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New record of *Danio assamila* Kullander (Teleostei: Cyprinidae) from Arunachal Pradesh, India

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Abstract

Danio assamila Kullander 2015 was first described from the Brahmaputra River drainage of Assam in northeastern India. Its occurrence to the Brahmaputra drainages in Arunachal Pradesh was unknown till date. Recent collections of *Danio* specimens from Chatjo River in Tirap district, Poma River in Papumpare district and Singen River in East Siang district of Arunachal Pradesh includes the species, and it is hereby reported as a new occurrence record for the first time from the state. *D. assamila* is diagnosed by a unique combination characters such as: first ray of pectoral and pelvic fins projected distally from the rest of the rays, cleithral spot large and rounded or slightly oval, an anterior interstripe '1a' usually present between the two series of horizontally elongated ring shape markings along flank, ring chain pattern not extending onto the caudal peduncle and lateral line complete with 32–36 scales. Earlier records of *Danio dangila* from the state are merely misidentifications of *D. assamila*. So to validate species conformity, morphometrics and meristics variations of the species have been discussed here thoroughly.

Keywords: *Danio assamila*, new record, Arunachal Pradesh.

1. Introduction

Fishes of genus *Danio* was established by Hamilton (1822: 321)^[1] as a division of *Cyprinus*. This genus is comprised of about 25 valid species and are known only from the South and Southeast Asian region (Kullander, 2015^[2]; Kullander & Britz, 2015)^[3]. Out of these, Kullander (2015)^[2] recognized a distinctive group of five species and they are informally named as chain danios viz. *Danio assamila* Kullander, *D. catenatus* Kullander, *D. concatenatus* Kullander, *D. dangila* (Hamilton), and *D. sysphigmatus* Kullander. These Chain danios are characterized by the flank colour pattern consisting of two or more series of dark rings enclosing light centres resembling as that of chains. In addition to this, they have a unique combination of distinguishing characters such as the more (vs. less) numbers of branched dorsal-fin rays, the first ray of the pelvic and pectoral fins are prolonged (vs. not extended), very long barbels (vs. shorter), and broad caudal fin in adults.

Two species of chain danios are known from India: *D. dangila* are occurring in the Ganga and adjacent Brahmaputra drainage while *D. assamila* are restricted in the upper Brahmaputra River in Assam (Kullander, 2015)^[2]. In Arunachal Pradesh, about 95% of streams and rivers flow through the state and drain into the Brahmaputra basin while the rest drain into the Chindwin-Irrawaddy basin (Bagra *et al.*, 2009)^[4]. These rivers and rivulets are known for their rich fish diversity but not fully explored.

In this study, *Danio* specimens were collected from various water bodies of Arunachal Pradesh viz. Chatjo River (a tributary of Buri-Dihing river) in Tirap district, Singen river of East Siang district and Poma river of Papumpare district (all Brahmaputra drainages). We investigated these *Danio* specimens, and came to know that some of the specimens are *Danio assamila*. The occurrence of this species is unknown from Arunachal Pradesh. Thus, this study reports the species for the first time from the state.

2. Materials and Methods

Measurements were made on the left side of specimens with a digital caliper to the nearest 0.1 mm. Fin rays and scales were counted under transmitted light using a Nikon SMZ 800 stereoscopic microscope.

Measurement of body parts and counts (scales and fins) follow Fang (1997) [5] and Kullander (2015) [2] respectively. Terminology of body colour marking follow Fang (1998) [6] along with the modifications of Kullander (2015) [2] as: P+1, P+2, and P+3 stripes located dorsally to the 'P' mid-stripe (largest) and P-1, P-2, and P-3 stripes below, similarly I+1 and I+2 located dorsal to the 'I' mid-interstripe (formed between P and P+1) and I-1 and I-2 located below it (Fig. 1). Numbers in parentheses following a count are the number of specimens with that count. The method for clearing and staining of bones follows Hollister (1934) [7]. The collected specimens for this study are deposited in the Rajiv Gandhi University Museum of Fishes (RGUMF), Itanagar. Data of holotype and paratypes of *D. assamila* is taken from Kullander (2015) [2].

3. Result

Danio assamila Kullander 2015

Material examined. RGUMF 322, 3 exs., 40.8–56.7 mm SL, Chatjo River (R.) at Deomali, a tributary of Buri-Dihing R., Brahmaputra basin (Bb.), Tirap District, Arunachal Pradesh (AP); Collected by Phurin Songtheng, Nov., 2016. RGUMF 21, 9 exs., 42.0–57.0 mm SL, Poma R. in Papumpare dist., Bb., AP. RGUMF 132, 15 exs., 44.3–73.4 mm SL, Singen R. (upper reaches of Simen R., Bb.), East Siang Dist., AP.

Diagnosis. *Danio assamila* is diagnosed in having a unique combination of the following characters: first ray of pectoral and pelvic fins projected distally from the rest of the fin rays, cleithral spot large and rounded or slightly oval, the anterior interstripe 'Ia' usually present between the two series of horizontally elongated ring shape markings along flank, ring chain pattern not extending onto caudal peduncle, lateral line complete with scale count 32-36 and total vertebrae with 34-38.

3.1. Description.

General body shape and appearance are illustrated in Fig. 2. Morphometric and meristic data are shown in Table 1 & 2.

Shape: Compressed body, elongate to moderately deep, no sexual dimorphism evident. Head compressed, slightly deeper than wide. Short and round snout with length smaller or about equal to eye diameter. Terminal mouth and oblique in profile, almost equal jaws in anterior extension or lower jaw slightly projecting. Maxilla extends up to front margin of orbit vertically or slightly beyond it. Lower jaw ends anteriorly at about middle of eye or slightly higher. No tubercles present on lower jaw and pectoral fin. Rostral barbel long and reaches pectoral-fin ray or, usually crosses beyond base of leading pectoral-fin ray. Maxillary barbel long and reaches till middle or 4/5 of pectoral fin.

Scales: Lateral line complete, comprising 32 (5), 33 (3), 34 (1) scales which anteriorly descends for about 7 scales from some of which pore absent and posteriorly parallels to ventral profile. Median predorsal scales 15 (1), 16 (6), 17 (2). Scales in transverse series from dorsal-fin origin to pelvic-fin origin $\frac{1}{2}$ 6+1+1 $\frac{1}{2}$ (9) below lateral line scales much smaller than above. Prepelvic scales elongate, about 15-18 scales along prepelvic midline; pelvic-fin base covered by overlapping scales arranged in three rows. Circumpeduncular scale rows 14 (9). Pelvic axillary scale present. A row of scales along anal-fin base.

Fins: Dorsal fin inserted slightly posterior to middle of distance from snout tip to caudal-fin base with ii,8 $\frac{1}{2}$ (2) or ii,9 $\frac{1}{2}$ (7) rays; pectoral-fin inserted at about vertical through posterior margin of opercle with i,9 (1) or i,10 (7) or i,11(1), plus 1–2 minute unbranched ventral rays, posterior margin of branched rays rounded and outer unbranched rays prolonged beyond rest of fin, fin bears well developed axial lobe; pelvic-fin originates slightly anterior to midbody and the margin slightly rounded or truncate in shape with i,7 (9) rays, unbranched ray a little longer than rest of fin, reaching to base of first anal-fin ray or sometimes shorter; anal-fin with iii,12 $\frac{1}{2}$ (6) or iii,13 $\frac{1}{2}$ (1) or iii,14 $\frac{1}{2}$ (1) or iii,15 $\frac{1}{2}$ (1) rays; caudal fin slightly forked, lobes about equal, lobe tips subacuminate with 10+9 (7) principal caudal-fin rays.

Colouration in 10% formalin. No sexual dimorphism observed in colour pattern. Ground colour dull yellowish, lighter abdominally or dull whitish along ventral midline. No markings from head to venter, except slight concentration of dark pigment adjacent to lower margin of orbit and opercle. Cleithral spot blackish, rounded, equal to pupil size, slightly ovate in some specimens, narrower ventrally. Mid dorsal stripe brownish. Lateral P, P+1, P+2, P+3, P-1 and P-2 stripes dark brown; P-2 stripe diffuse brownish in some specimens. P+3 stripe originated from above upper end of gill cleft and continue to below middle or posterior part of dorsal-fin base. P+2 stripe often fragmented, originated from slightly above cleithral spot and continue to the level of dorsal-fin base or to middle of caudal peduncle. P+1 and P stripes prominent, parallel and straight on caudal peduncular region and continue till middle of caudal fin, anteriorly P+1 and P stripes anastomised forming about 6-8 elongate dark brown chain like rings enclosing interstripe I. A distinct row P-1 stripe running parallel posteriorly to posterior parts of P and P+1 stripes; anteriorly anastomizing with P stripe at lower branch forming about 6-7 dark brown rings. Narrow interstripe Ia runs between upper and lower rows of rings which extends from below cleithral spot to about vertical margin of anterior anal-fin rays. Narrow P-2 stripe originates at pectoral-fin base, anteriorly diffused and extends up to upper posterior part of anal-fin base. Dorsal fin basally hyaline, with indistinct greyish median stripe, distal half hyaline. Anal fin with a distinct dark median stripe. Caudal with distinct marking of continuation of P+1, P, and P-1 stripes.

Geographical distribution. Known only from the Brahmaputra drainage in Northeast India: Assam and Arunachal Pradesh (Fig. 3 & 4).

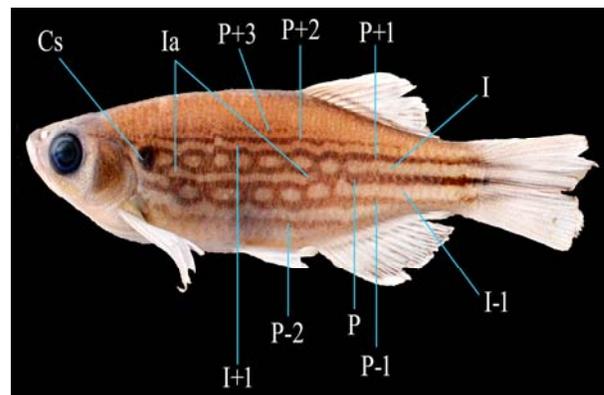


Fig 1: Terminology used for body colour marking in chain danios (photograph is for *D. assamila*).



Fig 2: Lateral view of *Danio assamila*, 57.3 mm SL, RGUMF 322, Chatjo River, Tirap dist. Arunachal Pradesh.



Fig 3: Collection site of *Danio assamila*: Chatjo River, Tirap District, Arunachal Pradesh.

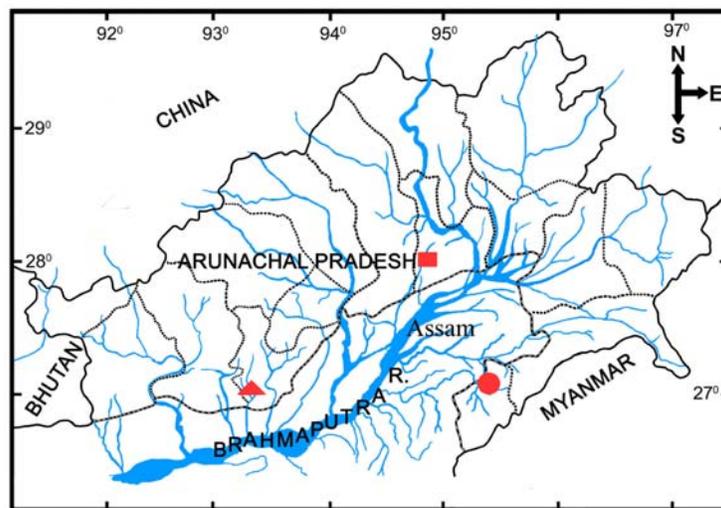


Fig 4: Map showing the distribution of *Danio assamila* in Arunachal Pradesh (redrawn after Darshan *et al.*, 2016) [8]. [circle: Chatjo River, Tirap District, square: Singen River, East Siang district; triangle: Poma, Papumpare district]

Table 1: Morphometric measurement of *Danio assamila*.

	RGUMF 322; RGUMF 132; RGUMF 021		Kullander (2015)
	Range	mean±SD	Range
No. of specimens (n)	9	-	-
Standard length	35.5–58.7	44.8±9.6	37.6–68.3
Body depth	27.7–33.0	29.3±1.6	26.9–34.6
Head length	22.9–23.9	23.4±0.4	21.9–24.2
Snout length	6.0–6.7	6.2±0.3	6.0–6.7
Head depth	15.6–17.1	16.3±0.6	15.2–17.3
Head width	12.8–13.5	13.2±0.2	12.4–13.6
Upper jaw length	8.32–9.5	9.01±0.37	8.8–9.6
Lower jaw length	10.6–11.5	11.1±0.3	10.1–12.2
Orbital diameter	6.6–7.9	7.3±0.5	6.6–8.0
Interorbital width	10.1–10.8	10.5±0.2	10.1–11.3
Caudal peduncle length	15.5–16.9	16.3±0.4	13.0–17.8
Caudal peduncle depth	11.7–13.3	12.2±0.5	11.7–14.8
Dorsal-fin base length	14.9–16.1	15.5±0.4	14.4–20.2
Anal-fin base length	19.2–22.9	20.9±1.2	18.6–24.8
Predorsal length	58.1–59.9	58.8±0.6	58.2–61.1
Preanal length	65.1–68.3	67.9±0.8	66.3–71.0
Prepelvic length	46.8–49.4	47.9±0.8	46.7–49.7
Pectoral-fin length	24.7–28.5	26.5±1.0	25.9–31.6
Pelvic-fin length	16.6–19.0	17.8±0.8	16.5–22.7
Rostral barbel length	16.5–22.1	19.0±2.3	15.2–22.7
Maxillary barbel length	24.1–35.1	30.5±3.5	24.0–37.3

Table 2: Meristic count of *Danio assamila*. (* indicates holotype)

	RGUMF 322; RGUMF 132; RGUMF 021	Kullander (2015)
Dorsal fin count	ii,8½ (2), ii,9½ (7)	ii,9½ (5), ii,10½* (4)
Pectoral fin count	i,9 (1), i, 10(7), i,11 (1)	i,10* (7), i,11 (1)
Pelvic fin count	i,7 (9)	i,7* (9)
Anal fin count	iii,12½ (6), iii,13½ (1), iii,14½ (1), iii,15½ (1)	iii,12½ (1), iii,13½ (3), iii,14½* (4), iii,15½ (1)
Caudal fin count	10+9 (9)	10+9* (7)
Lateral line scale	32 (5), 33 (3), 34 (1)	32 (1), 33* (4), 34 (3), 36 (1)
Median predorsal scale	15 (1), 16 (6), 17 (2)	16 (5), 17 (2), 18* (1)
Scales in transverse series from dorsal-fin to origin to pelvic-fin origin	½6+1+1½ (9)	½6+1+1½* (8), ½7+1+1½ (1)
Scales along prepelvic midline	15–18	14–17
Circumpeduncular scales rows	14 (9)	14* (9)

4. Discussion

Chain danios are distinct group of fishes which share a typical colour pattern consisting of dark rings on the side, and a distal projection of first ray from rest of the rays in pectoral and pelvic fins. These species are easily differentiated from each other by the colour pattern. The actual diversity of this group of fishes is still not known as new taxon are regularly added, for instance *Danio annulosus* Kullander *et al.* (2015) [9].

The present study recorded *Danio assamila*, from various water bodies of Arunachal Pradesh. It is observed that most of the morphological and meristic characters are under the range of original description but some characters are slightly deviated in terms of upper jaw length 35.5–58.7 (vs. 37.6–68.3), predorsal length 58.1–59.9 (vs. 58.2–61.1), preanal length 65.1–68.3 (vs. 66.3–71.0), pectoralfin length 24.7–28.5 (vs. 25.9–31.6); dorsal fin count ii,8½ –9½ (vs. ii,9½ –10½), pectoral fin count i,9–11 (vs. i,10–11), median predorsal scale 15–17 (vs. 16–18), scales in transverse series from dorsal-fin to origin to pelvic-fin origin ½6+1+1½ (vs. ½6+1+1½–½7+1+1½) and scales along prepelvic midline 15–18 (vs. 14–17). The reasons behind such differences may be due to examination of small sample size and limited coverage of population in the original description. Data generated from immature stage may also contribute in variation of morphological features.

Kullander (2015) [2] commented about the possibility of occurrence of *D. assamila* from Arunachal Pradesh, but he could not confirm due to inaccessibility of specimens from the state. We crossed examined *D. dangila* specimens of Bagra and Das (2010) [10] collected from Siyom River in West Siang district, Bagra *et al.* (2009) [4] from the Poma river in Papumpare district (RGUMF 21) and Singen river in East Siang District (RGUMF 132), and also text figure 14 of Nath and Day (2000) [11], and found that it is a misidentification of *D. assamila*. Reports of *D. dangila* by other workers (Tesia and Bordoloi 2012 [12]; Bakalial *et al.*, 2014 [13]; Gurumayum *et al.*, 2016) [14] from the state are also probably due to misidentification.

5. Conclusion

The present investigation reveals that *Danio assamila* is occurring in the state Arunachal Pradesh, and hereby reported its first occurrence record from the state. Earlier records of *D. dangila* from the state are due to misidentification of *D. assamila*.

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