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Revalidation of *Schizothorax chivae* Arunkumar & Moyon, 2016 from the Chindwin River basin, Northeastern India

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Abstract

Schizothorax chivae Arunkumar & Moyon, a cold-water cyprinid fish under family Cyprinidae, from Chiva River (Chindwin basin), Manipur, needs taxonomic validation as the authors did not registered in the research paper in Zoobank, a mandatory for online publication of journal as per ICZN electronic publication amendment (ICZN 2012: 1–7) in addition to articles 8.1.1–8.1.3 of ICZN (1999). The study on its type species from the museum specimens, the type species were found un-catalogued though mentioned in the research paper and there have been a lot of ambiguities in terms of its meristic and morphometric features. With fresh collection of specimens and the re-examination of type species, *Schizothorax chivae*" is redescribed here. The redescription is based on its morphological, meristic, and some of the osteological features. A drastic difference in morphometric and meristic data of the type species comparing to data from its original publication have been observed. Erratic representation of data creates more puzzle at the time of identification. Thus proper taxonomic procedure should be maintained at the time of identification and description of a species.

Keywords: *Schizothorax chivae*, redescription, Cyprinidae, Zoobank, re-examination

Introduction

Arunkumar & Moyon (2016) described a new species as *Schizothorax chivae* from Chindwin river basin of Manipur by distinguishing from its congeners of characters viz. lateral line scales, predorsal scales, scale rows between lateral line of base of dorsal fin and base of ventral fin respectively, in percentage of head length of interorbital space and snout length. *Schizothorax chivae* adapts in cold water bodies with an altitude of 236m above sea level (asl) as compared to other schizothorid fishes generally adapting to an altitude above 920m asl. The species needs a taxonomic validation as the authors did not registered the original research paper in Zoobank, a mandatory for online publication of journal as per ICZN electronic publication amendment (ICZN 2012: 1–7) in addition to articles 8.1.1–8.1.3 of ICZN (1999). The study on its type species for verification, the paratypes were un-catalogued though mentioned in the research paper and a lot of ambiguities have been revealed at the time of examination of type species in terms of its meristic and morphometric features. Attempts were made to collect species from its type locality but could not be found. However, two species from two different locality probably syntypes from the same river basin have been collected and studied for its taxonomic status. With this fresh collection of specimens and the re-examination of type species are deposited in the Manipur University Museum (NH/MUM), *Schizothorax chivae* is redescribed here through morphological, meristic, and some of the osteological features. The 5 paratypes have been

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registered in the same museum and its catalogue number is given here.

Material and methods

General counts and measurements follow Kottelat (2001). Measurements were made point to point with a dial calliper to the nearest 0.1 mm on the left side of the specimens whenever possible. Measurements of body parts were given as proportions of standard length (SL). Measurements of subunits of heads were given as proportions of dorsal head length (DHL) and lateral head length (LHL). Fin rays were counted under a stereozoom microscope and were confirmed through a cleared and stained specimens following Taylor & Van Dyke (1985). Vertebral counts and description of caudal complex were done from cleared and stained specimens following Sawada (1982). Freshly collected specimens were deposited in Manipur University Museum of Fish (MUMF). Gill rakerswere counted from the first left side of gill arch. The five paratypes have been registered in Manipur University Museum (NH/MUM).

Results

***Schizothorax chivae Arunkumar & Moyon*, 2016**

(Figure 1 A-D)

Material examined

50/NH/MUM**,** 174.6 mm SL, holotype, female**;** India: Manipur: Chandel district: Chiva River at Khongjon village (Chindwin Basin), 24^{0}15′3″N 94^{0}17′59″E, alt. 236 m above sea level; W. Alphonsa Moyon and party, 4 April, 2015. 51/NH/MUM, 5 exs., 104.5–149.5 mm SL, paratypes; data same as holotype. MUMF 2843, 103.8 mm SL, syntype; India: Manipur: Ukhrul district: Thoubal River upper reach at Hundung village (Chindwin basin); Abdul Hei, 10 December 2010. MUMF 18092, 101.9 mm SL, syntype; India: Manipur: Tengnoupal district: Okta River at Tengnoupal (Chindwin basin); Thangliankhai & Augustni, 10 February 2021. One specimen (MUMF 18092, 101.9 mm SL) was cleared and stained for osteology.

Diagnosis: *Schizothorax chivae* is distinguished from its congeners in having a dark brown stripe at caudal peduncle with a broad base at caudal-peduncle base from which tapering towards anterior reaching vertical to the level of middle of dorsal fin, a wide head (14.3–15.2% SL), 3 simple and 7½–8½ branched dorsal-fin rays, 2 simple and 5½ branched anal-fin rays, 15 branched pectoral-fin rays, 90–91 lateral line scales, 35–38 predorsal scales, 28 circumpeduncular scales row, first gill arch with 3+11 rakers, 11 anal-fin base scales, 16.5–17 transverse scale rows above lateral line, a long anal fin (20.0–23.6% SL) reaching caudal peduncle end when adpressed, and a wide interorbital distance (8.5–9.9% SL).

Description

A comparative morphometric data of *Schizothorax chivae* from its original description is shown in Table 1. Body moderately arched and elongate; predorsal region subcylindrical in cross section, slightly compressed (ratio of body depth to body width at dorsal-fin origin 0.9–1.5 times), thereafter compressed gently to posterior end of caudal peduncle. Body profound depth at dorsal-fin origin (21.6–24.7% SL). Dorsal profile arched to dorsal-fin origin then gently sloping down towards caudal peduncle. Ventral profile slightly arched; rounded chest and abdomen in cross section; more or less straight up to anal-fin base then slanting abruptly up to posterior of anal-fin base, thereafter more or less straight towards caudal-fin base. Head smooth and moderate; snout moderately compressed with 8–19 visible tubercles, rounded from dorsal view (blunt from lateral view); height less than length (ratio of head depth at nape to dorsal-head length and to lateral-head length 0.8–0.9 times and 0.7–0.8 times respectively). Mouth inferior, transverse and slightly arched; lips fleshy, continuous; upper and lower lip well developed, papillated. Rostrum and upper lip well demarcated with a deep groove, rostral caps lightly covering upper lip ventrally. Right and left labial fold of lower lip deeply incised, central labial shallow incision, papillated. Anterior margin of lower mandible covered with horny sheath, not sharp edge. Barbel two pairs, a short rostral and a bit longer maxillary barbel. Nostril closer to eye than tip of snout, a flap lip like structure partitioned between anterior and posterior nostril. Eyesmoderately large (20.6–24.4% HL); not visible from ventral, closer to snout than posterior end of lateral head length. Interorbital space convex,width 39.9–50.2% HL.

Dorsal fin with 3*–4 simple and 7½*–8½ branched rays; distal margin concave; dorsal fin originating slightly ahead of ventral fin origin; posterior margin of last simple dorsal-fin ray serrated with 18–21 antrorse denticles. Pectoral fin acuminate, triangular shape with 2 simple and 14–15* branched rays; anterior margin slightly convex, posterior

distal margin straight; first branched ray longest, length shorter than lateral head length; reaching midway to pectoral-pelvic distance when adpressed. Pelvic fin short with 2 simple and 9* branched rays; anterior margin with convex tip, distal margin straight; reaching half way to pelvic-anal distance when adpressed not reaching anus. Anal fin long, acuminate with 2 simple and 5½* branched rays; long with curve posterior margin, reaching caudal-fin base. Caudal fin forked with 9+8* principal branched rays.

Body covered with small cycloid scales; breast and belly before pectoral-fin tip naked, smooth. Thick epidermis embedded on thoracic area. Lateral line complete with 90*–91 scales; running on horizontal midline of each flank. Transverse scales row between lateral line and dorsal-fin origin 16–17, scales between pelvic-fin origin to lateral line 13–14. Predorsal scales 33–38; dorsal-fin base scales 16 and anal-fin base scales 11. Scales along anal sheath enlarged with 22, encircling on both side of vent; commencing from midway between pelvic-anal distance and extended up to end of anal-fin base.

Osteological features: Total vertebrae 47; abdominal vertebrae 30, and caudal vertebrae 17. Outer side of first gill arch with 14* rakers (3 epibranch and 11 hypobranch). Pterygiophore of first simple dorsal fin in between 16thand 17thvertebrae, pterygiophore of last branched dorsal fin in between 23rdand 24th vertebrae. Pterygiophore of first simple anal fin in between 31stand 32nd vertebrae and pterygiophore of last branched ray in between 35thand 36th vertebrae. Caudal procurrent rays 4 each in both dorsal and ventral lobe of caudal fin.

Colour: Colour in fresh (Figure 3)**:** Body bluish grey above lateral line. A faint dark blotch at posterior end of caudal peduncle. Lateral line scales appears a dark blue stripe. An elongated dark blue patches below the eye on flank extending to and confluence at snout from both the flanks. Ventral and ventrolateral portion of head or below lateral line creamy white. Opercle tinged light golden. All fins golden red with dusky white posterior margin. Principal rays of branched caudal fin tinged golden brown.

Colour in 10% buffered formalin: Body colour faded; a dark brown stripe at caudal peduncle with a broad base at caudal peduncle base from which tapering towards anterior reaching vertical to the level of middle of dorsal fin. Dorsum and dorsolateral region above lateral line dark brown. Dorsal half of operculum, dorsum head, tip of snout and its lateral flank dark brown. Ventral and ventrolateral surface of head or body below lateral like creamy white. All fins yellowish cream except dorsal and caudal-fin rays tinged dusky.

Sexual dimorphism: Males are smaller than females with more tubercles on snout.

Discussion

The original description of *Schizothorax chivae* Arunkumar & Moyon, 2016, has a lot of taxonomic ambiguity starting from materials and methods till publication. The normal patterning of taxonomic characterization was not following properly like uncataloguing of paratypes, variation on the morphometry and meristic count upon verification of the type specimens, and violation of ICZN electronic publication amendment (ICZN 2012: 1–7) in addition to articles 8.1.1–8.1.3 of ICZN (1999) for non registry of the research paper in Zoobank. Although the type species is already mentioned in the original research paper yet the paratypes are found uncatalogued. Now the paratypes are registered and the species is revalidating through verification of type species and newly collected fresh specimen.

There are 10 valid *Schizothorax* species all over India, of this 4 species have been reported from different river basins of the Northeastern India. The Brahmaputra River basins has 3 valid species viz. *Schizothorax molesworthi* (Chaudhuri, 1913), *S. progastus* (McClelland, 1839) and *S. richardsonii* (Gray, 1832). *Schizothorax chivae* is the only single species known from Chindwin River basin Manipur and is distinguished from the species of the Brahmaputra River in having a dark brown stripe at caudal peduncle with a broad base at caudal peduncle base from which tapering towards anterior reaching vertical to the level of middle of dorsal fin. *Schizothorax chivae* is further distinguished from *S. progastus* in its branched dorsal-fin rays (8½ vs. 8), pectoral-fin rays (ii.14–15 vs. i.16), pelvic-fin ray (ii.9 vs. i.10), anal-fin rays (ii.5½ vs. iii.5), principal caudal-fin rays (17 vs. 19), number of lateral lines scales (90–91 vs. 104–114), lateral transverse scales row between dorsal-fin origin and lateral line (16–17 vs. 20–21), number of gill rakers (14 vs. 11–12) as well as circumpeduncular scale row (28 vs. 64); from *S. richardsonii* in its simple and branched pectoral-fin rays (ii.14–15 vs. i.15–16), simple pelvic-fin rays (ii vs. i), anal-fin rays (ii.5½ vs. iii.5), and number of lateral transverse scales row between dorsal-fin origin as well as lateral line (16–17 vs. 25); and from *S. molesworthi* in its branched dorsal-fin rays (8½ vs. 8), pectoral fin rays (ii.14–15 vs. i.14), simple pelvic-fin ray (ii vs. i), anal-fin rays (ii.5½ vs. iii.5), number

of lateral line scales (90–91 vs. 98), transverse scales row between dorsal-fin origin to lateral line (16–17 vs. 27) as well as circumpeduncular scale row (28 vs. 44).

Schizothorax chivae is also distinguished from *S. kumaonensis* described from the Ganga River system in having lesser lateral line scales (90–91 vs. 94–100), more simple- and lesser branched pectoral-fin rays (ii.14–15 vs. i.17), lesser simple and more branched anal-fin rays (ii. 5½ vs. iii.5), lesser lateral transverse scales row between dorsal-fin origin and lateral line (16–17 vs. 23), and lesser transverse scales row between pelvic-fin origin to lateral line (13–14 vs. 31).

Schizothorax chivae is further distinguished from the species from Yunnan Province, China, the adjacent river basin of Irrawaddy River system viz. *S. heteri, S. leukus, S. nudiventris,* and *S. heterophysallidos* in having a dark brown stripe at caudal peduncle with a broad base at caudal peduncle base from which tapering towards anterior reaching vertical to the level of middle of dorsal fin, number of lateral line scales (90–91 vs. 94–105 in *S. leukus,* 99-115 in *S. nudiventris,* 96-124 in *S. heterophysallidos*) as well as transverse scales row between dorsal-fin origin and lateral line (16–17 vs. 24–33 in *S. heteri,* 26-34 in both *S. leukus* and *S. nudiventris,* 21-27 in *S. heterophysallidos*).

Arunkumar & Moyon (2016) concluded that species of *Schizothorax richardsonii* (Gray) mentioned by Sharma (1989) and Singh (1998) collected from the Chindwin basin in Manipur, is *S. chivae* species because of the position of dorsal fin which is close to tip of snout and in presence of a convex interorbital space. Further, they have given a strong concluding remark that all the specimens collected from Chindwin basin of Manipur mentioned by various workers viz. Sharma (1989), Singh (1998), and Selim (1998), will be *Schizothorax chivae*. This statement is more hyperbolic and controversial. Arunkumar and Moyon's examined specimens used for comparison in the description of *Schizothorax chivae* appeared to be taken out from the Ph.D. thesis of Sharma (1989), Singh (1998), and Selim (1998). We found these anomalies after examining the respective Ph.D. thesis of previous workers. Such controversial conclusion without proper verification and observation of the specimens creates problems in taxonomy and diversity studies. We disagree to their conclusion being mentioned and cannot be concluded, since all the other species of *Schizothorax* mentioned by Sharma, Singh, and Selim from the Chindwin basin might be a different species and need to be verified, with freshly collected specimens from the locality mentioned by them, by using proper taxonomic tools and techniques.

Comparative materials

Schizothorax beipanensis: Data from Yang *et al.* (2009); *Schizothorax heteri*: Data from Yang *et al.* (2009); *Schizothorax heterophysallidos*: Data from Yang *et al.* (2013); *Schizothorax kumaonensis*: Data from Tilak (1987); *Schizothorax leukus*: Data from Yang *et al.* (2013).

Schizothorax molesworthi: ZSI F 7735/1, 182 mm SL; Yembung, 1100 ft. Altitude, Abor country, Arunachal Pradesh (collection through Abor expedition); *Schizothorax nudiventris*: Data from Yang *et al.* (2009); *Schizothorax progastus*: Data from Kullander *et al.* (1999) and Tilak (1987); *Schizothorax richardsonii*: Data from Kullander *et al.* (1999) and Tilak (1987).

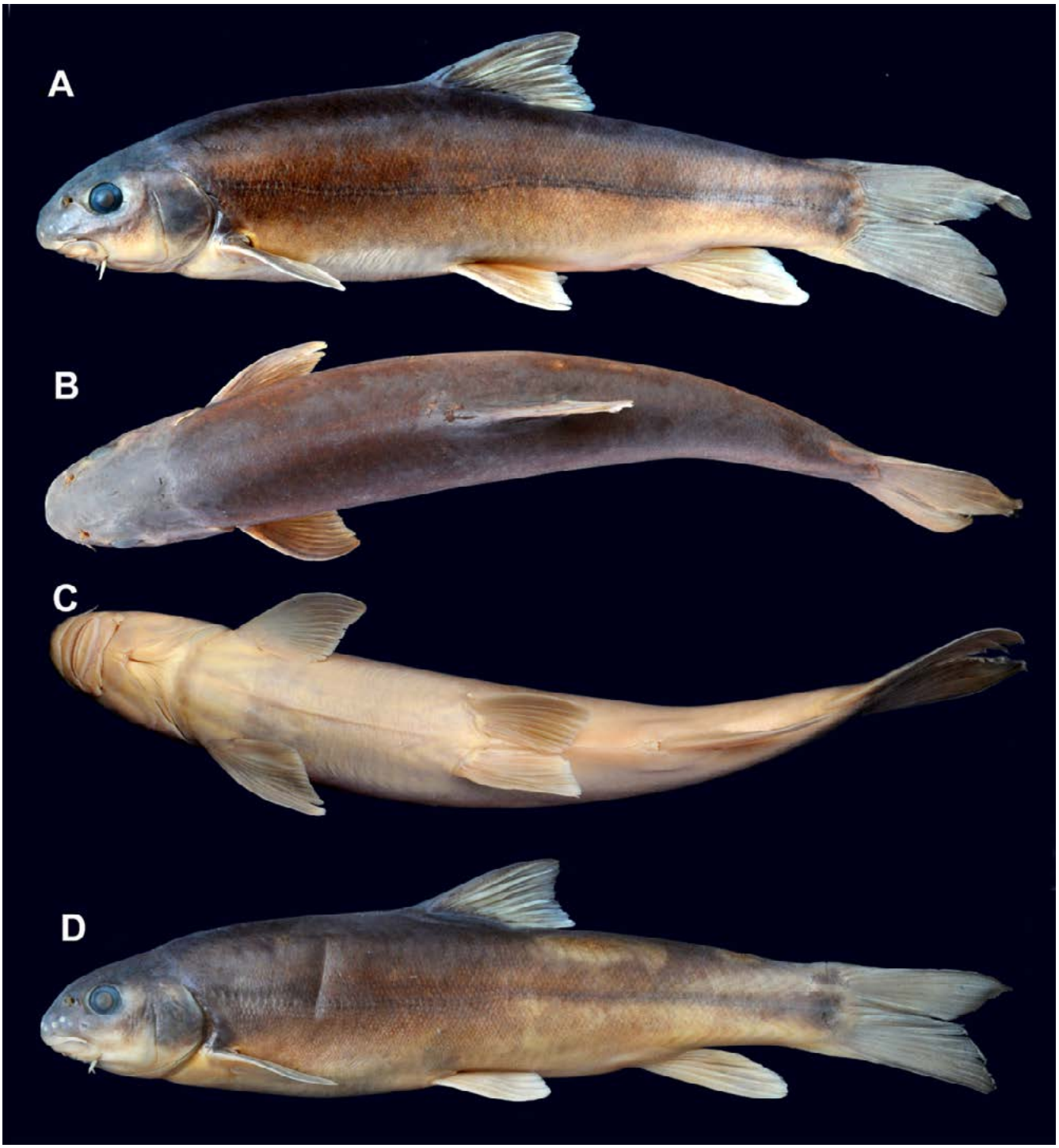

Figure 1: *Schizothorax chivae*, 50/NH/MUM**, holotype,** 174.6 mm SL, female, **A.** lateral, **B.** dorsal, **C.** ventral; **D.** 51/NH/MUM, **paratype**, 148.8 mm SL, lateral.

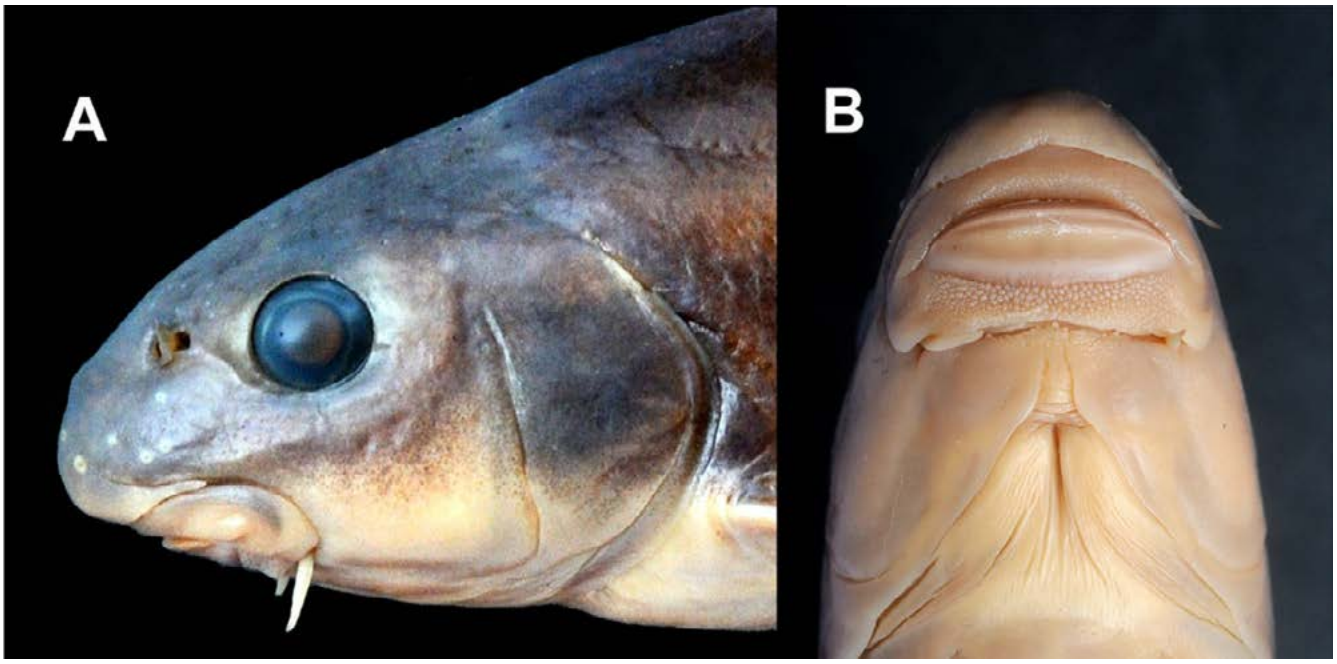

Figure 2: *Schizothorax chivae*, 50/NH/MUM**, holotype,** 174.6 mm SL, female, **A.** lateral head; **B.** ventral head showing lip.

Figure 3: *Schizothorax chivae*, MUMF 18092, 101.9 mm SL, lateral view (fresh specimen).

Table 1: Comparative account of *Schizothorax chivae* Chindwin basin Manipur showing the ambiguities in morphometry and meristic.

	Recent observation on Arunkumar & Moyon's collection		Fresh collection	Arunkumar & Moyon, 2016	
	Holotype 50/NH/MUM	Paratype (n=5)	Syntype (n=2)	Holotype 50/NH/MUM	Paratype (n=6)
Standard length (mm)	174.6	104.5–149.5	101.9–102.8	184.1	75.0–159.4
% in SL					
Body depth	24.0	22.0–24.7	21.6–24.7	21.7	23.9–25.4
Head length (dorsal)	18.9	18.2–20.0	17.8–20.8	17.6	17.2–19.3
Head length (lateral)	22.7	21.3–24.6	21.6–24.5	21.7	22.3–25.0
Head height at nape	15.9	15.6–17.5	15.1–18.4	16.6	15.7–17.3
Snout length	9.0	7.7–9.0	5.4–9.3	8.4	7.8–8.6
Eye diameter	4.0	3.8–4.7	3.9–4.9	--	--
Inter orbital space	9.5	8.5–9.9	5.1–8.8	--	--
Caudal peduncle length	15.4	13.9–17.8	15.0–17.3	17.4	18.0–18.3
Caudal peduncle height	10.7	10.1–10.8	11.4–12.0	10.7	9.5–10.9
Predorsal length (pdl)	49.0	47.3–49.5	47.4–50.6	48.5	47.4–50.9
Prepectoral length	22.4	21.1–23.3	--	--	--
Prepelvic length (pvl)	49.9	48.8–52.2	53.3–54.5	49.5	50.2–51.1
Preanus length	73.6	71.7–74.7	76.2–77.4	71.8	70.4–75.6
Preanal length	74.3	72.4–75.2	78.4–78.7	73.0	71.4–77.4
Mouth gap width	9.3	7.9–9.6	--	--	--
Dorsal-fin height	21.2	20.9–23.7	19.5–26.7	19.9	18.0–20.1
Pectoral-fin length	16.4	16.4–18.9	16.1–20.3	15.4	15.4–18.7
Pelvic-fin length	15.6	15.1–16.8	14.2–17.2	13.6	14.1–15.6
Anal-fin depth	21.9	20.0–23.6	--	--	--
Caudal-fin length (upper lobe)	23.2	23.2–28.4	--	21.7	23.9–25.4
Caudal-fin length (lower lobe)	22.2	22.2–27.5	--	--	--
Caudal-fin middle branched ray length	10.5	10.5–14.3	--	--	--
Dorsal-fin base length	14.2	13.4–16.8	--	--	--
Anal-fin base length	7.5	6.8–8.6	--	--	--

	Recent observation on Arunkumar & Moyon's collection		Fresh collection	Arunkumar & Moyon, 2016	
	Holotype 50/NH/MUM	Paratype (n=5)	Syntype (n=2)	Holotype 50/NH/MUM	Paratype (n=6)
Head width (max)	14.3	14.3–15.2	--	--	--
Pelvic-anal distance	21.0	16.7–23.5	--	--	--
Body width (dorsal ori)	16.1	14.4–16.3	13.8–16.0	14.5	14.3–15.1
Body width (anal ori)	10.1	8.5–10.3	8.2–8.7	11.2	9.5–11.3
% in HL (dorsal)					
Head depth at nape	83.68	83.7-93.8	72.43–88.5	81.2	77.1-78.5
Head depth at eye	69.18	65.2-73.0	58.54–70.22	76.6	69.4-74.6
Snout length	47.73	41.7-49.3	41.9–44.5	38.5	34.4-35.5
Eye diameter	21.08	20.6-24.4	23.3–23.6	18.3	19.7-21.4
Inter orbital space	50.21	45.1-50.2	39.9–42.5	43.0	37.1-40.8
Mouth gap width	48.76	42.3-48.8	--	37.5	37.5-40.6
Head width (max)	75.37	73.0-79.8	--	66.2	62.8-70.1
% in prepelviclength to predorsal length	98.2	91.5-98.6	--	98.1	94.4 – 99.6
Scales count					
Lateral line scales	90	90-91	--	--	83-90
circumpeduncular scale rows	28	28	--	--	--
Predorsal scales	35	35-38	--	--	33-35
Dorsal-fin base scales	16	16	--	--	--
Anal-fin base scales	11	11	--	--	--
Tubercles on snout	12	8-19	--	--	--
Meristic count					
Dorsal-fin rays	iii,7½	iii,7-8½	iii-iv, 7½–8½		iii,7-8
Pectoral-fin rays	i,15	i,15	ii, 14–15		i,14
Pelvic-fin rays	i,9	i,9	ii, 9		i,6
Anal-fin rays	ii,5½	ii,5½	ii, 5½		ii,6
Caudal-fin rays	9+8	9+8	9+8		8+8
Vertebrae	47	47	47		47
First gill arch	3+11=14	3+11=14	3+11=14		14–18

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