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Devarioheirokensis, a new Danionine Fish Species from Manipur, Northeast India (Teleostei: Cyprinidae)

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ABSTRACT

Devarioheirokensis, a new danioninefish, is described from the Heirok River, Chindwin drainage,Manipur, India. The species is distinguished from its congeners in having three stripes on the body, P stripedarker and of uniform width,about one scale widethroughout its length,P+1 and P-1 stripes paler andnarrower than P stripe and tapering caudad, interstripesI+1 and I-1 narrower and about one-third as wide as P stripe; complete lateral linewith 36–38 pored scales; 9 dorsal-fin branched rays; 17–18 predorsal scales; 13 circumpeduncular scale rows and12 anal-fin base scales.

KEYWORDS: New *Devario*,Heirok River,Chindwin drainage, Manipur.

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INTRODUCTION

The danionine fishes of the genus *Devario*Heckel, 1843[1] are small sized, less than 10cm SL, most of which are found in small schools in hill streamsKullander, 2017[2].Members of the genus are distributed in freshwater habitats covering most of the South and Southeast Asiafrom the Indus River drainage eastward to the Mekong River drainage Kullander*et al*., 2017[3].Fang *et al*.,2009[4] clearly associates the taxa *Chela*, *Devario* and *Laubuca* under the *Devario* clade. Following a robust molecular study, Tang *et al*., 2010[5] put the genus *Devario* along with *Chela*, *Laubuca*, *Microdevario*and *Microrasbora* under the clade *Devario*of the tribe Danionini. Two genera, viz, *Microdevario*and *Microrasbora* are miniature taxa (respectively as per Fang *et al.*, 2009[4] and Tang *et al*., 2010[5]). The remaining three taxa have distinct colour patterns.Species belonging to the genus *Devario* are distinguished from those of *Chela* and *Laubuca*in possessing the following characters: P stripe extending to the median caudal-fin rays, infra-orbital five not or slightly reduced, maxillary barbel shorter than eye diameter, short and wide ascending process of premaxillary with a minute apophysis contacting the kinethmoid.

Kottelat, 2013[6] considered *Danioyuensis* Arun kumar & Tombi, 1998[7]of the Yu River drainage, India and Myanmar, a junior synonym of *Devarioaequipinnatus*M'Clelland, 1839[8] with a question mark. However, Kullander, 2017[2] identified specimens previously identified as *D. strigillifer* or *D. annandalei* from HtansinChaung in Myanmar, near Tamu on the border with India and from the Yu River drainage, as *D. yuensis,* treated it as valid and recorded for the first time from Myanmar. He restricted the distribution of *D. aequipinnatus* in the Ganga-Brahmaputra-Surma-Meghna drainage and stated that those identified as this species from Myanmar were misidentifications. Kullander*et al*.,2017[3] reaffirmed the same distribution pattern of *D. aequipinnatus*and considered*D. ostreographus*M'Clelland, 1839[8] a junior synonym of the former.

Presently,21 valid species of the genus*Devario*areknown to occur in the Chindwin-Irrawaddy,the Ganga-Brahmaputra,the Barak-Surma-Meghna and the Karnafulidrainage systems, of which*D.acuticephala*Hora, 1921[9],*D. affinis*Blyth, 1860[10], *D. annandalei*Chaudhuri, 1908[11], *D. browni*Regan, 1907[12], *D. deruptotalea*Ramananda&Vishwanath, 2014[13],*D. fangae*Kullander, 2017[2], *D.kakhienensis*Anderson, 1879[14],*D.manipurensis* Barman, 1987[15], *D. myitkyinae*Kullander 2017[2], *D. naganensis*Chaudhuri, 1912[16], *D shanensis*Hora, 1928[17],*D.sondhii*Hora&Mukerji, 1934[18], *D.spinosus*Day, 1870[19], *D.strigillifer*Myers, 1924[20], *D. xyrops* Fang &Kullander, 2009[21]and *D. yuensis*Arunkumar& Singh, 1998[7] are in the Chindwin-Irrawaddy.*D.aequipinnatus*M'Clelland, 1839[8], is

in the Ganga-Brahmaputra and the Barak-Surma-Meghna; *D.devari*Hamilton, 1822[22] is in theGanga-Brahmaputra, the Barak-Surma-Meghna and the Chindwin-Irrawaddy; *D. anomalous* Conway *et al*., 2009[23] and *D. coxi*Kullander*et al*., 2017[3] are in the Karnafuli; and *D. horai* Barman, 1983[24] is in the Brahmaputra.

A collection of fishes from the Heirok River (Chindwin drainage), Phanjakhongvillage in the Thoubal District of Manipur, India, included an undescribed species of *Devario*, which is herein described as *Devarioheirokensis*, new species.

MATERIAL AND METHODS

The specimens were fixed in 10% formalin and then transferred to 70% ethanol for preservation. Measurements were made point to point with digital callipers to 0.1 mm on the left side of the specimens whenever possible. Counts and measurements follow Fang, 1997a[25] except that interorbital widthis measured as the shortest distance between the left and right osseous supraorbital margins, and head width, as the widest distance between the opercles. For osteology, one specimen (MUMF 16022) was cleared and stained with Alizarin Red-S following Potthoff, 1984[26]. Meristic counts and tubercles examination were done under a stereoscopic light microscope. Colour pattern terminology, including definitions of P stripe and I interspace follows Fang, 1997a[25].The value in parentheses after a specific count indicates the frequency of that count. Images of tubercles and pharyngeal bone were captured using a Leica DFC 425 camera fitted on a Leica stereo-zoom microscope S8APO. The specimens are deposited in the Manipur University Museums of Fishes (MUMF).

Devarioheirokensis, new species (Fig. 1)

*Holotype*MUMF 16016, 58.3 mm SL: India: Manipur state,Thoubal District, Heirok River Chindwin drainage, 24°32′07″N 94°07′42″E, 868m asl, Y. Ramananda & party, 9 Nov 2014.

*Paratypes*MUMF 16017–16021,5, 52.8–58.1 mm SL; same data as holotype.One paratype (MUMF 16022, 53.3 mm SL) was cleared and stained for osteology.

Diagnosis

A medium-sized *Devario* reaching upto 58.3 mm SL, characterised by the combination of following characters: colour pattern consisting of P, P+1 and P-1 stripes; P stripe about one scale wide,darker and extending uptosubterminal end of median caudal-fin rays; P+1 and P-1 stripes about

one half as wide as P, the former extending to caudal-fin base and the latter extending to the vertical level of last insertion of anal-fin base; I+1 and I-1 interspaces distinct and about one third of width of P; I+1 extending up to caudal-fin base and I-1 extending up to the vertical level of last insertion of anal-fin base ultimately coalescing with body ground colour; complete lateral line with 36–38 pored scales; 9 dorsal-fin branched rays; 17–18 predorsal scales; 13 circumpeduncular scale rows; and 12 anal-fin base scales.

Description

Morphometric data are in Table1. Body laterally compressed and elongated. Dorsal profile of head smoothly arched from tip of mouth to occiput, then more arched from occiput upto first insertion of dorsal-fin ray, then slanting down posteriorly upto caudal-fin base. Ventral profile of body regularly curved from tip of mouth upto last insertion of anal-fin, then straight upto caudal-fin base. Head compressed,slightly deeper than its width. Mouthterminal, obliquely directed upward, its articulation with the upper jaw reaches slightly above middle of orbit along median axis.Presence of moderately sized symphysial knob fitting into danionine notch,supraorbital shelves and cleithralspot. Skin behind lower jaw with narrow band of about 3 rows of densely packed pointed tubercles along lateral marginsparsely scattered on the anterior most portion(Fig. 2). Rostral barbelsshort,at most two-third of eye diameter; maxillary barbels rudimentary.Sexual dimorphism absentboth in colouration and tuberculation.

Lateral line complete with 36 (2), 37 (3) or 38 (2) pored scales.Median predorsal17(3)–18(4) scales. Anal-fin base scales 12 (7).Circumpeduncular scales 13 (7). Dorsal fin with 2 simple rays and 9½ (7) branched rays. Anal fin with 3 simple rays and 12½ (3)–13½ (4) branched rays. Pectoral fin with 1 simple ray and 9 (2)–10 (5) branched rays. Pelvic fin with 1 simple ray and 6 (2)–7 (5) branched rays. Pectoral-fin axillary lobe moderately develop and fleshy. Pelvic-fin axillary scale thinner and longer than pectoral axillarylobe. Caudal fin forked with equal lobes. Principal caudal-fin rays 10+9 (7).Vertebrae 16+21(1).Fifth ceratobranchialwith tooth formula 5,4,2/2,4,5 arranged in three rows(Fig. 3). Teeth with prominent terminal hooks, but with very narrow grinding surfaces.

Table 1. Morphometric data of holotype and 6 paratypes of *Devarioheirokensis*(n=6)

	Holotype MUMF 16016	Paratypes MUMF 16017–16022		
		range	mean	SD
Standard length (mm)	58.3	52.8–58.3	56.2	
In % of standard length				
Body depth	24.2	22.3–24.8	23.7	0.8
Head length	32.2	22.3–24.8	23.4	0.8
Head depth	16.5	15.7–17.2	16.4	0.5
Head width	12.9	11.9–13.9	12.8	0.7
Snout length	7.4	6.6–7.4	7.1	0.3
Upper jaw length	9.3	8.6–9.6	9.2	0.3
Lower jaw length	11.4	10.3–12	11	0.7
Eye diameter	6.7	6.4–7	6.7	0.2
Interorbital width	9.6	9.1–9.8	9.5	0.2
Caudal peduncle length	25.7	21.3–23.1	22.8	1.5
Caudal peduncle depth	10.8	11–11.7	11.2	0.3
Length of dorsal-fin base	16	15–16.3	15.7	0.5
Length of anal-fin base	17.8	17.8–20	19	1
Predorsal length	55.1	56.1–58.8	57.1	1.3
Preanal length	62.7	58.7–62.3	61.6	1.4
Prepelvic length	45.2	42.4–47.4	44.8	1.7
Prepectoral length	23.5	22.3–24.6	23.1	0.8
Pectoral-fin length	17.5	15.1–18.8	17.5	1.4
Pelvic-fin length	12.2	12.4–14.1	13	0.7

FIGURE 1.*Devarioheirokensis*, holotype MUMF 16016, 58.2 mm SL, Heirok River, a tributary of the Imphal River, Chindwin drainage, Thoubal District, Manipur, India.

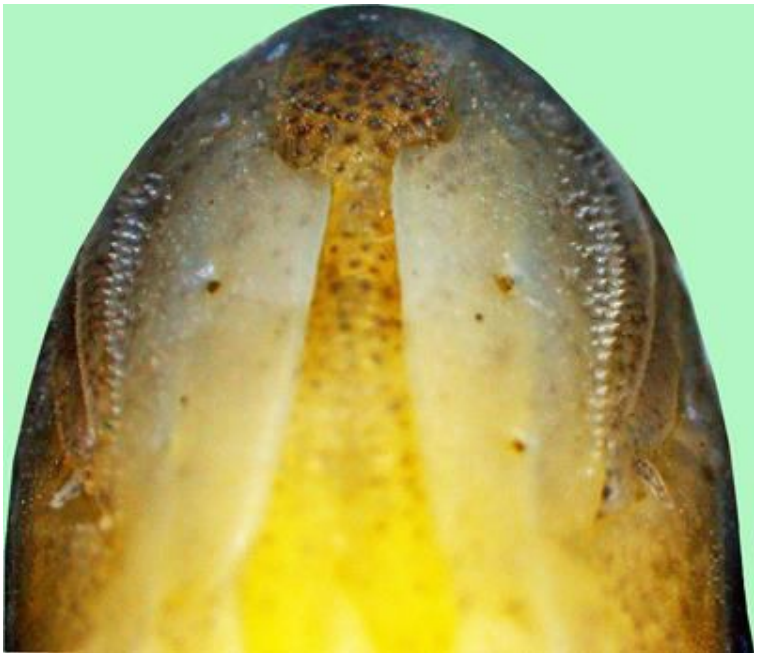

FIGURE 2. Ventral view of head of *Devarioheirokensis*, MUMF 16016, showing arrangement of tubercles.

FIGURE 3.*Devarioheirokensis,* MUMF 16022, 53.3mm SL, fifth ceratobranchial of left side in ventromedial view.

Colouration in preservative

In freshly preserved specimens,dorsum pale orange suffused with grey; whereasabdomen relatively paler orange.Stripes and other markings greyish-black to dark-black(Fig.1). Head dorsally dark brown, sides and opercles relatively lighter and sparsely pigmented.Cleithral spot darker, oval shaped and about one scale wide, covering about 2/3rdportion of the first lateral line pored scale. Anterior colour patternjuxtaposed to cleithralspot develops as a relatively large greyish diffused patch posteriorly up to 4–6vertical scale rows, then organised into three distinct stripes separated by two light bright golden orange interspaces obviously derived from body ground colour. Pigmentation of P stripe increasing posteriorly upto caudal-fin base with uniform width of about one scale wide throughout its length, then extended faintly up to sub marginal region of the median caudal-fin rays. Both P+1 and P-1 stripes relatively fainter than P, paralleling P stripe and taper posteriorly. P+1 stripe extendsup to end of caudal-fin base whereas P-1 stripe ceases at the verticallevelof last insertion of anal-fin rays. Posterior free margin of scales above level of P+1 stripe marked with prominent dark brown crescent shaped pattern, scales below the level of P-1 stripe spotted with sparsely distributed light brown spots.

Both dorsal and anal fins marked with greyish pigments basally from middle of first ray ending distally at tips of last branched rays. Pectoral fins and pelvic fins pale orange.Caudal-fin rays golden orange, inter-radial membranes hyaline.

Distribution and Habitat

*Devarioheirokensis*is known only from the type locality, a small river in Phanjakhong village (Fig. 4). The Heirok River is a small rain-fed river which originates from the Manipur hills nearNungtakinThoubal district and enters the pains near Heirok. It then flows westwards till it reaches Tentha thereby falls into Ikoplake. Finally, the watershed of the Ikoplake drains into the Imphalriver, a part of Chindwin drainage.The type locality has clear, shallow water measuring about 0.05 m to 1.5 m deep in the month of November. The species is collected from the pool formed around a turn of the river where the flow of the water is relatively slower(Fig. 5).Other species like *Channagachua*, *Garralissorhynchus*,*Lepidocephalichthysberdmori*,*Opsariusbarnoides*, *Pethaikhugae*,*Schistura reticulate* were also collected.

Etymology

The species is named after its type locality, Heirok River.

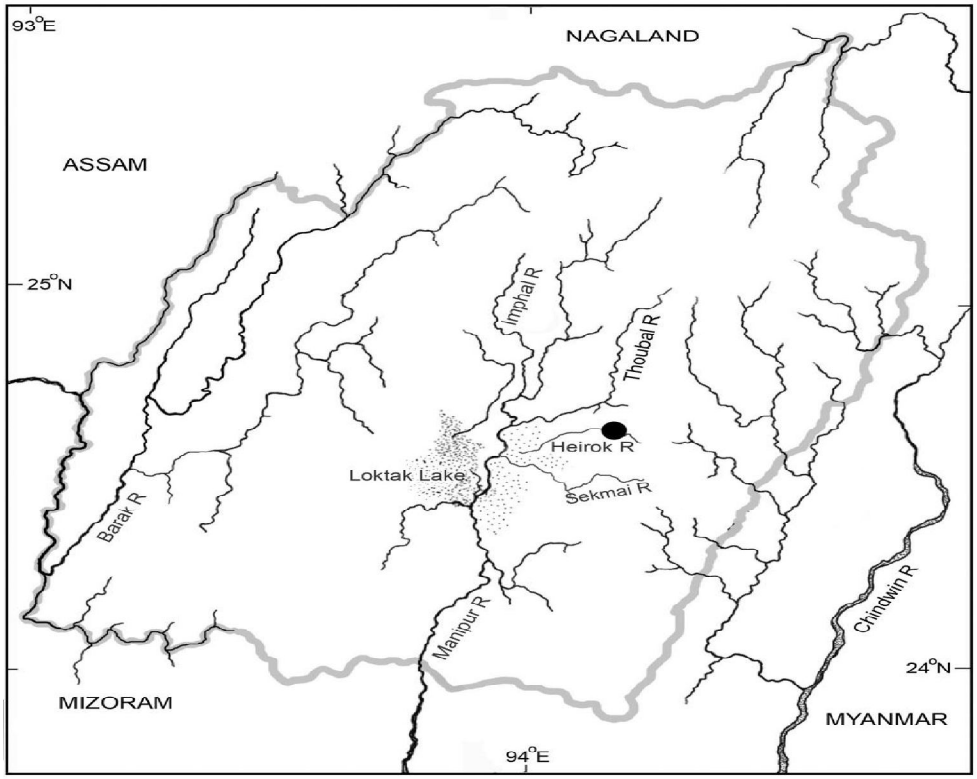

FIGURE 4. Map showing type locality of *Devarioheirokensis*

FIGURE 5. Heirok River, type locality and habitat of *Devarioheirokensis.*

DISCUSSION

Fishes of the genus *Devario*are characterised by specific colour patterns usually in the form of bars or stripes on the side of the body.Based on these colour patterns, *Devarios*were broadly divided into two groups: "striped *Devario*" Fang, 1997a[25]and "barred *Devario*" Fang, 1997b[27].The new species, *Devarioheirokensis*belongs to "striped *Devario*"group since P stripe extends on to the median caudal-fin rays based on Fang, 1997a[25]. *Devarioheirokensis* is compared with all the species of *Devario* known to occur in thedrainages of the eastern Himalaya-: Barak-Surma-Meghna, Brahmaputra and Chindwin-Irrawaddy.*D. assamensis* Barman, 1984[28], a nominal species from Assam was treated as a junior synonym of *D. ostreographus*, and consequently of *D. aequipinnatus*Kullander*et al.*, 2017[3] and thus not discussed here.

*Devarioheirokensis*is differentiated from *D. acuticephala* in having complete (vs. incomplete) lateral line, 9 (vs. 6–7)dorsal-fin branched rays,13 (vs.10)circumpenduncular scales and presence (vs. absence) of barbels;from *D. affinis* in having 9 (vs.13)dorsal-fin branched rays, 12–13 (vs.16) anal-fin branched rays, terminal (vs. distinctly upturned) mouth and wider (vs. narrower) P stripe than P+1. The new species differs from *D.annandalei* in having 36–38 (vs. 46–50) lateral line scales and 9 (vs. 15) dorsal-fin branched rays;from *D. anomalus* in having three sripes (vs. 5–8 irregular vertical bars) on the

sides of the body, 36–38 (vs. 33–35) lateral-line scales, 17–18 (vs. 15–16) predorsal scales; from *D. brownii*by the presence of P stripe with almost equal width (vs. P stripe broadens out anteriorly usually becomes double in width, forming a loop in the middle of the side above the ventral fins while the stripe below curves upwards in front of the loop), only 3 (vs. 3–5)stripes on the side of the bodyand 36–38 (vs. 30–34) lateral-line scales; from *D. deruptotalea*by the presence of only three stripes (vs. 4–6 irregularly shaped and arranged bars followed by three distinct stripes posteriorly)and 36–38 (vs. 32–34) pored lateral line scales; from *D. devario* in having 13 (vs. 16) circumpeduncular scales, 17–18 (vs. 13–15) predorsal scales, 36–38 (vs. 38–50) lateral line scales; from *D. fangae* in having 17–18 (vs. 13) predorsal scales; 13 (vs. 12) circumpeduncular scales; P stripe wide and P+1 and P-1 much narrower (vs. all 3 stripes wide and of similar width);from *D. horai* in having 17–18 (vs. 14) predorsal scalesand complete (vs. absence) of lateral line; from *D. kakhienensis*in having wider and darker P stripe than P+1 and P-1 stripes (vs. almost equally wide, three stripes and three interspaces), 17–18 (vs. 12–16) predorsal scales and 37 (vs. 33–35) vertebrae.*Devarioheirokensis*differs from *D. manipurensis* in having 3 (vs. 1) stripes, 13 (vs.8–10) circumpeduncular scales,9 (vs. 10–11) dorsal-fin branched rays and pectoral fins not reaching (vs. reaching) pelvic-fin base;from *D. myitkyinae* in having P stripe wide and P+1 and P-1 stripes much narrower (vs. all 3 stripes are irregular and of about equal width), 36–38 (vs. 30–33) lateral line scales, 13 (vs. 12) circumpeduncular scales; from *D. naganensis* in having 36–38 (vs. 40–42)lateral-line scales, 13 (vs.10–11)circumpeduncular scales, 17–18 (vs. 20) predorsal scales and P, P+1 and P-1(vs. P)stripes; from *D. shanensis*in having 3 stripes (vs. only one stripe posterior to bars), 13 (vs. 10) circumpeduncular scales, 9 (vs. 7) dorsal-fin branched rays;from *D.sondhi* in having 17–18 (vs.15) predorsal scales, complete (vs. incomplete) lateral line scales; from *D.spinosus*in having 36–38 (vs. 52) lateral line scales, absence (vs. presence) of preorbitalspinosus process and presence (vs. absence) of barbels; from *D. strigillifer*by the absence (vs.presence) of spots and streaks anterior to stripes and wider (vs. narrow) P and P+1 stripes; from *D. xyrops* in having three stripes (vs. 4–5 short partly confluent vertical bars and a wide P stripe posteriorly) on the side of the bodyand 17–18 (vs.13–15) predorsal scales; from *D. xyrops* by the absence (vs. presence) of infraorbital process; from *D. yuensis* in having 15–16 (vs. 17–18) predorsal scales, 12 (vs. 14–15) anal-fin base scales, 36–38 (vs. 35–36) lateral line scales, 13 (vs. 14) circumpeduncular scales.

COMPARATIVE MATERIAL

Devarioacuticephala: MUMF 1801–1805 (5), 31.5–40.7 mm SL, paratypes; India: Manipur, Iril River, BamonKampu, Imphal East District.

D.aequipinnatus (M'Clelland): MUMF 16028–16035 (7), 51–72.3 mm SL, paratypes; India, Arunachal Pradesh, Dikrong River, Papum Pare District.

D. affinis: Data from Blyth,1960[10].

D. annandalei: Data from Chaudhuri, 1908[11].

D. anomalus; Data from Conway *et al*., 2009[23].

D. browni: Data from Regan, 1907[12].

D. coxi: Data from Kullander, 2017[3].

D.deruptotalea: MUMF 16001, 63.4 mm SL, holotype, India: Manipur, Dutah Stream, a tributary of Yu River, Chandel District.

D. devario: Data from Kullander*et al*., 2017[3].

D. fangae: Data from Kullander, 2017[2].

D. horai: Data from Barman, 1983[24].

D. kakhienensis: Data from Fang, 1997a[25].

D.manipurensis: MUMF 1701–1705 (5), 50.6–40.7 mm SL, paratypes; India: Manipur.

D. myitkyinae: Data from Kullander, 2017[2].

D.naganensis: MUMF 1501–1506 (6), 51.3–65.1 mm SL, paratypes; India: Manipur, Momo stream, Tusom, Ukhrul District.

D. shanensis: Data from Hora, 1928[17].

D. sondhii: Data from Hora and Mukerji, 1934[18].

D. spinosus: Data from Day, 1870[19].

D. strigillifer: Data from Myers, 1924[20].

D. xyrops: Data from Fang and Kullander, 2009[21].

Devarioyuensis: MUMF 3000/5A (1), 52.8 mm SL, paratype; India: Manipur, Yu River, Chandel District.

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