Dawkinsia assimilis	BNHS FWF 1022	Nethravati River	12.842	75.278	MT329027	MT334788	Current study
Dawkinsia assimilis	KUFOS.18.02.06	Nethravati River	12.682	75.595	MT329028	—	Current study
Dawkinsia austellus	BNHS FWF 750	Muvattupuzha River	9.986	76.585	MT329029	MT334789	Current study
Dawkinsia crassa	BNHS FWF 1038	Kumaradhara River	12.559	75.381	MT329030	MT334790	Current study
Dawkinsia crassa	BNHS FWF 1039	Cauvery River	12.457	75.716	MT329031	—	Current study
Dawkinsia crassa	KUFOS.18.02.07	Nethravati River	12.682	75.595	MT329032	—	Current study
Dawkinsia exclamatio	--	India	—	—	JX975492	JX975489	GenBank
Dawkinsia filamentosa	BNHS FWF 735	Edathua	9.370	76.466	MT329033	MT334791	Current study
Dawkinsia filamentosa	BNHS FWF 736	Edathua	9.370	76.466	MT329034	MT334792	Current study
Dawkinsia filamentosa	BNHS FWF 752	Muvattupuzha River	9.972	76.594	MT329035	MT334793	Current study
Dawkinsia filamentosa	BNHS FWF 766	Yercaud Lake	11.783	78.209	MT329036	MT334794	Current study
Dawkinsia filamentosa	BNHS FWF 767	Yercaud Lake	11.783	78.209	MT329037	MT334795	Current study
Dawkinsia filamentosa	BNHS FWF 1021	Nettoor	13.916	74.889	MT329038	MT334796	Current study
Dawkinsia filamentosa	BNHS FWF 734	Nagodi	13.930	74.902	—	MT334797	Current study
Dawkinsia filamentosa	BNHS FWF 732	Siddhapur	14.498	74.865	MT329039	MT334798	Current study
Dawkinsia filamentosa	BNHS FWF 733	Nanikatta	14.498	74.865	MT329040	MT334799	Current study
Dawkinsia filamentosa	BNHS FWF 731	Sanguem	15.234	74.182	MT329041	MT334800	Current study
Dawkinsia filamentosa	BNHS FWF 727	Malvan	16.778	74.001	MT329042	MT334801	Current study
Dawkinsia filamentosa	BNHS FWF 718	Mahad	18.075	73.421	—	MT334802	Current study
Dawkinsia filamentosa	BNHS FWF 716	Kal River	18.232	73.284	MT329043	MT334803	Current study
Dawkinsia filamentosa	BNHS FWF 717	Kal River	18.232	73.284	—	MT334804	Current study
Dawkinsia filamentosa	BNHS FWF 1027	Karuvannoor	10.392	76.225	MT329044	MT334805	Current study
Dawkinsia filamentosa	BNHS FWF 1028	Aquarium trade			MT329045	MT334806	Current study
Dawkinsia filamentosa	KUFOS.19.06.22	Sita River	13.479	75.005	MT329046	—	Current study
Dawkinsia filamentosa	KUFOS.19.06.23	Sita River	13.479	75.005	MT329047	—	Current study
Dawkinsia filamentosa	NBFGR:PFL5	India	9.070	76.850	JX181883	JQ795448	GenBank
Dawkinsia filamentosa	M-CCI-PF1	India	10.210	76.150	HE801574	—	GenBank
Dawkinsia filamentosa	FBRC_ZSI_DNA433_F2966	India	14.596	79.687	MK681760	—	GenBank
Dawkinsia filamentosa	3F_COIAR_29995-4_8799	India: Tamilnadu,Tirunelveli	8.730	77.710	KX984246	—	GenBank

Table 1 continued.

Species	Voucher	Location / River	Latitude (ºN)	Longitude (ºE)	cox1	cyt *b*	Source
Dawkinsia lepida	BNHS FWF 1023	Bhavani River	11.321	76.962	MT329048	MT334807	Current study
Dawkinsia lepida	BNHS FWF 751	Muvattupuzha River	9.986	76.585	MT329049	MT334808	Current study
Dawkinsia lepida	BNHS FWF 1024	Chalakudy River	10.298	76.571	MT329050	MT334809	Current study
Dawkinsia lepida	KUFOS.14.05.31	Muvattupuzha River	9.986	76.585	MT329051	—	Current study
Dawkinsia rohani	BNHS FWF 1029	Nagercoil	8.144	77.308	MT329052	MT334810	Current study
Dawkinsia rohani	BNHS FWF 1030	Aquarium trade			MT329053	MT334811	Current study
Dawkinsia rohani	BNHS FWF 1031	Aquarium trade			MT329054	MT334812	Current study
Dawkinsia rohani	BNHS FWF 1032	Aquarium trade			MT329055	MT334813	Current study
Dawkinsia rohani	BNHS FWF 1033	Aquarium trade			MT329056	MT334814	Current study
Dawkinsia rohani	—	India	—	—	JX975491	JX975488	GenBank
Dawkinsia rubrotincta	BNHS FWF 762	Cauvery River	12.753	76.012	MT329057	MT334815	Current study
Dawkinsia rubrotincta	BNHS FWF 763	Cauvery River	12.753	76.012	MT329058	MT334816	Current study
Dawkinsia rubrotincta	DR2	India: Western Ghats	—	—	KJ683748	—	GenBank
Dawkinsia rubrotincta	DR1	India: Western Ghats	—	—	KJ683747	—	GenBank
Dawkinsia ‘*singhala*’	WHT8843_33	Sri Lanka	—	—	—	JF793617	GenBank
Dawkinsia ‘*singhala*’	—	Sri Lanka: Bopath Ella	—	—	—	AY925192	GenBank
Dawkinsia ‘*singhala*’	—	Sri Lanka	—	—	—	AY708256	GenBank
Dawkinsia ‘*singhala*’	—	Sri Lanka: Bopath Ella	—	—	—	AY925193	GenBank
Dawkinsia sp.	BNHS FWF 725	Kajali River	16.916	73.635	MT329059	MT334817	Current study
Dawkinsia sp.	BNHS FWF 726	Kajali River	16.916	73.635	MT329060	MT334818	Current study
Dawkinsia sp.	BNHS FWF 730	Terekhol River	15.925	73.883	MT329061	MT334819	Current study
Dawkinsia srilankensis	WHT8844_19	Sri Lanka	—	—	—	JF793618	GenBank
Dawkinsia srilankensis	—	Sri Lanka	—	—	—	AY708271	GenBank
Dawkinsia tambraparniei	BNHS FWF 1034	Tambraparniei River	8.677	77.569	MT329062	MT334820	Current study
Dawkinsia tambraparniei	BNHS FWF 1035	Aquarium trade			MT329063	MT334821	Current study
Dawkinsia tambraparniei	BNHS FWF 1036	Tambraparniei River	8.677	77.569	MT329064	MT334822	Current study
Dawkinsia tambraparniei	BNHS FWF 1037	Tambraparniei River	8.677	77.569	MT329065	MT334823	Current study
Dawkinsia tambraparniei	—	India	—	—	JX049983	JX049981	GenBank
Dawkinsia tambraparniei	—	India	—	—	JX975494	JX975490	GenBank
Dawkinsia tambraparniei	5T_COIAR_29995-12_8799	India: Tamil Nadu,Tirunelveli	8.710	77.840	KX984252	—	GenBank
Dawkinsia tambraparniei	4T_COIAR_29995-11_8799	India: Tamil Nadu,Tirunelveli	8.730	77.720	KX984251	—	GenBank
Outgroup							
Haludaria fasciata	NBFGR:PFA6	India	9.070	76.850	JX181850	JQ795453	GenBank
Haludaria melanampyx	73HA / NRM 50827	India: Pambar River	10.333	77.219	MF591709	EU241458	GenBank

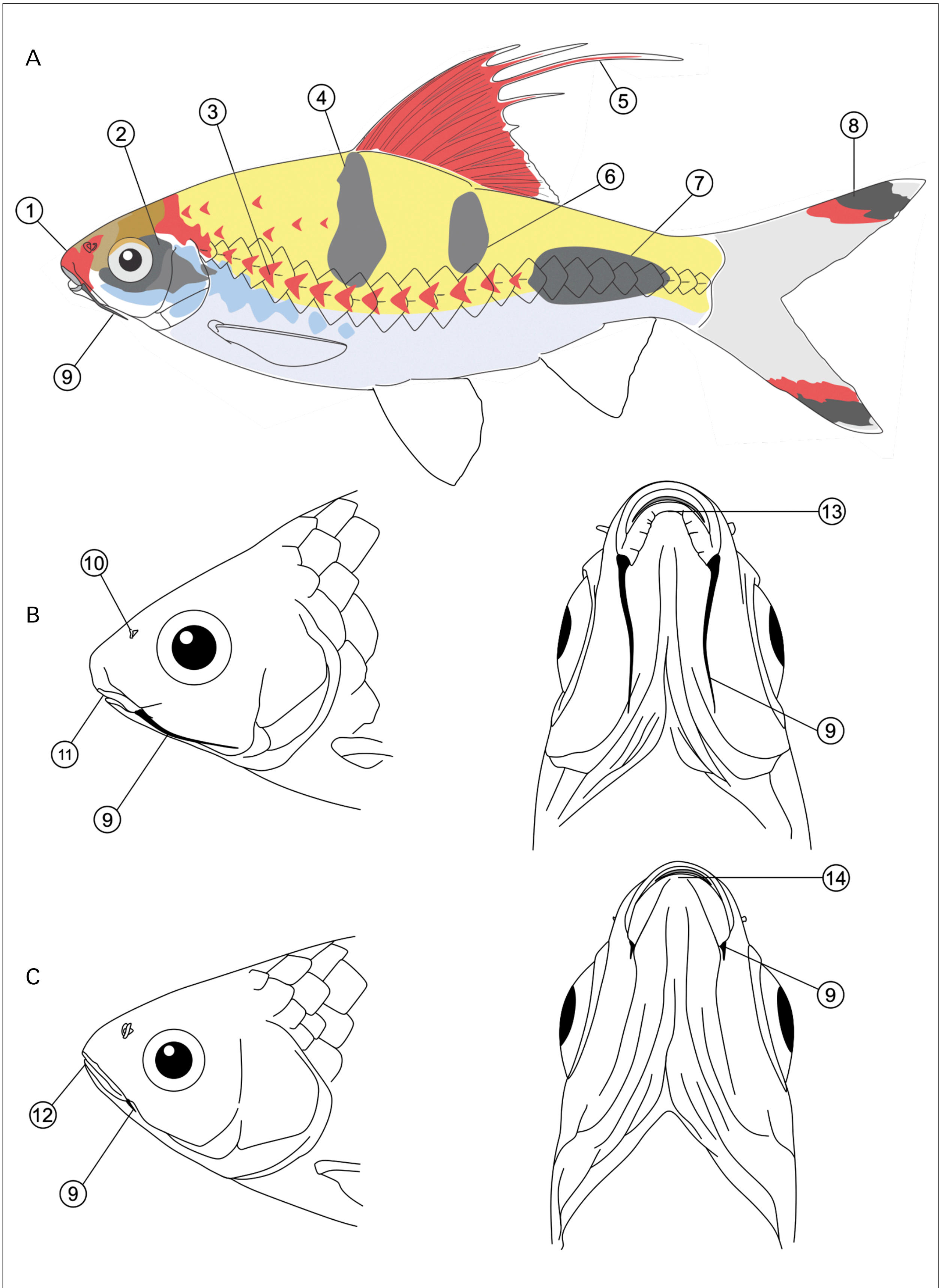

Fig. 2. Diagrammatic representation of (A) principal colour pattern and prominent taxonomic characters used in species descriptions and characters distinguishing (B) 'assimilis' and (C) 'filamentosa' groups. List of characters: 1, snout colour and shape; 2, kaadige blotch; 3, scarlet dotted line running through lateral line; 4, anterior dorsal blotch; 5, filamentously extended dorsal-fin rays; 6, posterior dorsal blotch; 7; caudal-peduncle blotch; 8, subdistal elongate black band on caudal-fin lobes; 9, extent of maxillary barbel; 10, posterior nostril; 11, inferior mouth; 12, terminal mouth; 13, lower lip continuous; 14, lower lip interrupted.

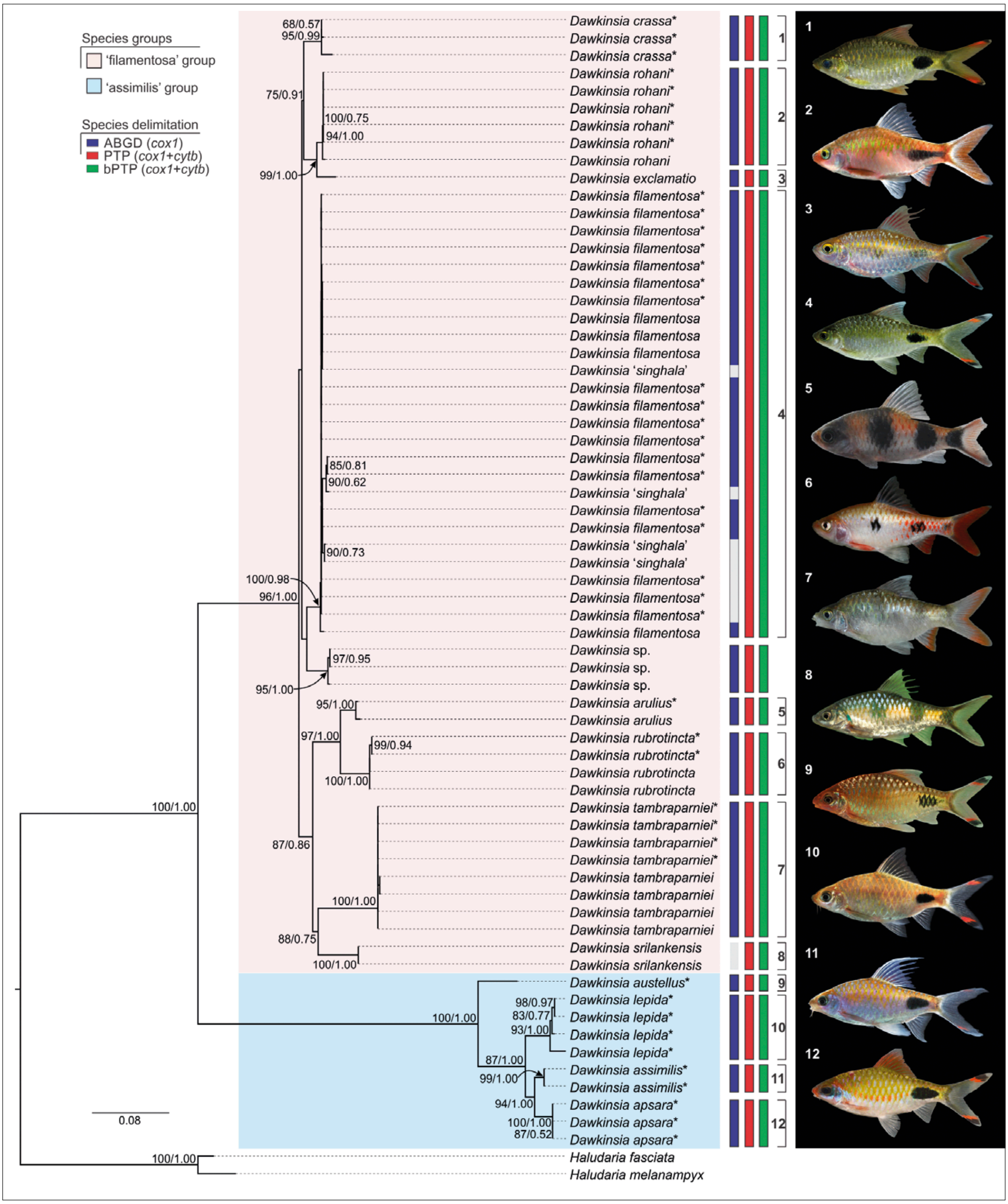

Fig. 3. Maximum Likelihood tree for *Dawkinsia* based on best partition of nucleotide substitution rates (log likelihood for consensus tree, lnL = –7005.116). Taxa with asterisk indicates sequences generated in the current study. Values along the nodes are per cent bootstraps for 1000 iterations followed by Bayesian posterior probabilities. Bootstrap values less than 50 are not shown. Species of *Haludaria* are used as the out-group. Individuals for which cox1 sequences were not available for ABGD delimitation are marked with grey bars.

Bank (Table 1). Our genetic analysis covers all valid species in the genus *Dawkinsia*. Two species of *Haludaria* were used as outgroup.

Sequences were aligned separately for the two genes using MUSCLE (Edgar, 2004) implemented in MEGA 7 (Kumar *et al.*, 2016), and were concatenated to form a combined matrix of 1746 bp in SEAVIEW (Gouy *et al.*, 2010). Data were partitioned into two genes and their respective codon positions to create a full partition with six character sets. Partition analysis (Chernomor *et al.*, 2016) and ModelFinder (Kalyaanamoorthy *et al.*, 2017) were used to find the right partitioning scheme and nucleotide substitution model for the partition scheme based on minimum Bayesian Information Criterion (BIC) (Schwarz, 1978; Nei & Kumar, 2000). Maximum Likelihood (ML) analysis was performed in iq-tree (Nguyen *et al.*, 2015) with best partition scheme and ultrafast bootstrap support for 1000 iterations (Hoang *et al.*, 2018). A Bayesian tree was constructed using mrbayes (Ronquist *et al.*, 2012) implemented in topali 2.5 (Milne *et al.*, 2004) with two runs of 5,000,000 generations, sampling frequency of 10 and 25% discarded as burn-in. The Maximum Likelihood phylogram obtained was edited in figtree v1.4.2 (Rambaut, 2009). Uncorrected *p* distances between pairs of sequences were determined in mega 7 (Kumar *et al.*, 2016).

Genetic delimitation of species was performed using barcode gap analysis and Poisson Tree Process (Puillandre *et al.*, 2012; Zhang *et al.*, 2013). Barcode gap analysis based on cox1 was performed in automatic barcode gap discovery (abgd) software (Puillandre *et al.*, 2012) employing K2P distances and transition/transversion ratio of 2. The maximum consensus ML tree based on concatenated cox1 and cyt *b* genes was used to delimit species based on poisson tree process (PTP) and maximum consensus Bayesian tree was used for bayesian poisson tree process (bPTP) using 100000 Markov chain Monte Carlo (MCMC) generations, thinning parameter of 100 and burn-in of 0.1.

Results

Molecular phylogenetics of *Dawkinsia*

IQ-TREE identified two partitions comprising of (1) first two codon positions of cox1 and cyt *b* and (2) third codon positions of cox1 and cyt *b* genes. Nucleotide substitution pattern of the partition scheme was identified as HKY+I (BIC = 15846.248, lnL = -7008.652, df=245) for first position and TN+G4 (BIC = 16294.245, lnL = -6963.907, df=317) for second position. Both ML and Bayesian trees had a similar topology. As a result, only the ML tree is shown (Fig. 3) with bootstrap and Bayesian posterior probability support for nodes. For both, ML as well as Bayesian tree, there were two distinct groups in *Dawkinsia*, which we identify as the ‘filamentosa’ and the ‘assimilis’ groups (Fig. 3). Barcode gap analysis and Poisson Tree Process delimited nine species in the ‘filamentosa’ group and four species in the ‘assimilis’ group.

The ‘filamentosa’ group formed a clade consisting of *D. arulius*, *D. exclamatio*, *D. filamentosa*, *D. rohani*, *D. rubrotincta*, *D. singhala*, *D. srilankensis* and *D. tambraparniei*, along with two undescribed species, of which we describe one here as *D. crassa*. Available sequences of *D. singhala* from Sri Lanka showed little to no genetic divergence from the widely distributed *D. filamentosa*. The ‘assimilis’ group formed a clade consisting of topotypic *D. assimilis*, topotypic specimens of *Puntius* (*Capoeta*) *lepidus* Day, which has so far been in the synonymy of *D. assimilis*, and two undescribed species. We therefore resurrect ‘*Puntius*’ *lepidus* as a valid species and describe two new species viz. *D. apsara* and *D. austellus*.

Taxonomy

Morphologically, species of the ‘assimilis’ group can be separated from species of the ‘filamentosa’ group based on a set of characters including inferior mouth (vs. terminal or subterminal mouth, except in *Dawkinsia srilankensis*) and long maxillary barbel covering anterior half of or reaching posterior margin of eye (vs. short maxillary barbel, barely reaching anterior margin of eye) (Fig. 2B–C). In this section, we designate a neotype for *D. assimilis* and redescribe the species. Additionally, we describe two new species in the ‘assimilis’ group, and resurrect and redescribe ‘*Puntius*’ *lepidus*. We also describe a new species from the ‘filamentosa’ group.

Dawkinsia assimilis (Jerdon, 1849)

(Fig. 4A–B)

Systomus assimilis Jerdon, 1849: p. 319

Neotype. By present designation, BNHS FWF 1010, 70.6 mm SL, male; India: Karnataka, Nethravati River, Dharmasthala, 12°57’57.52”N, 75°22’12.14”E, 83 m a.s.l., coll. N. Sood, 20th June 2019.

Topotypes. BNHS FWF 1011–1014, 4, 39.8–77.4 mm SL, same data as neotype. — BNHS FWF 1022, 1, 72.8 mm SL; India: Karnataka, Nethravati River, 12°50’31.2”N 75°16’40.8”E, coll. J. D. Marcus Knight, 15th January 2013.

Additional material. BNHS FWF 770, 1, 39.9 mm SL; India: Karnataka, Subramanya, Kumaradhara River, a tributary of Nethravati River, 12°40’42.64”N, 75°36’56.90”E, 133 m a.s.l., coll. Anoop V.K., 6th February 2018. — KUFOS.18.02.06, 1, 42.1; India: Karnataka, Subramanya, Kumaradhara River, a tributary of Nethravati River, 12°40’42.64”N, 75°36’56.90”E, 133 m a.s.l., coll. Anoop V.K., 6th February 2018.

Remarks. There are no known types for Jerdon’s *Systomus assimilis* (now *Dawkinsia assimilis*), and the type locality, the erstwhile British Indian region of ‘Canara’, now encompasses several districts in Southern Karnataka. While reviewing the filament barbs of southern India and Sri Lanka, Pethiyagoda & Kottelat (2005a) studied the Nethravati River (which traverses the erstwhile Canara region, Jerdon’s type locality) population and assigned the name *D. assimilis* to it, considering the fact that they matched Jerdon’s description. However, while re-describing Jerdon’s *Systomus assimilis*, Pethiyagoda & Kottelat (2005a) tentatively assigned and identified the populations from Chalakudy and Kallada River as *D. assimilis* while stating the difficulties in establishing the fact that Nethravati and Chalakudy/Kallada populations represent the same species, given the absence of adult specimens from the type locality (i.e. Canara). We

Fig. 4. *Dawkinsia assimilis*, (A) neotype in preservative, male, BNHS FWF 1010, 70.6 mm SL, from Nethravati River, Karnataka, India and (B) topotype in life, not preserved, male, Nethravati River, Karnataka, India.

do not have specimens of the 'assimilis' group species from the Kallada River, but in Chalakudy there are two species from 'assimilis' group that we identify as *Dawkinsia lepida* and *D. austellus* (described below). To complicate matters, two similar-looking species, *D. assimilis,* and *D. crassa* (a species we describe in this paper) occur sympatrically in the Nethravati River. This makes it necessary to fix the name *Systomus assimilis* Jerdon 1849 by designating a neotype for which we chose BNHS FWF 1010, following Article 75 and 75.3 of International Commission on Zoological Nomenclature (ICZN). The specimen is illustrated in Figure 4A and its morphometric and meristic data given in Table 2, which supplement the description of Jerdon (1849).

Diagnosis. *Dawkinsia assimilis* can be distinguished from all congeners by the following combination of characters: 21 lateral line scales; 7 pre-dorsal scales; 16–17 pre-anal scales; 4 scales between dorsal-fin origin and lateral-line scale row; 2½ scales between lateral-line scale row and pelvic-fin origin; dorsal fin originating over 7th lateral-line scale, much closer to snout than caudal-fin base; last unbranched and 1st and 2nd branched dorsal-fin rays elongated, almost reaching caudal-fin base in males; inferior mouth, lower lip continuous; maxillary barbel 16.6–31.7% of HL, barely reaching anterior margin of eye; kaadige blotch absent; snout brown in life in mature males; dorsal fin, with faded red-orange tinge on medial membrane towards proximal margin, but mostly hyaline; caudal-peduncle blotch relatively short, pear-shaped, covering 14th to 18th scales of lateral line, its length not exceeding length of longest anal-fin ray.

Description. For general shape and appearance see Figure 4A–B. Morphometric and meristic data for the designated neotype and 5 topotypes are provided in Table 2.

Table 2. Biometric data of *Dawkinsia assimilis* neotype and five topotypes, *D. apsara* holotype and eight paratypes, *D. austellus* holotype and paratype and *D. lepida* syntype and three additional topotypic specimens.

Characters	*D. assimilis*			*D. apsara*			*D. austellus*		*D. lepida*		
	Neo-type	Topotypes (n=5)		Holo-type	Paratypes (n=8)		Holo-type	Para-type	Syn-type	Additional topotypes (n=3)	
		Mean (sd)	Range		Mean (sd)	Range				Mean (sd)	Range
Morphometrics											
Total length (mm)	89.8	86.0 (20.7)	49.7–100.9	82.2	97.7 (19.6)	74.5–140.3	107.0	105.0	56.0	91.4 (23.1)	67.2–113.3
Standard length (SL, mm)	70.6	65.6 (14.8)	39.8–77.4	63.3	73.9 (15.4)	56.0–107.3	83.1	84.5	44.4	68.5 (17.2)	49.7–83.4
%SL											
Head length (HL)	26.3	26.3 (0.8)	25.2–27.6	28.5	26.6 (1.0)	24.9–27.9	26.2	24.1	24.7	26.3 (0.6)	25.6–26.8
Post-orbital head length	9.9	10.7 (0.4)	10.1–11.2	11.2	10.9 (0.7)	9.9–12.2	10.9	12.1	10.6	11.0 (0.6)	10.4–11.7
Head depth	21.3	21.3 (0.8)	20.2–22.3	21.7	21.1 (0.6)	19.9–21.9	22.2	22.1	21.4	21.1 (0.7)	20.7–21.9
Head width	16.9	15.8 (0.5)	15.2–16.3	16.6	15.5 (1.1)	13.9–17.1	16.7	—	—	16.3 (2.4)	14.6–18.0
Body depth	37.5	38.0 (1.6)	35.6–39.9	31.9	36.2 (2.0)	32.7–39.1	39.5	38.4	38.5	40.8 (3.1)	38.7–44.4
Body width at dorsal-fin origin	17.4	16.2 (2.0)	12.8–17.8	16.3	16.0 (3.7)	11.8–21.1	16.6	—	—	15.9 (1.0)	15.2–16.6
Body width at anal-fin origin	11.4	12.4 (1.5)	10.3–13.8	12.4	11.7 (1.9)	8.9–14.2	11.5	—	—	10.9 (2.5)	9.1–12.6
Pre-dorsal distance	45.1	45.8 (1.0)	44.4–46.8	44.3	46.9 (1.9)	44.5–50.3	45.6	42.9	44.7	46.6 (1.1)	45.4–47.3
Post-dorsal distance	83.6	85.3 (3.7)	80.8–91.0	83.8	87.7 (3.5)	82.3–91.7	81.2	80.7	81.1	88.1 (4.6)	83.4–92.7
Dorsal to hypural distance	57.5	57.3 (1.2)	55.2–58.1	53.3	57.0 (2.5)	53.4–61.1	57.6	56.0	55.2	55.4 (2.9)	53.0–58.7
Pre-pelvic distance	50.2	50.3 (1.3)	49.3–51.8	50.2	49.7 (1.0)	48.2–50.8	49.5	45.2	46.8	49.8 (1.3)	49.0–51.4
Pre-anal distance	72.0	72.2 (1.9)	70.4–74.5	70.6	72.7 (2.0)	70.0–75.1	70.4	68.4	71.7	72.2 (1.4)	71.3–73.8
Pre-pectoral distance	27.0	27.3 (0.5)	26.7–28.1	28.9	26.6 (0.8)	25.3–27.7	27.8	22.2	24.4	25.3 (1.0)	24.3–26.4
Length of last unbranched dorsal fin ray	40.5	33.9 (8.2)	26.2–47.9	31.1	27.3 (1.3)	25.8–29.8	30.3	20.9	—	31.8 (0.0)	31.7–31.8
Longest filamentous extension of dorsal fin rays	43.5	33.9 (8.2)	26.2–47.9	31.1	27.9 (1.4)	26.4–30.3	30.3	31.8	30.3	37.3 (9.7)	31.7–48.5
Length of dorsal-fin base	21.4	20.1 (0.9)	19.5–21.8	19.5	19.2 (1.4)	17.1–21.8	20.4	19.9	20.8	22.2 (4.7)	17.8–27.1
Pectoral-fin length	24.8	23.7 (0.7)	22.8–24.4	22.9	21.5 (1.5)	18.5–23.4	23	22.3	19.7	24.4 (1.4)	23.0–25.8
Anal-fin depth	19.0	19.0 (0.8)	17.6–19.6	19.8	17.1 (1.4)	14.0–18.2	18.5	15.5	19.0	19.7 (0.5)	19.2–20.2
Caudal-peduncle length	19.8	17.4 (2.2)	14.3–19.3	18.6	17.6 (1.7)	15.4–19.5	18.8	21.9	18.6	19.4 (2.7)	17.0–22.3
Caudal-peduncle depth	14.2	13.7 (0.6)	12.9–14.2	13.4	13.5 (0.5)	12.9–14.0	14.5	13.4	13.6	14.2 (0.5)	13.7–14.6
% HL											
Post-orbital head length	37.6	40.7 (1.6)	38.2–42.3	39.4	41.0 (1.7)	38.0–43.6	41.5	50.2	42.8	41.8 (3.5)	38.9–45.7
Head depth	81.3	80.8 (2.8)	77.2–83.9	76.0	79.6 (4.0)	75.0–86.8	84.6	91.6	86.6	80.4 (1.7)	78.4–81.7
Head width	64.5	60.2 (2.9)	55.2–62.5	58.1	58.4 (3.0)	53.3–61.4	63.6	—	—	61.1 (8.6)	55.0–67.2
Snout length	29.2	29.1 (2.7)	24.7–31.7	32.0	30.8 (2.1)	27.6–33.9	33.4	25.6	21.9	28.3 (2.5)	25.5–30.3
Eye diameter	30.7	32.4 (4.0)	29.6–39.5	30.3	30.3 (3.3)	25.4–33.9	27.3	23.2	37.1	33.8 (2.5)	31.1–36.2
Internarial width	26.0	24.1 (2.1)	20.8–26.2	23.5	23.2 (2.3)	17.8–24.8	26.4	—	—	24.5 (1.0)	23.8–25.2
Inter orbital width	41.1	41.1 (3.2)	36.5–45.2	37.9	39.2 (2.3)	35.9–42.6	39.4	—	—	38.4 (0.7)	37.9–38.9
Maxillary barbel length	26.8	23.6 (5.8)	16.6–31.7	21.4	16.7 (5.2)	7.3–22.6	17.6	10.2	15.0	35.7 (2.1)	34.2–37.2

Table 2 continued.

Characters	*D. assimilis*			*D. apsara*			*D. austellus*		*D. lepida*		
	Neo-type	Topotypes (n = 5)		Holo-type	Paratypes (n = 8)		Holo-type	Para-type	Syn-type	Additional topotypes (n = 3)	
		Mean (sd)	Range		Mean (sd)	Range				Mean (sd)	Range
Meristics											
Lateral line series scales	21		21	20		21	21	21	20		20
Transverse row scales	4/1/2½		4/1/2½	4/1/2		4/1/2	4½/1/2	4½/1/2	4/1/2		4 – 4½/1/2
Pre-dorsal scales	7		7	7		7	7	7	7		7
Pre-pelvic scales	10		10 – 11	10		10 – 11	9	9	—		10 – 11
Pre-anal scales	17		16 – 17	16		16 – 17	14	14	—		17 – 18
Circumpeduncular scales	12		12	12		12	12	12	12		12
Dorsal-fin ray	iii-i-8		iii-i-8	iii-i-8		iii-i-8	iii-i-8	iii-i-8	iii-i-8		iii-i-8
Pectoral-fin ray	i-14		i-13 – 14	i-14		i-14	i-13	i-13	i-14		i-14
Pelvic-fin ray	i-8		i-8	i-8		i-8	i-8	i-8	i-8		i-8
Anal-fin ray	ii-i-5		ii-i-5	ii-i-5		ii-i-5	ii-i-5	ii-i-5	ii-i-5		ii-i-5
Caudal-fin ray (procurrent)	8+7		7 – 8+7	6+6		6+6 – 7	7+6	7+6	6+6		6 + 7
Caudal-fin ray (principal)	9+8		9+8 – 9	8+9		8 – 9+8 – 9	9+8	9+8	9+8		9 + 8

Body elongate, deep, its length 2.5 – 2.8 times depth; head and body compressed laterally; pre-dorsal contour strongly convex, steadily rising to dorsal-fin origin, thereafter sloping down towards caudal-fin base in steep slope; ventral profile convex, rounded up to base of anal fin, thereafter sloping down sharply up towards caudal-fin base. Snout short, its length less than eye diameter and interorbital width. Eye large, mid-laterally positioned, much closer to snout tip than posterior margin of operculum, diameter less than interorbital width. Mouth small, inferior, diagonal in position, ventrally U-shaped, corner of mouth reaching vertical line through posterior nostril. Rostral fold present, overhanging posterior part of upper lip; jaws covered by horny sheath. Lips smooth, relatively thin, not interrupted, thinning medially. Nuptial tubercles prominent in mature males, scattered across snout and nape. Maxillary barbel long, reaching anterior margin of eye, length greater than eye diameter.

Dorsal fin originating over seventh lateral-line scale, one scale anterior to pelvic-fin origin, closer to tip of snout than to base of caudal peduncle; dorsal-fin length greater (1.1 – 1.9 times) than head length, posterior margin of dorsal fin concave, extending beyond vertical line through middle of anal fin. Dorsal fin with 3 supernumerary and one serially associated unbranched ray and 8 branched rays. Last unbranched and 1st and 2nd branched dorsal-fin rays filamentously elongated, sometimes reaching caudal-fin base in mature males. Pectoral fin with one simple and 13(1) to 14(5) branched rays. Pectoral and pelvic fins long, when adpressed reaching pelvic-fin and anal-fin origin, respectively. Anal fin with 2 supernumerary and one serially associated unbranched rays and 5 branched rays; distal margin of anal fin deeply concave. Caudal peduncle deep, its depth 72 – 92% of its length. Lateral line complete, with 21 perforated scales, curving ventrally up to 13th scale with ventral most point of curvature at 7th scale then running almost straight to middle of caudal-fin base. Caudal fin deeply forked, lobes measuring more than two thirds of total fin length, tips pointed. Principal caudal-fin rays 9 + 8(5) or 9 + 9(1); procurrent rays dorsally 7(1) or 8(5) and ventrally 7(6). Scales between lateral line and dorsal fin origin 4(6); scales between lateral line and pelvic fin origin 2½(6); pre-dorsal scales 7(6); pre-pelvic scales 10(5) or 11(1); pre-anal scales 16(1) or 17(5); circumpeduncular scales 12(6). Pelvic axillary scale present, one-third the length of adpressed pelvic fin.

Coloration. Adult specimens in formalin brownish on back; snout, head, dorsum and lower lip white, infraorbital region, cheek and gill cover sparsely studded with melanophores; lower head and chest, and abdomen uniformly white in colour (Fig. 4A). Iris white. Each body scale margined with sparsely arranged melanophores at base. A horizontally elongated, relatively short, pear-shaped, caudal-peduncle blotch, 1 to 1.5 scales high at highest point originate posterior to anal-fin origin, covering 14th to 18th scales of lateral line, its length not exceeding length of longest anal-fin ray. Caudal fin hyaline, with

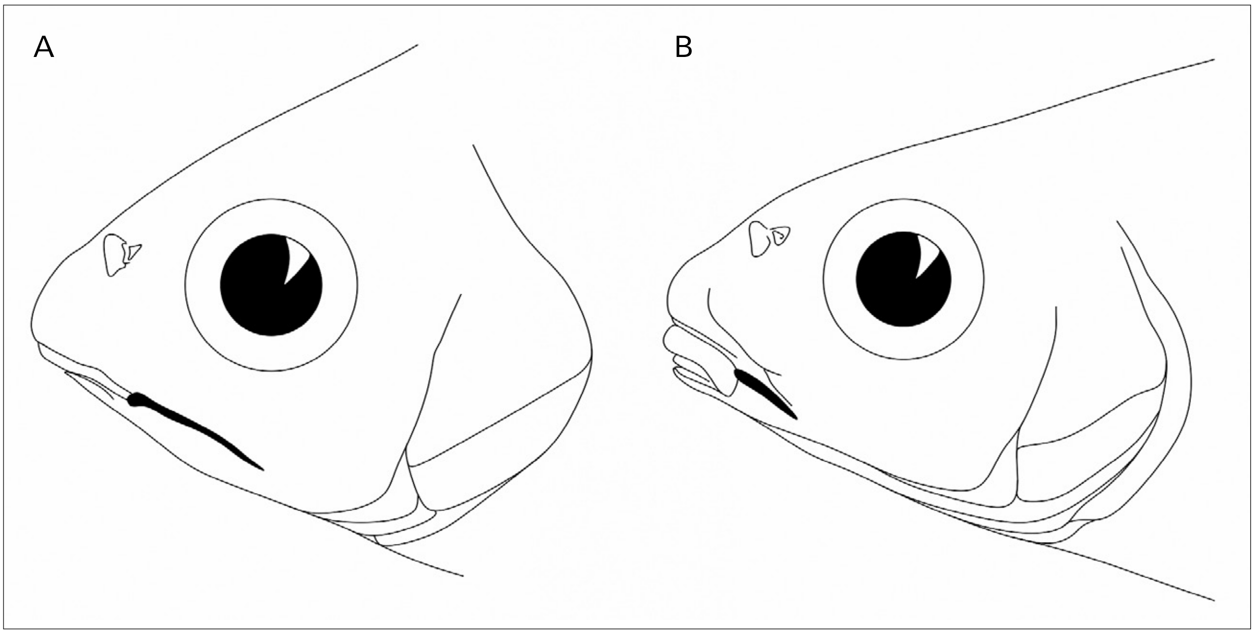

Fig. 5. Lip structure and placement of maxillary barbel in (A) *Dawkinsia assimilis* and (B) *D. apsara*.

subdistal elongate black band on each lobe with maximum length of about half of eye diameter, proximally bordered in white towards middle of tips of caudal-fin lobes; caudal-fin tips white.

In life (Fig. 4B), olive above lateral line, darker on dorsal side of head and body. Mature males with deep blue iridescence over opercular bones, cheek, and on side of body. Snout deep olive. Iris black. Lateral line scales with deep iridescent blue coloration at base. Dorsal fin mostly hyaline, but with faded red-orange tinge on fin membrane towards base. Pectoral, pelvic, anal and caudal fins hyaline. Caudal-peduncle blotch as described for preserved specimens. Subdistal elongate black band proximally bordered by elongate, red band towards middle of tips of caudal-fin lobes. Caudal-fin tips hyaline.

Comparison. Adults of *Dawkinsia assimilis* can be distinguished from adults of its sister species, *D. apsara* (described below), by the following characters: corner of mouth reaching beneath level of posterior nostril (vs. ending anterior to level of posterior nostril) (Fig. 5); 2½ scales between lateral-line scale row and pelvic-fin origin (vs. 2 scales); filaments of adpressed last unbranched and 1st and 2nd branched dorsal-fin rays reaching caudal-fin base (vs. dorsal fin without filamentously extended rays or, if present, not reaching caudal-fin base); kaadige blotch absent (vs. kaadige blotch broad, extending over infraorbital and opercular bones); snout brown in adult males (vs. deep red); caudal-peduncle blotch relatively short, pear-shaped, covering 14th to 18th scales of lateral line, its length not exceeding length of longest anal-fin ray (vs. elongated caudal-peduncle blotch, covering 14th to 20th lateral line scales, its length exceeding length of longest anal-fin ray); 3–5 scales between caudal-peduncle blotch and base of caudal fin (vs. gap of 1–2 scales); in life, no pigment on lateral line scale row (vs. deep scarlet dotted line running along lateral line scale row).

Dawkinsia assimilis can be distinguished from *D. austellus* (described below) by having 10–11 pre-pelvic scales (vs. 9), 16–17 pre-anal scales (vs. 14); 4 scales between dorsal-fin origin and lateral-line scale row (vs. 4½ scales); 2½ scales between lateral line scale row and pelvic-fin origin (vs. 2 scales); caudal-peduncle blotch pear-shaped (vs. consisting of 4-5 diamond-shaped black markings with light middle) and ending 3–5 scales in front of caudal-fin base (vs. caudal-peduncle blotch ending two scales in front of base caudal-fin base).

Dawkinsia assimilis differs from its congener *D. lepida* by the following characters: 21 lateral line scales (vs. 20); 16–17 pre-anal scales (vs. 17–18); maxillary barbel short, 16.6–31.6% of HL (vs. long maxillary barbel, 34.2–37.2% of HL); caudal-peduncle blotch pear-shaped, ending 3–5 scales in front of caudal-fin base (vs. caudal-peduncle blotch, oval, ending 2 scales in front of caudal-fin base).

Furthermore, *D. assimilis* differs from its distant congeners of the 'filamentosa' group by having, inferior mouth (vs. terminal mouth in *D. crassa*, or subterminal mouth in *D. exclamatio*, *D. filamentosa* and *D. rohani*). *Dawkinsia assimilis* also differs from *D. arulius*, *D. rubrotincta*, *D. srilankensis* and *D. tambraparniei* by having only a caudal-peduncle blotch (vs. anterior and posterior dorsal blotches or bands in front of caudal-peduncle blotch).

Genetic distances. *Dawkinsia assimilis* differs from its sister species *D. apsara* (Fig. 3) by a genetic distance of 2.2% and 3.2% in cox1 and cyt *b*, respectively. From *D. austellus* and *D. lepida, D. assimilis* differs by 3.2–7.8% for cox1 and 4.7–7.5 % for cyt *b*. *Dawkinsia assimilis* also genetically differs from all other species in the 'filamentosa' group by 14.0 – 16.6% for cox1 and 14.1–19.3% for cyt *b* genes.

Common name. Assimilis Barb. The common name is derived from the specific epithet.

Distribution. *Dawkinsia assimilis* is currently known with certainty only from the upper catchment areas of the Nethravati River in Karnataka (Fig. 1b). Pethiyagoda & Kottelat (2005a) recorded *D. assimilis* from Chalakudy and Kallada Rivers in Kerala. We could not study specimens from Kallada. However, specimens from Chalakudy studied by Pethiyagoda & Kottelat (2005a) are now known to comprise both *D. austellus* and *D. lepida*.

Habitat and ecology. *Dawkinsia assimilis* occurs in large, relatively deep pools (3–4 ft depth) in the main river channel with sluggish water current, and fallen branches and other detritus, and sand, large boulders and gravel as substrate. Co-occurring fishes at the type locality of *D. assimilis* included the cyprinids *Dawkinsia crassa*, *Devario malabaricus*, *Rasbora dandia*, *Haludaria* sp., *Hypselobarbus* sp., *Osteochilichthys* cf. *nashii*, *Pethia* sp. and the bagrid *Mystus* sp.

Dawkinsia apsara, sp. nov.

ZOOBANK urn:lsid:zoobank.org:act:B1ABAF50-E55C-4934-A3C2-253207FE1494

(Fig. 6A–C)

Holotype. BNHS FWF 1007, 63.3 mm SL, male; India: Karnataka, Sita River, 13°28’47.50”N, 75°00’16.73”E, 70 m a.s.l., coll. N. Sood, 21st June 2019.

Paratypes. KUFOS.19.06.21, 1, 56.0 mm SL, male; same data as holotype. — BNHS FWF 1025, 1, 64.3 mm SL, male; India: Karnataka, Sita River, 13°28’47.50”N, 75°00’16.73”E, 70 m a.s.l., coll. J.D.M. Knight, 01st June 2014.— BNHS FWF 753–758, 6, 42.9–107.3 mm SL, male; India: Karnataka, Sowparnika River, 13°49’48.04”N, 74°48’15.15”E, 105 m a.s.l., coll. U. Katwate, N. Dahanukar, P. Kumkar and R. Raghavan, 30th June 2014.

Diagnosis. *Dawkinsia apsara* can be distinguished from all congeners by the following combination of characters: 20–21 lateral line scales; 7 pre-dorsal scales; 16–17 pre-anal scales; 4 scales between dorsal-fin origin and lateral-line scale row; 2 scales between lateral line scale row and pelvic-fin origin; short pectoral fins, fairly separated from level of pelvic-fin origin, leaving 1–2 scale wide gap in-between; dorsal fin originating over 7th lateral line scale, closer to snout than caudal-fin base; dorsal fin without filamentously extended rays; inferior mouth, corner of mouth not reaching vertical line through posterior nostril; maxillary barbel short, 7.3–22.6% of HL, barely reaching anterior margin of eye; kaadige blotch broad, extending over infraorbital and opercular bones; snout and dorsal fin dark red in life in mature males; caudal-peduncle blotch elongated, almost 2 scales broad, covering 14th to 20th scales of lateral line, its length exceeding length of longest anal-fin ray and a characteristic coloration pattern with deep scarlet dotted line running along lateral line scale row.

Description. For general shape and appearance see Figure 6A–C. Morphometric and meristic data for holotype and 8 paratypes are provided in Table 2.

Body elongate, deep, its length 2.5–3.1 times depth; head and body compressed laterally; pre-dorsal contour convex, humped posterior to nape, steadily rising to dorsal-fin origin, thereafter sloping gradually down towards caudal-fin base; ventral profile convex, rounded up to base of anal fin, thereafter sloping down sharply towards caudal-fin base. Snout length almost equal or slightly greater (0.9–1.2 times) than eye diameter and lesser (0.7–0.8 times) than interorbital width. Eye small, somewhat medially positioned between snout tip and posterior margin of operculum, diameter almost equal to or greater than (1.1–1.6 times) interorbital width. Mouth small, inferior, diagonal in position, U-shaped in ventral view, corner of mouth not reaching vertical line through posterior nostril. Rostral fold present, overhanging posterior part of upper lip; jaws covered by horny sheath. Lips smooth, not interrupted, upper lip fleshy, lower lip thinner than upper lip, slightly folded backwards, resulting in continuous postlabial groove. Nuptial tubercles prominent in mature males, sparsely distributed, large tubercles on snout but smaller ones on nape and dorsum. Short maxillary barbel, barely reaching or often not reaching anterior margin of eye, shorter (0.2–0.7 times) than eye diameter.

Dorsal fin originates over seventh lateral-line scale, one scale anterior to pelvic-fin origin, closer to tip of snout than to base of caudal peduncle; dorsal-fin length almost equal (0.9–1.1 times) to head length; posterior margin of dorsal fin concave, extending beyond vertical line through middle of anal fin. Dorsal fin with 3 supernumerary and one serially associated unbranched ray and 8 branched rays. Pectoral fin with one simple and 14 (9) branched rays. Pectoral fin short, when adpressed not reaching pelvic-fin origin, stopping 2 scale rows in front of it. Pelvic fin short, when adpressed not reaching (8) or barely reaching (1) anal-fin origin. Anal fin with 2 supernumerary and one serially associated unbranched ray and 5 branched rays; distal margin of anal fin somewhat concave. Caudal peduncle deep, its depth 66–90% of its length. Lateral line complete, with 20(1) to 21(8) perforated scales, curving ventrally up to 13th scale with ventral most point of curvature at 7th scale then running almost straight to middle of caudal-fin base. Caudal fin deeply forked, lobes measuring almost two thirds of total fin length, tips pointed. Principal caudal-fin rays 8+8(3), 9+8(1) or 9+9(5); procurrent rays dorsally 6(9) and ventrally 6(5) or 7(4). Scales between lateral line and dorsal fin origin 4 (9); scales between lateral line and pelvic fin origin 2(9); pre-dorsal scales 7(9); pre-pelvic scales 10(8) or 11(1); pre-anal scales 16(8) or 17(1); circumpeduncular scales 12(9). Pelvic axillary scale present, one-third the length of adpressed pelvic fin.

Coloration. Adult specimens in formalin, pale brownish on back; snout, head, dorsum and lower lip white; infraorbital and opercular region covered with broad ka-

Fig. 6. *Dawkinsia apsara* sp. nov., holotype in preservative (A) and in life (B), male, BNHS FWF 1007, 63.3 mm SL, from Sita River, Karnataka, India and (C) topotype in life, not preserved, male, Sita River, Karnataka, India (Photo courtesy: Ralf Britz).

adige blotch; lower head, chest and abdomen uniformly pale in colour (Fig. 6A). Iris white. Each body scale margined with sparsely arranged melanophores at base. A horizontally elongated, caudal-peduncle blotch, about 2 scales high at highest point, originating posterior to anal-fin origin, covering 14^{th}(9) to 19^{th}(7) or 20^{th}(2) scales of lateral line, its length exceeding length of longest anal-fin ray. Dorsal, anal, pectoral and pelvic fins hyaline. Caudal fin dusky at base, with subdistal black band on each lobe with maximum length of about half of eye diameter, proximally bordered in white towards middle of tips of caudal-fin lobes; caudal-fin tips white.

In life (see Fig. 6B–C), deep olive above lateral line, darker on dorsal side of head and body. Mature males with deep blue iridescence over opercular bones, cheek, and on side of body. Snout deep scarlet. A deep scarlet dotted line running along lateral line scale row. Dorsal fin dark red; pectoral, pelvic, anal and caudal fins hyaline. Infraorbital and opercular region covered with blue iridescence and broad kaadige blotch. Caudal-peduncle blotch as described for preserved specimens. Subdistal elongate black band proximally bordered by elongate red band towards middle of tips of caudal-fin lobes. Caudal-fin tips hyaline.

Comparison. Adults of *Dawkinsia apsara* can be distinguished from adults of its sister species, *D. assimilis* and other distant congeners viz. *D. austellus* and *D. lepida*, by the following characters: corner of mouth not reaching beneath level of posterior nostril (vs. ending beneath level of posterior nostril) (Fig. 5); maxillary barbel short, not reaching anterior margin of eye (vs. barbel long, ending posterior to anterior margin of eye); snout scarlet in adult males (vs. olive brown); kaadige blotch broad, extending over infraorbital and opercular bones (vs. kaadige blotch absent); caudal-peduncle blotch covering 14th to 20th scales of lateral line (vs. covering 14th to 18th lateral line scales in *D. assimilis*, 15th to 18th scales in *D. lepida* and 13th to 19th in *D. austellus*); in life deep scarlet dotted line running along lateral line scale row (vs. no pigment on lateral line scale row).

Further, *Dawkinsia apsara* can be distinguished from *D. assimilis* by having dorsal fin without filamentously extended rays (vs. filamentously extended last unbranched and 1st and 2nd branched dorsal-fin rays). Furthermore, *D. apsara* differs from *D. assimilis* and *D. lepida* by having a short pectoral fin, not reaching level of pelvic-fin origin (vs. pectoral fin long, reaching level of pelvic-fin origin). *Dawkinsia apsara* also differs from *D. austellus* by having pre-anal scales 16–17 (vs. 14) and 4 scales between dorsal-fin origin and lateral-line scale row (vs. 4½ scales).

Dawkinsia apsara differs from its distant congeners of the 'filamentosa' group by having an inferior mouth (vs. terminal mouth in *D. crassa*, or subterminal mouth in *D. exclamatio*, *D. filamentosa* and *D. rohani*). *Dawkinsia apsara* also differs from *D. arulius*, *D. rubrotincta*, *D. srilankensis* and *D. tambraparniei* by having only a caudal-peduncle blotch (vs. anterior and posterior dorsal blotches or bands, in front of caudal-peduncle blotch).

Genetic distances. *Dawkinsia apsara* differs from its sister species *D. assimilis* (Fig. 3) by having a genetic distance of 2.2% and 3.2% in cox1 and cyt *b* genes respectively. From its other congeners, *D. austellus* and *D. lepida*, *Dawkinsia apsara* differs with a genetic distance of 3.7–8.7% for cox1 and 5.5–7.9 % for cyt *b* gene. *Dawkinsia apsara* also genetically differs from all other species of the 'filamentosa' group by 13.8–16.3% in cox1 and 12.9–18.9% in cyt *b* genes.

Etymology. The species epithet '*apsara*' is derived from the Sanskrit word "अप्सराः", pronounced as "ap-sar/ā-", which refers to the most beautiful celestial nymphs in Hindu mythology. The name was inspired by the sensational life colours of the species. A noun in apposition.

Common name. Apsara Barb. The common name is derived from the specific epithet.

Distribution. *Dawkinsia apsara* is currently known from the upper catchment areas of the Sowparnika River near Anejhari Butterfly Camp, and in the Sita River in Karnataka (Fig. 1b).

Habitat and ecology. *Dawkinsia apsara* occurs in adjoining streams and large, deep pools in the main river channel with sluggish water current, and sand, bedrock, large boulders and gravel as substrate. Co-occurring fishes at the type locality of *D. apsara* included the cyprinids *D. filamentosa*, *Haludaria* sp., *Osteochilichthys* cf. *nashii* (Day), *Pethia* sp., *Devario malabaricus* (Jerdon) and *Pristolepis malabaricus* (Pristolepididae). Interestingly, we found *D. apsara* living in syntopy with *D. filamentosa*.

Dawkinsia austellus, sp. nov.

ZOOBANK urn:lsid:zoobank.org:act:407811A0-A160-4632-84E5-6C865FE8D040

(Fig. 7A–C)

Holotype. BNHS FWF 750, 83.1 mm SL, male, India: Kerala, Muvattupuzha River, 09°59'09.90''N, 76°35'04.90''E, 123 m a.s.l., coll. U. Katwate and F. Baby, 31st May 2014.

Paratype. WHT 296, 1, 105.0 mm SL; India: Kerala, Panamkulam, 26 km from Chalakudy on Valparai road, Chalakudy River, 10°17'31.2"N 76°26'02.4"E, 133 m a.s.l., coll. R. Pethiyagoda, 27th April 1992.

Diagnosis. *Dawkinsia austellus* can be distinguished from all congeners by the following combination of characters: 21 lateral line scales; 7 pre-dorsal scales; 14 pre-anal scales; 4½ scales between dorsal-fin origin and lateral-line scale row; 2 scales between lateral-line scale row and pelvic-fin origin; short pectoral fins, fairly separated from the level of pelvic-fin origin, leaving about a scale gap in-between; dorsal fin originating over 7th lateral line scale, much closer to snout than caudal-fin base; last unbranched and 1st and 2nd branched dorsal-fin rays filamentously elongated, almost reaching caudal-fin base in males; inferior mouth, lower lip interrupted; maxillary barbel 10.2–17.6% of HL, reaching anterior margin of eye; wide mouth, corner of mouth reaching vertical line through posterior nostril; snout large, length 1.2 times

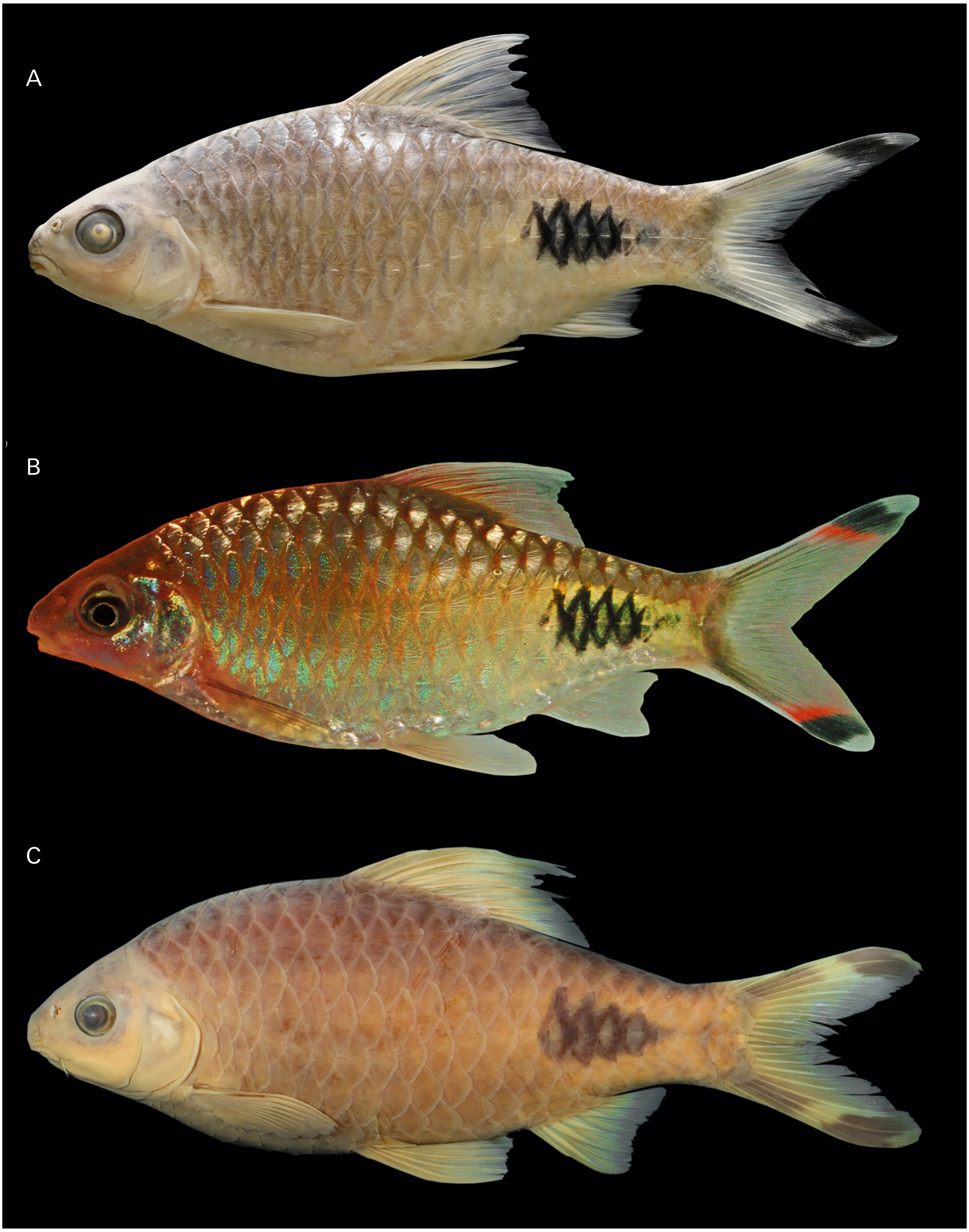

Fig. 7. *Dawkinsia austellus* sp. nov., holotype (A) in preservative and (B) in life, male, BNHS FWF 750, 83.1 mm SL, from Muvattupuzha River, Kerala, India and paratype (C) in preservative, male, WHT 296, 105.0 mm SL, from Chalakudy River, Kerala, India (Photo courtesy: Hiranya Sudasinghe).

of eye diameter; eye small, 23.2–27.3% of HL; caudal-peduncle blotch broad, elongated, consisting of series of 4-5 diamond-shaped black markings with light middle, covering 13^{th} to 19^{th} scales of lateral line.

Description. For general shape and appearance see Figure 7A–C. Morphometric and meristic data for the holotype and paratype is provided in Table 2.

Body elongate, deep, its length 2.5 times depth; head and body compressed laterally; pre-dorsal contour straight, steadily rising to dorsal-fin origin, thereafter sloping down towards caudal-fin base; ventral profile convex, rounded up to base of anal fin, thereafter sloping down sharply up towards caudal-fin base. Snout long, its length (1.2 times) greater than eye diameter. Eye small, mid-laterally positioned, much closer to snout tip than posterior margin of operculum, diameter almost equals the interorbital width. Mouth inferior, somewhat horizontal in position, U-shaped in ventral view, corner of mouth reaching vertical line through posterior nostril. Rostral fold present, overhanging posterior part of upper lip; jaws covered by horny sheath. Lips, thick, fleshier, lower lip interrupted, slightly folded backwards, resulting in a continuous postlabial groove. Nuptial tubercles prominent in mature males, sparsely distributed, large sized aggregated on snout whereas smaller ones on nape and dorsum. Maxillary barbel long, reaching anterior margin of eye, shorter (0.7 times) than eye diameter.

Dorsal fin originates over seventh lateral-line scale, one scale anterior to pelvic-fin origin, closer to tip of snout than to base of caudal peduncle; dorsal-fin length almost equal (1.1 times) of head length, posterior margin of dorsal fin concave, extending beyond vertical line through middle of anal fin. Dorsal fin with 3 supernumerary and one serially associated unbranched ray and 8 branched rays. Last unbranched and 1st to 3rd branched dorsal-fin rays elongated in mature males. Pectoral fin with one simple and 13(2) branched rays. Pectoral fin short, when adpressed not reaching pelvic-fin origin, leaving a scale gap in-between. Pelvic fin short, when adpressed not reaching (1) or barely reaching (1) anal-fin origin. Anal fin with 2 supernumerary and one serially associated unbranched rays and 5 branched rays; distal margin of anal fin concave. Caudal peduncle deep, its depth 61 – 77% of its length. Lateral line complete, with 21(2) perforated scales, curving ventrally up to 14th scale with ventral most point of curvature at 6th scale then running almost straight to middle of caudal-fin base. Caudal fin deeply forked, lobes measuring almost two-thirds of total fin length, tips pointed. Principal caudal-fin rays 9 + 8(2); procurrent rays 7 + 6(2). Scales between lateral line and dorsal fin origin 4½(2); scales between lateral line and pelvic fin origin 2(2); pre-dorsal scales 7(2); pre-pelvic scales 9(2); pre-anal scales 14(2); circumpeduncular scales 12(2). Pelvic axillary scale present, half the length of adpressed pelvic fin.

Coloration. Adult specimens in ethanol, pale brownish on back; snout, head, dorsum, lower lip, cheek and gill cover pale white; lower head, chest and abdomen region uniformly white (Fig. 7A, C). Iris white. Each body scale margined with sparsely arranged melanophores at base. A horizontally elongated caudal-peduncle blotch, consisting of 4 – 5 diamond-shaped black markings with light middle, about 1½ scales high at highest point originate posterior to anal-fin origin, covering 13th(1) or 15th9 1) to 19th(2) scales of lateral line, its length exceeding length of longest anal-fin ray. Dorsal, anal, pectoral and pelvic fins hyaline. Caudal fin dusky, darker at base, with subdistal elongate black band on each lobe with maximum length of about half of eye diameter, proximally bordered in white towards middle of tips of caudal-fin lobes; caudal-fin tips white.

In life (see Fig. 7B), olive above the lateral line, darker on dorsal side of head and body. Mature males with deep blue iridescence over opercular bones, cheek, and on side of body. Snout brown. Iris black. Dorsal fins with reddish-orange tinge at base; pectoral, pelvic, anal and caudal fins hyaline. Caudal-peduncle blotch as described for preserved specimens. Subdistal elongate black band proximally bordered by elongate red band towards middle of tips of caudal-fin lobes. Caudal-fin tips hyaline.

Comparison. *Dawkinsia austellus* lives in sympatry with *D. lepida* from which it differs by the following characters: maxillary barbel short, 10.2 – 17.6% of HL (vs. maxillary barbel long, 34.2 – 37.1% of HL); lower lip interrupted (vs. lower lip continuous); 21 lateral line scales (vs. 20); eye small, 23.2 – 27.3% of HL (vs. eye big, 31.1 – 36.2% of HL); caudal-peduncle blotch elongated, consisting of 4-5 diamond-shaped black markings with light middle, covering 13th to 19th scales of lateral line (vs. short, oval caudal-peduncle blotch, covering 14th to 16th lateral line scales). *Dawkinsia austellus* also differs from its other congeners *D. assimilis* and *D. apsara* by having 4½ scales between dorsal-fin origin and lateral-line scale row (vs. 4 scales); pre-pelvic scales 9 (vs. 10 – 11); pre-anal scales 14 (vs. 16 – 17); caudal-peduncle blotch consisting of 4-5 diamond-shaped black markings with light middle (vs. oval or pear-shaped). *Dawkinsia austellus* more specifically differs from *D. apsara* by absence of the kaadige blotch (vs. kaadige blotch broad, extending over infraorbital and opercular bones) and lack of pigment on lateral line scale row in life (vs. deep scarlet dotted line running along lateral line scale row).

Furthermore, *D. austellus* differs from its distant congeners of the 'filamentosa' group by having an inferior mouth (vs. terminal mouth in *D. crassa*, or subterminal mouth in *D. exclamatio*, *D. filamentosa* and *D. rohani*). *Dawkinsia austellus* also differs from *D. arulius*, *D. rubrotincta*, *D. srilankensis* and *D. tambraparniei* by having only a caudal-peduncle blotch (vs. anterior and posterior dorsal blotches or bands in front of caudal-peduncle blotch).

Genetic distances. *Dawkinsia austellus* differs from its other congeners in the 'assimilis' group by a genetic distance of 7.8 – 8.7% for cox1 and 7.5 – 8.6 % for cyt *b* genes. *Dawkinsia austellus* also genetically differs from all other species of the 'filamentosa' group by 14.8 – 16.0% in cox1 and 12.9 – 18.9% in cyt *b* genes.

Etymology. Species epithet '*austellus*' refers to Latin for 'South' and refers to the distribution of the species in southern India. A noun in apposition.

Common name. Austellus Barb. The common name is derived from the specific epithet.

Distribution. *Dawkinsia austellus* is currently known from the Muvattupuzha and Chalakudy rivers in Kerala (Fig. 1b).

Habitat and ecology. At the type locality (Muvattupuzha River), *Dawkinsia austellus* inhabits the main part of the river, where it co-occurs with the cyprinids *Dawkinsia filamentosa*, *D. lepida*, *Pethia punctata*, *Puntius mahecola*, *Devario malabaricus* (Jerdon) and the cichlid *Pseudetroplus maculatus*.

Dawkinsia lepida (Day, 1868)

(Fig. 8A–C)

Puntius (Capoeta) lepidus Day, 1868: p. 196
Puntius filamentosus (non Valenciennes, 1844): Menon (1999: p. 93)
Puntius assimilis (non Jerdon, 1849): Pethiyagoda & Kottelat (2005a: p. 134)
Dawkinsia assimilis (non Jerdon, 1849): Pethiyagoda *et al*. (2012: p. 80)

Material examined. Syntype. BMNH 1868.10.27.22, subadult, 44.4 mm SL; India: Tamil Nadu, Bhavani River at Mettapolliam (= Mettupalayam).

Additional material: BMNH 1889[1].2.1.672, adult, 83.4 mm SL; India: Tamil Nadu, Bowany (=Bhavani) River, coll. Francis Day (mentioned under Day's material in Table 2) — BNHS FWF 1023, 1, 73.9 mm SL; India: Tamil Nadu, Bhavani River, Mettupalayam, Coimbatore, 11°19'15.6"N 76°57'43.2"E, coll. J.D.M. Knight, 25th April 2014. — BNHS FWF 751, 1, 72.4 mm SL, male; India: Kerala, Muvattupuzha River, 09°59'09.90''N, 76°35'04.90''E, 123 m a.s.l., coll. U. Katwate and F. Baby, 31st May 2014. — BNHS FWF 784 (diaphanized specimen), 1, 44.9 mm SL, male, coll. data same as BNHS FWF 751. — BNHS FWF 785 (diaphanized specimen), 1, 47.6 mm SL, male; coll. data same as BNHS FWF 751. — BNHS FWF 747, 1, 49.7 mm SL; male, India: Kerala, Chalakudy River, 10°17'55.84"N, 76°34'18.95"E, 171 m a.s.l., coll. R. Raghavan and A. Ali, 03rd June 2011. — BNHS FWF 1024, 1, 79.8 mm SL; India: Kerala, Chalakudy River, 10°17'52.8"N 76°34'15.6"E, coll. J.D.M. Knight, 13th October 2014. — KUFOS.14.05.31, 1; India: Kerala, Muvattupuzha River, 9°59'09.6"N 76°35'06.0"E, coll. U. Katwate and F. Baby, 31st May 2014.

Diagnosis. *Dawkinsia lepida* can be distinguished from all congeners by the following combination of characters: 20 lateral line scales; 7 pre-dorsal scales; 10–11 prepelvic scales; 17–18 pre-anal scales; 4–4½ scales between dorsal-fin origin and lateral-line scale row; 2 scales between lateral-line scale row and pelvic-fin origin; Pectoral fins long, when adpressed reaching pelvic-fin origin; dorsal fin originating over 7th lateral-line scale, closer to snout than caudal fin base; last unbranched and 1st and 2nd branched dorsal-fin rays filamentously elongated, almost reaching caudal-fin base in males; mouth wide, inferior, lower lip continuous, corner of mouth reaching vertical line through posterior nostril; long maxillary barbel 34.2–36.2% of HL; snout protruding over upper lip; caudal-peduncle blotch short, oval, covering 14th to 18th scales of lateral line.

Description. For general shape and appearance see Figure 8A–C. Morphometric and meristic data for the syntype and three topotypes are provided in Table 2.

Body elongate, deep, its length 2.5–2.6 times of depth; head and body compressed laterally; pre-dorsal contour convex, humped posterior to nape, steadily rising to the dorsal-fin origin, thereafter sloping down towards caudal-fin base; ventral profile deep, convex, rounded up to base of anal fin, thereafter sloping down sharply up towards caudal-fin base. Snout length shorter (0.8–0.9 times) than eye diameter. Eye large, positioned closer to snout tip than posterior margin of operculum. Mouth inferior, almost horizontal in position, U-shaped in ventral view, corner of mouth reaching vertical line through posterior nostril. Rostral fold present, overhanging posterior part of upper lip; jaws covered by a horny sheath. Lips smooth, not interrupted, thinning medially. Nuptial tubercles prominent in mature males, large sized aggregated on snout. Maxillary barbel long, reaching posterior margin of eye, 34.2–36.2% of HL.

Dorsal fin originates over seventh lateral-line scale, anterior to pelvic fin origin, closer to tip of snout than to base of caudal peduncle; dorsal-fin length greater than head length, posterior margin of dorsal fin concave, extending beyond vertical line through middle of anal fin. Dorsal fin with 3 supernumerary and one serially associated unbranched ray and 8 branched rays. Last unbranched and 1st and 2nd branched dorsal-fin rays filamentously elongated, reaching to caudal-fin base in mature males. Pectoral fin with one simple and 14(4) branched rays. Pectoral fin long, when adpressed reaching pelvic-fin origin. Pelvic fin long, when adpressed reaching anal-fin origin. Anal fin with 2 supernumerary and one serially associated unbranched ray and 5 branched rays; distal margin of anal fin concave. Caudal peduncle deep, its depth 70-90% of its length. Lateral line complete, with 20(4) perforated scales, curving ventrally up to 14th scale with ventral most point of curvature at 7th scale then running almost straight to middle of caudal-fin base. Caudal fin deeply forked, lobes measuring almost two thirds of total fin length, tips pointed. Principal caudal-fin rays 9+8(4); procurrent rays dorsally 6(3) or 7(1) and ventrally 6(2) or 7(2). Scales between lateral line and dorsal fin origin 4(4); scales between lateral line and pelvic fin origin 2(4); pre-dorsal scales 7(4); pre-pelvic scales 10(1) or 11(1); pre-anal scales 17(1) or 18(1); circumpeduncular scales 12(4). Pelvic axillary scale present, one-third the length of adpressed pelvic-fin.

Coloration. Adult specimens in ethanol, dark yellowish on back; snout, head, dorsum, lower lip, cheek and gill cover pale; lower head, chest and abdomen uniformly white in colour (Fig. 8A–B). Iris white. Each body scale margined with sparsely arranged melanophores at base. A horizontally elongated, caudal-peduncle blotch, about a scale high at highest point originate posterior to anal-

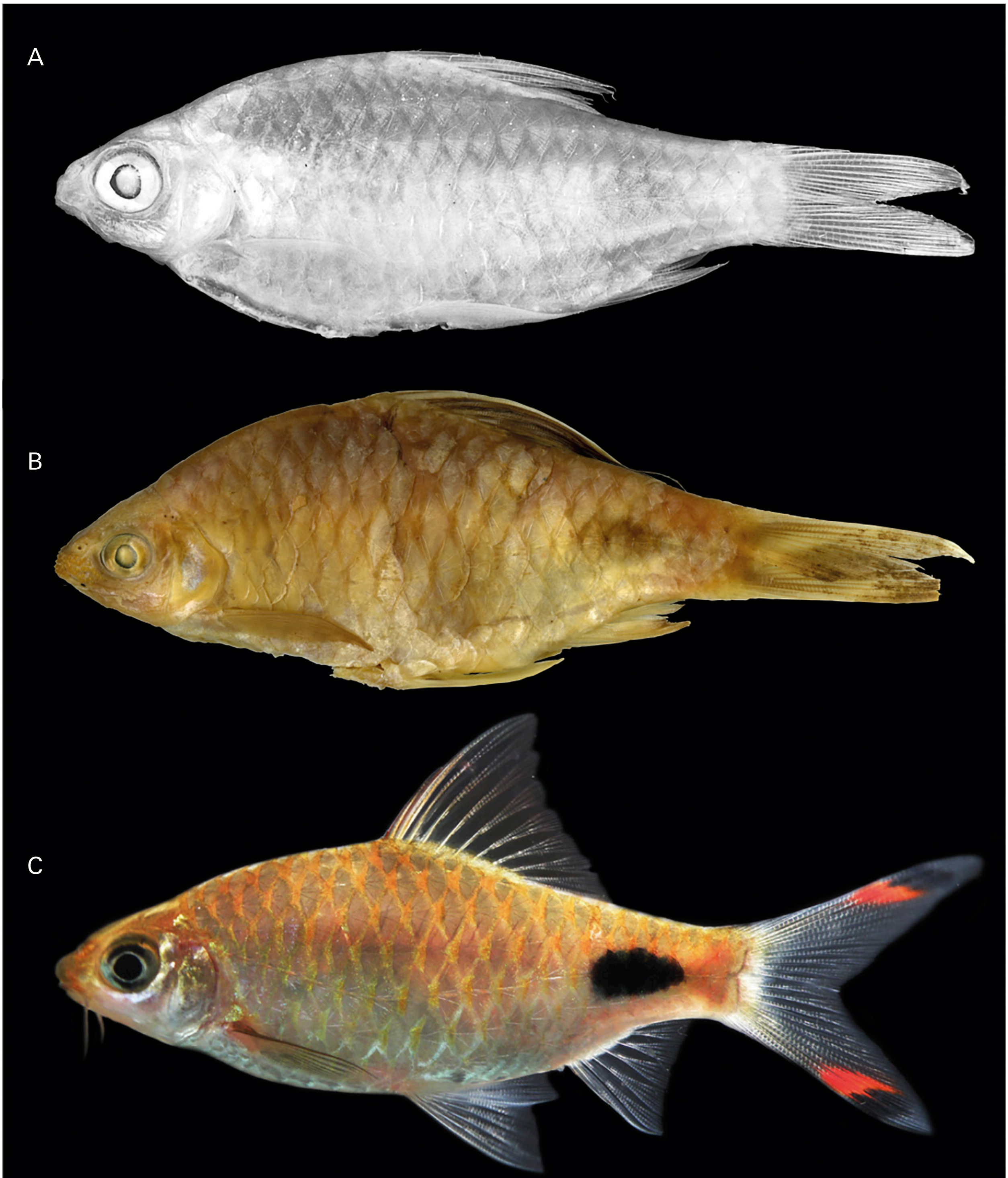

Fig. 8. *Dawkinsia lepida* in preservative, (A) syntype, BMNH 1868.10.27.22, subadult, 44.4 mm SL, coll. F. Day, Bhavani River at Mettapolliam (=Mettupalayam), Tamil Nadu, India; (B) Day's material, adult male, BMNH 1889[1].2.1.672, adult, 83.4 mm SL, coll. F. Day, Bowany (Bhavani) River, Tamil Nadu, India; (C) topotype in life, BNHS FWF 1023, male, Bhavani River, Mettupalayam, Coimbatore, Tamil Nadu, India.

fin origin, covering 15^{th}(4) to 18^{th}(4) scales of lateral line. Dorsal, anal, pectoral and pelvic fins hyaline. Caudal fin dusky, with subdistal elongate black band on each lobe with maximum length of about half of eye diameter, proximally bordered in white towards middle of tips of caudal-fin lobes; caudal-fin tips white.

In life (see Fig. 8C), deep brown above lateral line, darker on dorsal side of head and body. Snout dark brown. Iris black. Infraorbital and opercular region covered with iridescence. Dorsal, pectoral, pelvic, anal and caudal fins hyaline. Caudal-peduncle blotch as described for preserved specimens. Subdistal elongate black band proximally bordered by elongate red band towards middle of tips of caudal-fin lobes. Caudal-fin tips hyaline.

Comparison. Adults of *Dawkinsia lepida* can be distinguished from adults of its newly described congener, *D. austellus* by the following characters: snout long, pointed, protruding over upper lip (vs. short, blunt, does not extend over upper lip); maxillary barbel long, reaching posterior margin of eye, 34.2 – 37.2% of HL (vs. short barbel, not reaching posterior margin of eye, 10.2 – 17.6% of HL); 17 – 18 pre-anal scales (vs. 14); caudal-peduncle blotch short, narrow, covering 14th to 18th scales of lateral line (vs. elongated, broad, caudal-peduncle blotch, consisting of 4-5 diamond-shaped black markings with light middle, covering 13th to 19th lateral line scales). *Dawkinsia lepida* differs from *D. apsara* by, absence of kaadige blotch (vs. kaadige blotch broad, extending over infraorbital and opercular bones); last unbranched and 1st and 2nd branched dorsal-fin rays filamentously elongated (vs. dorsal fin without filamentously extended rays); maxillary barbel long, reaching posterior margin of eye, 34.2 – 37.2% of HL (vs. short barbel, not reaching posterior margin of eye, 7.3 – 22.6% of HL); in life no pigment on lateral line scale row (vs. deep scarlet dotted line running along lateral line scale row). *Dawkinsia lepida* also differs from *D. assimilis* by, 20 lateral line scales (vs. 21); 2 scales between lateral-line scale row and pelvic-fin origin (vs. 2½ scales); maxillary barbel long, 34.2 – 37.2% of HL (vs. short, 16.6 – 31.6% of HL).

Furthermore, *D. lepida* differs from its distant congeners of the 'filamentosa' group by having an inferior mouth (vs. terminal mouth in *D. crassa*, or subterminal mouth in *D. exclamatio*, *D. filamentosa* and *D. rohani*). *Dawkinsia lepida* also differs from *D. arulius*, *D. rubrotincta*, *D. srilankensis* and *D. tambraparniei* by having only a caudal-peduncle blotch (vs. anterior and posterior dorsal blotches or bands in front of caudal-peduncle blotch).

Genetic distances. *Dawkinsia lepida* differs from its congeners with a genetic distance of 3.2 – 8.4% for cox1 and 4.7 – 8.6 % for cyt *b* genes. *Dawkinsia lepida* also genetically differs from all other species of the "filamentosa" group by 13.3 – 16.1% in cox1 and 12.4 – 20.2% in cyt *b* genes.

Common name. Lepida Barb. The common name is derived from the specific epithet.

Distribution. *Dawkinsia lepida* is currently known from its type locality, the east-flowing Bhavani River, a tributary of the Cauvery river system in Tamil Nadu, and also from two west flowing rivers of Kerala viz. Muvattupuzha and Chalakudy (Fig. 1b).

Habitat and ecology. *Dawkinsia lepida* occurs in deep pools and in the main river channel with sluggish water current, having large boulders and gravels as substrate. Co-occurring fishes include members of family Cyprinidae: *Haludaria* sp., *Osteochilichthys* sp., *Pethia* sp., *Dawkinsia austellus* and *D. filamentosa*.

Dawkinsia crassa sp. nov.

ZOOBANK urn:lsid:zoobank.org:act:FABF89FD-42BD-46D1-8224-6ABA8DDF3CAD

(Fig. 9A – B)

Holotype. BNHS FWF 1015, 60.1 mm SL, male; India: Karnataka, Nethravati River, Dharmasthala, 12°57'57.52"N, 75°22'12.14"E, 83 m a.s.l., coll. N. Sood, 20th June 2019.

Paratypes. BNHS FWF 1016, 1, 67.8 mm SL, male; same data as holotype. — BNHS FWF 771, 1, 60.0 mm SL, male; India: Karnataka, Nethravati River, Dharmasthala, 12°57'57.52"N, 75°22'12.14"E, 83 m a.s.l., coll. V.K. Anoop, 7th February 2018. — BNHS FWF 1039, 1, 58.0 mm SL; India: Karnataka: Kumardhara River, Coorg, 12°27'25.20"N, 75°42'57.60"E, 83 m a.s.l., coll. N. Dahanukar, R. Raghavan, A. Ali and S. Philip, 11th May 2013. — KUFOS.18.02.07, 1, 57.5 mm SL, male; India: Karnataka: Nethravati River, Dharmasthala, 12°57'57.52"N, 75°22'12.14"E, 83 m a.s.l., coll. N. Sood, 20th June 2019.

Additional material. BNHS FWF 1038, 1; India: Karnataka, Sullya, Kumaradhara, 12°33'32.4"N 75°22'51.6"E, coll. J.D.M. Knight, 17th August 2014.

Diagnosis. *Dawkinsia crassa* can be distinguished from all congeners by the following combination of characters: 20 lateral line scales; 10 – 11 pre-pelvic scales; 15 – 16 pre-anal scales; 4½ scales between dorsal-fin origin and lateral-line scale row; 2½ scales between lateral-line scale row and pelvic-fin origin; short pectoral and pelvic fins, when adpressed, not reaching the level of pelvic and anal fin origin, respectively; dorsal fin originating over 6th lateral line scale, mid-way between snout tip and caudal-fin base; dorsal fin without any filamentously extended rays; maxillary barbel moderately sized, reaching vertical line through anterior half of eye, 7.0 – 13.5% of HL; wide, terminal mouth, corner of mouth reaching vertical line through posterior nostril and anterior margin of eye; big eye, 28.6 – 30.3% of HL; caudal-peduncle blotch short, oval, covering 13th to 17th scales of lateral line.

Description. For general shape and appearance see Figure 9A – B. Morphometric and meristic data for holotype and four paratypes are provided in Table 3.

Body elongate, deep, its length 2.6 – 2.7 times depth; head and body compressed laterally; pre-dorsal contour convex, humped posterior to nape, steadily rising to dorsal-fin origin, thereafter sloping down towards caudal-fin base; ventral profile convex, rounded up to base of anal fin, thereafter sloping down sharply up towards caudal-fin base. Snout length equal (1.1 times of) of eye diameter. Eye large, medially positioned between snout tip and posterior margin of operculum, diameter lesser than interorbital width. Mouth large, terminal, diagonal in position, U-shaped in ventral view, corner of mouth reaching vertical line through posterior nostril. Rostral

Fig. 9. *Dawkinsia crassa* sp. nov., (A) holotype in preservative, BNHS FWF 1015, male, 60.1 mm SL and (B) paratype, male, BNHS FWF 771, 60.0 mm SL, from Nethravati River, Karnataka, India.

fold present, overhanging posterior part of upper lip; jaws covered by a horny sheath. Lips smooth, thin, not interrupted. Maxillary barbel present.

Dorsal fin originates over seventh lateral line-scale, one scale anterior to pelvic-fin origin, closer to tip of snout than to base of caudal peduncle; dorsal-fin length equal of head length; posterior margin of dorsal fin concave, not extending beyond vertical line through middle of anal fin. Dorsal fin with 2 supernumerary and one serially associated unbranched ray and 8 branched rays. Pectoral fin with one simple and 10 (5) branched rays. Pectoral fin short, when adpressed not reaching pelvic-fin origin, leaving 2 scale wide gap in-between. Pelvic fin short, when adpressed not reaching anal-fin origin. Anal fin with 2 supernumerary and one serially associated unbranched ray and 5 branched rays; distal margin of anal fin concave. Caudal peduncle deep, its depth 68–98% of its length. Lateral line complete, with 20(5) perforated scales, curving ventrally up to 14th scale with ventral most point of curvature at 8th scale then running almost straight to middle of caudal-fin base. Caudal fin deeply forked, lobes measuring almost two thirds of total fin length, tips pointed. Principal caudal-fin rays 6 + 7(1) or 6 + 8(4); procurrent rays 5 + 6(5). Scales between lateral line and dorsal fin origin 4½(5); scales between lateral line and pelvic fin origin2½ (5); pre-dorsal scales 7(2) or 8(3); pre-pelvic scales 10(2) or 11(3); pre-anal scales 15(1) or 16(4); circumpeduncular scales 12(5). Pelvic axillary scale large, half the length of adpressed pelvic fin.

Coloration. Adult specimens in formalin, dark brownish on back; snout, head, dorsum and lower lip dark brown; infraorbital and opercular region pale white, studded with sparsely arranged melanophores; lower head, chest and abdomen uniformly white in colour (Fig. 9A). Iris white. Each body scale margined with sparsely arranged melanophores at base. Small, oval caudal-peduncle blotch, a scale high at highest point originate posterior to anal-fin origin, covering 13th to 17th (5) scales of lateral line. Dorsal, anal, pectoral and pelvic fins hyaline. Caudal fin dusky, darker at base, with subdistal elongate black band

Table 3. Biometric data of *Dawkinsia crassa* type material and *Dawkinsia filamentosa* topotypic material.

Characters	***Dawkinsia crassa***			***Dawkinsia filamentosa***	
	Holotype	Paratypes (n=4)		Topotypes (n=7)	
		Mean (sd)	Range	Mean (sd)	Range
Morphometrics					
Total length (mm)	79.7	81.1 (2.3)	78.7–84.1	112.1 (7.0)	104.0–120.2
Standard length (SL, mm)	60.1	60.7 (4.9)	57.5–67.8	87.1 (5.5)	80.4–92.7
%SL					
Head length (HL)	27.3	28.4(1.3)	26.9–30.1	27.1 (1.0)	26.0–28.8
Post-orbital head length	11.5	11.4(0.6)	10.6–11.9	12.1 (0.6)	11.3–13.0
Head depth	21.8	22.4(0.9)	21.3–23.6	21.1 (0.9)	20.1–22.3
Head width	16.8	16.1(0.6)	15.4–16.9	15.6 (0.7)	14.6–16.6
Body depth	37.7	36.5(1.7)	34.9–38.7	34.6 (1.8)	31.8–37.7
Body width at dorsal-fin origin	15.8	14.6(0.9)	13.3–15.4	15.4 (2.0)	11.9–17.9
Body width at anal-fin origin	10.9	10.3(0.4)	9.8–10.6	11.0 (1.3)	8.9–12.8
Pre-dorsal distance	44.4	52.2(4.5)	45.5–54.8	46.6 (1.4)	43.9–48.2
Post-dorsal distance	86.6	45.2(22)	32.5–78.2	83.0 (1.8)	80.5–85.2
Dorsal to hypural distance	56.8	55.5(2.7)	53.7–59.5	55.5 (1.1)	54.2–57.4
Pre-pelvic distance	48.8	53.7(3)	50.8–56.5	49.9 (0.7)	48.6–50.9
Pre-anal distance	71.3	76.8(3.8)	72.0–80.9	72.5 (1.0)	70.8–73.7
Pre-pectoral distance	26.8	28.8(1.7)	26.7–30.6	27.2 (0.9)	26.1–28.5
Length of last unbranched dorsal fin ray	28.2	28(1.7)	25.6–29.5	26.0 (2.3)	23.2–29.9
Longest filamentous extension of dorsal fin rays	28.2	28.3(1.1)	27.2–29.5	38.3 (11.5)	24.8–51.7
Length of dorsal-fin base	20.1	19.5(1.5)	17.4–21.2	18.1 (1.4)	15.9–19.8
Pectoral-fin length	22.3	21.6(0.8)	20.5–22.3	20.8 (0.4)	20.2–21.3
Anal-fin depth	17.5	16.9(0.5)	16.1–17.3	16.4 (0.7)	15.3–17.3
Caudal-peduncle length	19.1	17.1(1.9)	15.4–19.6	18.9 (1.6)	16.7–20.6
Caudal-peduncle depth	13.9	15.6(1.6)	13.4–17.2	13.6 (0.6)	12.6–14.5
% HL					
Post-orbital head length	42.0	40.1(1.1)	39.5–41.7	44.7 (1.5)	43.0–47.1
Head depth	80.0	79(3.2)	75.0–82.9	78.1 (3.9)	73.1–84.8
Head width	61.7	56.7(1.8)	54.6–59.0	57.6 (1.9)	54.1–59.8
Snout length	31.2	30.8(1.7)	28.8–33.0	28.4 (2.0)	26.3–31.5
Eye diameter	28.9	32.3(3.5)	28.6–36.0	27.9 (2.5)	24.8–31.3
Internarial width	20.3	26.3(9)	20.5–39.5	23.3 (1.7)	21.3–25.5
Inter orbital width	39.0	35.1(8)	23.1–40.1	40.0 (1.9)	36.4–42.0
Maxillary barbel length	13.5	9.9 (2.7)	7.0–13.5	7.3 (2.0)	3.1–9.1
Meristics					
Lateral line series scales	20		20		23–24
Transverse row scales	4½/1/2½		4½/1/2½		4–4½/1/2½
Pre-dorsal scales	7		7–8		7–8
Pre-pelvic scales	10		10–11		10
Pre-anal scales	16		15–16		16–17
Circumpeduncular scales	12		12		12
Dorsal-fin ray	ii-i-8		ii-i-8		ii-i-8
Pectoral-fin ray	i-10		i-10		i-13
Pelvic-fin ray	i-8		i-8		i-8
Anal-fin ray	ii-i-5		ii-i-5		ii-i-5
Caudal-fin ray (procurrent)	5+6		5+6		
Caudal-fin ray (principal)	6+7		6+7–8		8–9+8

on each lobe with maximum length of about half of eye diameter, proximally bordered in white towards middle of tips of caudal-fin lobes; caudal-fin tips white.

In life (Fig. 9B), deep olive above lateral line, darker on dorsal side of head and body. Mature males with iridescence over opercular bones, cheek, and on side of body. Snout deep olive. Dorsal, pelvic and anal fins with reddish tinge; pectoral fins hyaline; caudal fin pale yellow. Caudal-peduncle blotch as described for preserved specimens. Subdistal elongate black band proximally bordered by elongate red band towards middle of tips of caudal-fin lobes. Caudal-fin tips hyaline.

Comparison. Adults of *Dawkinsia crassa* can be distinguished from adults of its genetically closest congener *Dawkinsia exclamatio* (Pethiyagoda & Kottelat, 2005) and *Dawkinsia rohani* (Rema Devi *et al*., 2010), by the following characters: terminal mouth (vs. subterminal mouth); caudal-fin lobes with subdistal elongate black band (vs. no band on caudal-fin lobes); caudal-peduncle blotch small, oval, covering 13th to 17th scales of lateral line (vs. elongated, striped, covering 13th to 20th lateral line scales in *D. exclamatio* and 12th to 23rd lateral line scales in *D. rohani*).

In general appearance, *Dawkinsia crassa* looks similar to *D. filamentosa* but shows morphometric differences in characters such as, post-dorsal distance and post-orbital head length (Table 3). *Dawkinsia crassa* further differs from *D. filamentosa* by having 20 lateral line scale (vs. 21 – 24 in widely distributed populations), caudal-peduncle blotch covering 13th to 17th scales of lateral line (vs. covering 17th to 19th lateral line scales), dorsal fin without filamentously extended rays (vs. dorsal fin with filamentously extended 2nd to 5th branched rays).

Dawkinsia crassa differs from *D. arulius*, *D. rubrotincta*, *D. tambraparniei* and *D. srilankensis* by having only a caudal-peduncle blotch (vs. anterior and posterior dorsal blotches or bands in front of caudal-peduncle blotch).

Furthermore, *D. crassa* differs from its distant congeners of ‘assimilis’ group, *D. apsara*, *D. assimilis*, *D. austellus* and *D. lepida* by having, terminal mouth (vs. inferior mouth) and 2 supernumerary dorsal-fin rays (vs. 3 supernumerary rays).

Genetic distances. *Dawkinsia crassa* differs from its congeners of ‘filamentosa’ group by a genetic distance of 2.0 – 5.6% for cox1 and 3.4 – 7.4% for cyt *b* genes. *Dawkinsia crassa* also differs from all other species of the ‘assimilis’ group by a genetic distance of 14.1 – 16.3% in cox1 and 16.1 – 17.2% in cyt *b* genes.

Etymology. Species epithet ‘*crassa*’ is Latin for ‘round/thick/fat’ and refers to the rounded appearance of the species. Species epithet is an adjective.

Common name. Rounded Filament Barb. The common name refers to the etymology of the species name.

Distribution. *Dawkinsia crassa* is currently known only from the upper catchment areas of west flowing Nethravati River of Karnataka, in the Central part of Western Ghats, India (Fig. 1a).

Habitat and ecology. *Dawkinsia crassa* occurs in the main river channel with big ponds of sluggish water current and with mud, sand, large boulders and gravels as substrate. *Dawkinsia crassa* has been recorded in sympatry with *D. assimilis*. Additional co-occurring fishes at the type locality of *D. crassa* included the cyprinids *Devario malabaricus*, *Rasbora dandia*, *Haludaria* sp., *Hypselobarbus* sp., *Osteochilichthys* cf. *nashii*, *Pethia* sp. and the bagrid *Mystus* sp.

Discussion

While investigating the systematics of South Asian fishes referred to as the ‘catch all’ genus *Puntius* s.l., Pethiyagoda *et al.* (2012) erected a new genus *Dawkinsia* for the species of the *Puntius “filamentosa”* complex. Nine species are now known in this genus, which is endemic to peninsular India and Sri Lanka: *Dawkinsia arulius*, *D. assimilis*, *D. exclamatio*, *D. filamentosa*, *D. rohani*, *D. rubrotincta*, *D. singhala*, *D. srilankensis* and *D. tambraparniei*. Our comprehensive taxonomic study of the genus *Dawkinsia* using specimens collected from throughout the known distribution range, including material from areas not covered in previous studies, revealed unidentified, cryptic species diversity. Our accompanying molecular phylogenetic investigation using concatenated cox1 and cyt *b* genes, demonstrated the presence of two species groups, the ‘filamentosa’ and ‘assimilis’ species groups.

Jerdon (1849) described *Systomus assimilis* from “a river in Canara” (currently in the southern region of the state of Karnataka). Jerdon (1849) described *Systomus assimilis* as “very closely allied to the last [while referring to the *D. filamentosa*], the same general proportions, number of scales &c.; 1st, 2nd, 3rd and 4th soft rays of the dorsal prolonged, the 3rd the longest, the 4th the shortest, and the rest rapidly diminishing to the 7th; second dorsal spine short, not more than half the length of the membrane; green above, reddish silvery beneath; black spot on the tail more diffuse than in the last [comparing with *D. filamentosa*]. Cheeks golden orange; dorsal fin with the membrane yellow; 2nd dorsal spines red, other rays blueish. Caudal pale reddish yellow, with a bright red spot at each tip, and black at the base and sides. Pectoral rosy, ventral and anal transparent, tinged black at the base—D. 10, A. 7 &c. I procured this fish in a river in Canara. It appears to differ from *S. filamentosus* [now *D. filamentosa*] in the formation of the dorsal fin, colors &c.” Thus Jerdon (1849) diagnosed *D. assimilis* from *D. filamentosa* solely based on differences in the dorsal-fin ray extensions and colour pattern. Pethiyagoda & Kottelat (2005a) studied the Nethravati River (which traverses the erstwhile Canara region) population and assigned the name *D. assimilis* to it, as they matched Jerdon’s description. However, Pethiyagoda & Kottelat (2005a) mentioned that they examined only subadult topotypes (no adult topotypes were collected) which differ from Jerdon’s description only with respect to the elongation of dorsal-fin rays. In this study, we examined the adult topotypes (Fig. 4A–B) of *D. assimilis*, which show the extensions of the dorsal fin rays, especially the 1st to 4th branched fin rays, consistent with Jerdon's description of *D. assimilis*. However, the widespread *D. assimilis* comprises genetically and morphologically distinct species that are more narrowly distributed. Based on both morphology and genetic analysis we not only resurrect *Puntius* (*Capoeta*) *lepidus* from its synonymy with *D. assimilis*, we also found two undescribed species among the 'assimilis' species group. Considering the cryptic diversity in the 'assimilis' group and the fact that there is no name bearing type, it is inevitable to fix the identity of Jerdon's *Systomus assimilis* (now *Dawkinsia assimilis*), and to do so we designate a neotype with formal species description.

DAY (1868) described *Puntius* (*Capoeta*) *lepidus* from the east-flowing "Bowany River at Mettapoliam.", which is now the Bhavani River, a tributary of the Cauvery River system. DAY (1878) placed *D. lepida* in the synonymy of *P. mahecola*. However, *P. mahecola* is a distinct species, presumably the sister species of *Puntius amphibius* (Valenciennes, 1842), both of which do not closely resemble any of the filament barbs of the 'assimilis' or 'filamentosa' species groups (also see PETHIYAGODA & KOTTELAT, 2005b). Based on its inferior mouth and prolonged maxillary barbel, PETHIYAGODA & KOTTELAT (2005b) tentatively referred *D. lepida* to the synonymy of *D. assimilis*. As suggested by PETHIYAGODA & KOTTELAT (2005b), we confirmed that *D. lepida* belongs to the 'assimilis' species group; however, *D. lepida* is a distinct species which differs from *D. assimilis* by a number of morphological characters, and, based on recently collected topotypes, shows a genetic distance of 3.2 – 3.7% in cox1 and 4.7 – 5.8% in cyt *b* genes from topotyic *D. assimilis* (see the comparison for *D. lepida*).

DUNCKER (1912) described *Barbus singhala* from the Yakvella [i.e. Wakwella], Gin River basin, near Galle, Sri Lanka. Along with description of *Barbus singhala* (now *Dawkinsia singhala*), he also recorded *D. filamentosa* from Sri Lanka. However, he did not realise that the type series of *D. singhala* consisted of juveniles with the juvenile colour pattern, which is strikingly different to that of the adult. *Dawkinsia singhala* has confused many previous authors, probably because it was described based on juvenile specimens and was subsequently referred to under several names including *P. mahecola* by DAY (1878), as *D. sinhala* (sic) by DERANIYAGALA (1930), a subspecies of *Haludaria melanampyx* (DAY, 1865), as *P. melanampyx singhala* by DERANIYAGALA (1949) and a synonym of *D. filamentosa* by MUNRO (1955), SENANAYAKE (1980) and PETHIYAGODA (1991). However, PETHIYAGODA & KOTTELAT (2005b) considered *D. singhala* as a distinct species endemic to Sri Lanka.

In the current study, we found that Indian populations of *D. filamentosa* and Sri Lankan *D. singhala* formed a monophyletic group with *D. singhala* specimens nested within the larger clade of *D. filamentosa*, suggesting their conspecificity. It is essential to note that sequences of *D. singhala* available in GenBank are short. However, sequences AY925192 and AY925193, which align with 5' end, and sequences JF793617 and AY708256, which align with 3' end of the cyt *b* gene sequences, are non-overlapping. So, by concatenating the sequences, about 930 bases of cyt *b* gene was recovered. These concatenated sequences are marginally (0.3 – 1.0%) different from the widely distributed *D. filamentosa*. Given the low genetic distance, we hereby treat *D. singhala* as a synonym of *D. filamentosa*.

PETHIYAGODA & KOTTELAT (2005a) diagnosed *D. singhala* based on characters such as no distinct marks on caudal fin lobes or on body in advance of anal-fin origin; length of maxillary barbel less than ¼ eye diameter; mouth subterminal. We found the characters mentioned by PETHIYAGODA & KOTTELAT (2005b), except the absence of distinct marks on caudal fin lobes, are also present in *D. filamentosa*; suggesting that *D. singhala* is not morphologically distinct from *D. filamentosa*.

While the 'assimilis' species group is endemic to the southern region of the Western Ghats of India and comprises four species, viz. *D. assimilis*, *D. lepida*, *D. apsara* and *D. austellus*; the 'filamentosa' species group is widely distributed across peninsular India (Western and Eastern Ghats) and Sri Lanka and is more diverse, comprising eight species: *D. crassa*, *D. arulius*, *D. exclamatio*, *D. filamentosa*, *D. rohani*, *D. rubrotincta*, *D. srilankensis* and *D. tambraparniei*. With the descriptions of three new species, *D. apsara*, *D. austellus*, and *D. crassa*, the synonymy of *D. singhala* with *D. filamentosa* and the resurrection of *D. lepida* from synonymy, the number of valid species of *Dawkinsia* is 12, but will no doubt increase once new collections are made and additional museum holdings are studied.

Key to the genus *Dawkinsia*

1. Adults with horizontally elongated blotch on caudal peduncle **2**
– Adults with two or more blotches on body **8**
2. Mouth inferior **3**
– Mouth not inferior **6**
3. 2 scales between lateral line scale row and pelvic-fin origin **4**
– 2½ scales between lateral line scale row and pelvic-fin origin .... ***D. assimilis***
4. Caudal peduncle blotch reaching up to 19th or 20th lateral line scale .... ***D. apsara***
– caudal peduncle blotch reaching up to 17th or 18th lateral line scale **5**
5. 14 pre-anal scales .... ***D. austellus***
– 17 – 18 pre-anal scales .... ***D. lepida***
6. Mouth terminal .... ***D. crassa***
– Mouth sub-terminal **7**
7. Caudal peduncle blotch not reaching caudal-fin base .... ***D. filamentosa***
– Caudal peduncle blotch reaching caudal-fin base .... ***D. rohani***

8. Two blotches on body; W or M shaped blotch below dorsal fin in addition to elongated caudal peduncle blotch .... ***D. exclamatio***
– Three blotches on body **9**
9. Mouth sub-terminal **10**
– Mouth inferior .... ***D. srilankensis***
10. Well defined blotches two scale high and three scales wide on body .... ***D. rubrotincta***
– large diffused blotches 3–4 scales high on body **11**
11. Small blotch on posterior base of dorsal-fin .... ***D. tambraparniei***
– No small blotch on posterior base of dorsal-fin .... ***D. arulius***

Materials Examined

Dawkinsia arulius: BNHS FWF 765, 1, 52.6 mm SL; India: Karnataka: Shivasamudram, Gaganchukki Falls, 12°17′55.63″N, 77°10′11.32″E, 486m a.s.l.; U. Katwate, R. Raghavan and N. Dahanukar, on 1st March 2014. — BNHS FWF 1026, 1, 49.3 mm SL; India: Karnataka, Srirangapattanam, 12°25′15.6″N 76°40′40.8″E, col. J. D.M. Knight, 25th April 2014.

Dawkinsia exclamatio: topotypes, BNHS FWF 1019–1020, 2, 75.5–93.2 mm SL; India: Kerala: Kallada River, downstream of Tenmalai Dam, 08°57′20.88″N, 77° 4′0.59″E, 84m a.s.l.; U. Katwate, J. Tharian and S. Raj, on 19th June 2019. — ZSI/SRS F5520, 1, 70.0mm SL; India: Kerala, Kallada River drainage, Varkala (8°53′N, 76°42′E), coll. P.T. Cherian, 03rd April 1998.

Dawkinsia filamentosa: topotypes, BNHS FWF 735–741, 7, 80.4–92.7 mm SL; India: Kerala, Vembanad Lake, 09°54′35″N, 76°20′34″E, 1–2m a.s.l., coll. U. Katwate and F. Baby, 29th May 2014. — topotypes, BNHS FWF 786–787 (diaphanized specimens), 2, 39.2–44.6 mm SL; India: Kerala, Vembanad Lake, 09°54′35″N, 76°20′34″E, 1–2m a.s.l., coll. U. Katwate and F. Baby, 29th May 2014. — BNHS FWF 742–745, 4, 70.9–87.1 mm SL; India: Kerala, Kuttanad, 09°54′40.57″N, 76°19′1.02″E, 6m a.s.l., coll. U. Katwate and Anoop V.K., 05th June 2017. — BNHS FWF 749 & 752, 2, 48.3–54.2 mm SL; India: Kerala, Muvattupuzha River, 09°59′09.90″N, 76°35′04.90″E, 123 m a.s.l., coll. U. Katwate and F. Baby, 31st May 2014. — BNHS FWF 766–767, 2, 27.3–31.8 mm SL; India: Tamil Nadu, Yercaud, Yercaud Lake, 11°46′56.42″N, 78°12′35.68″E, 1354 m a.s.l., coll. M.E. Ramanujam, 07th March 2014. — BNHS FWF 731, 1, 34.4 mm SL; India: Goa, Zuari River, Sanguem, 15°14′02.40″N, 74°10′55.20″E, 72 m a.s.l., coll. U. Katwate, N. Dahanukar and M. Paingankar, 10th August 2013. — BNHS FWF 732, 1, 28.8 mm SL; India: Karnataka, Aghanashini River, Nanikatta, Siddapur-Sirsi Road, first stream after Jog Fall, 14°29′54.11″N, 74°51′53.30″E, 583 m a.s.l., coll. P. Kumkar, 30th May 2014. — BNHS FWF 733, 1, 26.8 mm SL; India: Karnataka, Aghanashini River, Nanikatta, Siddapur-Sirsi Road, first stream after Jog Fall, 14°29′54.11″N, 74°51′53.30″E, 583 m a.s.l., coll. P. Kumkar, 1st July 2014. — BNHS FWF 734, 1, 34.4 mm SL; India: Karnataka, Nagodi stream, Sharavati River, Nagodi Village, 13°54′58.00″N, 74°53′21.00″E, 742 m a.s.l., coll. U. Katwate, P. Kumkar, N. Dahanukar and R. Raghavan, 30th June 2014. — BNHS FWF 727, 1, 31.8 mm SL; India: Maharashtra, Sindhudurg District, Gad River, Bandiwade, 16°08′60.00″N, 73°32′60.00″E, 64 m a.s.l., coll. U. Katwate and S. Rane, 15th September 2013. — BNHS FWF 728–729, 2, 67.1–70.8 mm SL; India: Maharashtra, Ratnagiri District, Bav River, Sakharpa, 17°06′06.08″N, 73°37′16.11″E, 506 m a.s.l., coll. U. Katwate and N. Dahanukar, 13th June 2013. — BNHS FWF 718–719, 2, 68.0–91.5 mm SL; India: Maharashtra, Raigad District, Savitri River, Mahad, 18°05′35.52″N, 73°27′06.05″E, 44 m a.s.l., coll. U. Katwate and N. Dahanukar, 27th December 2015. — BNHS FWF 720–722, 3, 70.5–92.4 mm SL; India: Maharashtra, Ratnagiri District, Jagabudi River, Bijaghar, Khed, 17°41′35.53″N, 73°32′47.15″E, 85 m a.s.l., coll. U. Katwate, N. Dahanukar and M. Paingankar, 22nd March 2014. — BNHS FWF 716–717, 2, 65.9–101.6 mm SL; India: Maharashtra, Raigad District, Kal River, Mangaon, 18°13′59.20″N, 73°17′06.98″E, 8 m a.s.l., coll. U. Katwate and C. Katwate, 05th July 2014. — BNHS FWF 1021, 1, 23.5 mm SL; India: Karnataka, Nettoor 13°54′57.6″N 74°53′20.4″E, coll. N. Dahanukar, U. Katwate and P. Kumkar, 30th July 2014. — BNHS FWF 1027, 1, 86.5 mm SL; India: Kerala, Karuvannoor, 10°23′31.2″N 76°13′30.0″E, coll. R. Raghavan, 3rd March 2013. — BNHS FWF 1028, 1, 72.5 mm SL; aquarium trade, coll. J.D.M. Knight, 1st April 2012. — KUFOS.19.06.22 & 23, 2; India: Karnataka, Sita River, 13°28′44.4″N 75°00′18.0″E, coll. N. Sood, 21st June 2019.

Dawkinsia rohani: Holotype, ZSI/SRS F.8336, 1, 69.0mm SL; India: Tamil Nadu: Kanyakumari District, Kodayar River drainage, near Mayilar, KWS, 08°30′18.72″N, 77°18′05.40″E, 135m, coll. S. Prabhakaran, 27th March 2009. — BNHS FWF 1029, 1, 65.3 mm SL; India: Tamil Nadu, Manavalakurchi near Nagercoil, 8°08′38.4″N 77°18′28.8″E, coll. J. D. Marcus Knight, 6th May 2014. — BNHS FWF 1030 – 1033, 4, 48.5–69.1 mm SL; aquarium trade, coll. J.D.M. Knight, 23rd July 2014.

Dawkinsia rubrotincta: topotypes, BNHS FWF 762–764, 3, 50.5–59.9 mm SL; India: Kerala: Wayanad, Muthanga, Kabini River, 11°40′41.20″N, 76°22′06.28″E, 856 m a.s.l., V.K. Anoop., 23rd April 2017.

Dawkinsia tambraparniei: topotypes, BNHS FWF 759–761, 3, 36.3–65.9 mm SL; India: Tamil Nadu: Mukkudal, Tambaraparini River, 08°43′45.86″N, 77°31′2.84″E, 52 m a.s.l., V.K. Anoop., 20th September 2015. — BNHS FWF 1034, 1036 & 1037, 3; India: Tamil Nadu, Cheramadevi, Tirunelveli, 8°40′37.2″N 77°34′08.4″E, coll. J.D.M. Knight, 13th September 2013. — BNHS FWF 1035, 1; aquarium trade, coll. J.D.M. Knight, 1st April 2012.

Acknowledgements

This study would not have been possible if not for the help and support of various people who were involved in field surveys and/or provided materials, photographs and information – Ralf Britz (Naturhistorische Sammlungen Dresden, Germany), Rohan Pethiyagoda (Australian Museum, Sydney, Australia), Nikhil Sood (India Gills, Bangalore, India), Ashwin Rai, Ronald D'souza, Hiranya Sudasinghe (Postgraduate Institute of Science, University of Peradeniya, Sri Lanka), Fibin Baby (Conservation Research Group, St. Albert's College, Kochi, India), Anvar Ali (KUFOS, Kochi, India), Eric Ramanujam (Pitchandikulam Bioresource Center, Auroville), Pradeep Kumkar (Modern College, Pune, India), Mandar Paingankar (Government College, Gadchiroli, India), Chetana Katwate, Sanjay Molur and Priyanka Iyer (Zoo Outreach Organization, Coimbatore), and Siby Philip (Nirmalagiri College, Koothuparambu). UK thanks Deepak Apte, Director, and Rahul Khot, Curator, Bombay Natural History Society (BNHS), Mumbai, India for their help and support; the Student Conference on Conservation Science (SCCS-Cambridge), the Natural History Museum (NHM), London, United Kingdom and the Critical Ecosystem Partnership Fund

(CEPF) (CEPF-ATREEWGhats/SGP/WGSG186 – BNHS_FISHES through Western Ghats small grant program) for funding; Oliver Crimmen for support and curatorial assistance at NHM, London; Suresh Kumar and K. Ranjeet, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi, India for facilities provided; and Liju Thomas and Mruthuchitra V Mohan (Laboratory of Systematics and Germplasm Conservation, KUFOS, Kochi, India) for help with the laboratory work; JDMK thanks the Officer-In-Charge, Zoological Survey of India (ZSI), Southern Regional Centre, Chennai, India for the facilities provided. VKA thanks the Kerala State Biodiversity Board (KSBB), Government of Kerala for a PhD fellowship. RR thanks the Center for Aquatic Resource Management and Conservation (CARMAC), KUFOS, Kochi, India for funding. The authors thank two anonymous reviewers, Hiranya Sudasinghe and Ralf Britz for their critical comments and suggestions, which greatly improved the manuscript.

References

Ali, A., Dahanukar, N., Kanagavel, A., Philip, S. & Raghavan, R. (2013). Records of the endemic and threatened catfish, *Hemibagrus punctatus* from the southern Western Ghats with notes on its distribution, ecology and conservation status. *Journal of Threatened Taxa*, **5**, 4569 – 4578.

Altschul, S. F., Gish, W., Miller, W., Myers, E. W. & Lipman, D. J. (1990). Basic local alignment search tool. *Journal of Molecular Biology*, **215**, 403 – 410.

Chernomor, O., von Haeseler, A. & Minh, B.Q. (2016). Terrace aware data structure for phylogenomic inference from supermatrices. *Systematic Biology*, **65**, 997 – 1008.

Collins, R. A., Armstrong, K. F., Meier, R., Yi, Y., Brown, S. D. J., Cruickshank, R. H., Keeling, S. & Johnston, C. (2012). Barcoding and border biosecurity: identifying cyprinid fishes in the aquarium trade. *PLoS ONE*, **7**, e28381.

Dahanukar, N., Raut, R. & Bhat, A. (2004). Distribution, endemism and threat status of freshwater fishes in the Western Ghats of India. *Journal of Biogeography*, **31**, 123 – 136.

Day, F. (1865). On the fishes of Cochin, on the Malabar Coast of India. Part II. Anacanthini. *Proceedings of the Zoological Society of London*, **1865**, 286 – 318.

Day, F. (1868). On some new fishes from Madras. *Proceedings of the Zoological Society of London*, **1868**, 192 – 199.

Day, F. (1878). *The Fishes of India; being a Natural History of the Fishes known to inhabit the Seas and Fresh Waters of India, Burma and Ceylon*. London, Bernard Quaritch.

Deraniyagala, P. E. P. (1930). The Eventognathi of Ceylon. *Spolia Zeylanica*, **16**, 1 – 41.

Deraniyagala, P. E. P. (1949). Some vertebrate animals of Ceylon. *National Museum Pictorial Series*, **1**, 1 – 119.

Duncker, G. (1912). Die Süsswasserfische Ceylons. Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten, 2. Beiheft, *Mitteilungen aus dem Naturhistorischen Museum in Hamburg*, **29**, 241 – 272.

Edgar, R. C. (2004). muscle: multiple sequence alignment with high accuracy and high throughput. *Nucleic Acids Research,* **32**, 1792 – 1797.

Fricke, R., Eschmeyer, W. N. & Van der Laan, R. (eds) (2020). Catalog of Fishes: Genera, Species, References. Available from: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (accessed 31 March 2020)

Gouy, M., Guindon, S. & Gascuel, O. (2010). seaview version 4: a multiplatform graphical user interface for sequence alignment and phylogenetic tree building. *Molecular Biology and Evolution*, **27**, 221 – 224.

Hoang, D. T., Chernomor, O., Von Haeseler, A., Minh, B. Q. & Vinh, L. S. (2018). UFBoot2: improving the ultrafast bootstrap approximation. *Molecular Biology and Evolution*, **35**, 518 – 522.

Jerdon, T. C. (1849). On the fresh-water fishes of southern India. *Madras Journal of Literature and Science*, **15**, 302 – 346.

Kalyaanamoorthy, S., Minh, B. Q., Wong, T. K. F., von Haeseler, A. & Jermiin L. S. (2017). ModelFinder: fast model selection for accurate phylogenetic estimates. *Nature Methods*, **14**, 587 – 589.

Katwate, U., Paingankar, M. S., Jadhav, S. & Dahanukar, N. (2013). Phylogenetic position and osteology of *Pethia setnai* (Chhapgar & Sane, 1992), an endemic barb (Teleostei: Cyprinidae) of the Western Ghats, India, with notes on its distribution and threats. *Journal of Threatened Taxa*, **5**, 5214 – 5227.

Katwate, U., Kumkar, P., Raghavan, R. & Dahanukar, N. (2018). A new syntopic species of small barb from the Western Ghats of India (Teleostei: Cyprinidae). *Zootaxa*, **4434**, 529 – 546.

Kumar, S., Stecher, G. & Tamura, K. (2016). MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. *Molecular Biology and Evolution*, **33**, 1870 – 1874.

Maitra, S., Harikrishnan, M., Shibu, A. V., Sureshkumar, S., Ranjeet, K. & Nandan, S. B. (2018). Studies on temporal variations of exploited fishery resources and their trophic levels in a tropical estuary. *Regional Studies in Marine Science,* **22**, 61 – 69.

Menon, A. G. K. (1999). Check list – fresh water fishes of India. *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper*, **175**, 1 – 366.

Milne, I., Wright, F., Rowe, G., Marshal, D.F., Husmeier, D. & McGuire, G. (2004). topali: software for automatic identification of recombinant sequences within DNA multiple alignments. *Bioinformatics,* **20**, 1806 – 1807.

Munro, I. S. R. (1955). *The marine and freshwater fishes of Ceylon*. Canberra, Department of External Affairs.

Nei, M. & Kumar, S. (2000). Molecular *Evolution and Phylogenetics*. New York, Oxford University Press.

Nguyen, L. T., Schmidt, H. A., von Haeseler, A. & Minh, B. Q (2015). iq-tree: A fast and effective stochastic algorithm for estimating Maximum Likelihood phylogenies. *Molecular Biology and Evolution*, **32**, 268 – 274.

Pethiyagoda, R. & Kottelat, M. (2005a). A review of the barbs of the *Puntius filamentosus* group (Teleostei: Cyprinidae) of southern India and Sri Lanka. *Raffles Bulletin of Zoology*, **12**, 127 – 144.

Pethiyagoda, R. & Kottelat, M. (2005b). The identity of the south Indian barb *Puntius mahecola* (Teleostei: Cyprinidae). *Raffles Bulletin of Zoology*, **12**, 145 – 152.

Pethiyagoda, R. (1991). *Freshwater Fishes of Sri Lanka*. Colombo, Wildlife Heritage Trust.

Pethiyagoda, R., Meegaskumbura, M. & Maduwage, K. (2012). A synopsis of the South Asian fishes referred to *Puntius* (Pisces: Cyprinidae). *Ichthyological Exploration of Freshwaters*, **23**, 69 – 95.

Puillandre, N., Lambert, A., Brouillet, S. & Achaz, G. (2012). abgd, Automatic Barcode Gap Discovery for primary species delimitation. *Molecular Ecology*, **21**, 1864 – 1877.

Rambaut, A. (2009). FigTree, ver 1.4.3. Available online at: http://tree.bio.ed.ac.uk/software/figtree (accessed 09 February 2020)

Ronquist, F., Teslenko, M., Van Der Mark, P., Ayres, D. L., Darling, A., Höhna, S., Larget, B., Liu, L., Suchard, M. A. & Huelsenbeck, J. P. (2012). MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology*, **61**, 539 – 542.

Sabaj-Pérez, M. H. (2009). Photographic atlas of fishes of Guiana Shield, pp. 53 – 59 i*n*: Vari, R. P., Ferraris, C. J., Radosavljevic, A. & Funk, V. A. (eds) *Check List of the Freshwater Fishes of the Guiana Shield*. Washington D. C., Bulletin of the Biological Society of Washington.

Schneider, C. A., Rasband, W. S. & Eliceiri, K. W. (2012). NIH Image to ImageJ: 25 years of image analysis. *Nature Methods*, **9**, 671–675.
Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, **6**, 461–464.
Senanayake, F. R. (1980). *The Biogeography and Ecology of the Inland Fishes of Sri Lanka*. Davis, Department of Wildlife and Fisheries Biology, University of California.
Zhang, J., Kapli, P., Pavlidis, P. & Stamatakis, A. (2013). A general species delimitation method with applications to phylogenetic placements. *Bioinformatics,* **29**, 2869–2876.

Zoobank Registrations

at http://zoobank.org

This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the International Commission on Zoological Nomenclature (ICZN). The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information can be viewed through any standard web browser by appending the LSID to the prefix http://zoobank.org. The LSID for this publication is as follows:

urn:lsid:zoobank.org:pub:F6CF9F86-B10B-46B8-B871-D4C4DE834B49