



***Badis singenensis*, a new fish species (Teleostei: Badidae) from Singen River, Arunachal Pradesh, northeastern India**

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Abstract: A new species of *Badis* from Singen River, Brahmaputra basin in Arunachal Pradesh, India, has the following combination of characters: a conspicuous round black blotch postero-dorsally on opercle at the base of opercle spine covering many scales; three distinct black blotches at dorsal fin base: the first, behind the third spine; the second, behind the sixth dorsal spine and the third, behind the fifth and sixth soft dorsal rays. The species differs from its nearest congeners, *B. assamensis* and *B. blosyrus* by the presence of a black blotch at the base behind the fifth soft anal fin ray.

Keywords: Arunachal Pradesh, Brahmaputra basin, new fish, Perciformes.

The Indo-Burmese genus *Badis* Bleeker is characteristic in having an opercle with a single sharp spine at its postero-dorsal corner; contiguous spinous and soft dorsal fins; the base of the soft part longer than that of the spinous part; anal fin with three

spines; lateral line pores tubed and interrupted; jaws, vomer and palatines with villiform teeth; scales both ctenoid and cycloid; 2-4 dentary foramina; 3-toothed hypobranchial; short pelvic fin in males, not reaching the first dorsal spine; short dorsal fin lappets and rounded caudal fin (Kullander & Britz 2002).

As many as 14 species of *Badis* are currently treated valid, of which six are from Brahmaputra drainage—*Badis assamensis* Ahl, *B. badis* (Hamilton), *B. blosyrus* Kullander & Britz, *B. dibruensis* Geetakumari & Vishwanath, *B. kanabos* Kullander & Britz, and *B. tuivaiei* Vishwanath & Shanta; five from Irrawaddy drainage—*B. corycaeus* Kullander & Britz, *B. ferrarisi* Kullander & Britz, *B. kyar* Kullander & Britz, *B. pyema* Kullander & Britz, and *B. ruber* Schreitmiiller and one each from Matamohuri River drainage, of Takaupa River basin and Mae Nam Khwae Noi drainage, respectively, *B. chittagongis* Kullander and Britz, *B. siamensis* Klausewitz and *B. khwae* Kullander and Britz.

During field surveys in northeastern India during 2008–2009, 27 specimens of an undescribed *Badis* were collected from Singen River, Brahmaputra basin, Arunachal Pradesh (Fig. 1). The species is herein described as *Badis singenensis* sp. nov.

Materials and Methods

Measurements were made with dial calipers to the nearest 0.1mm and expressed as percentages of standard length (SL). Counts and measurements were made on the left side of specimens under a PC-based binocular stereozoom microscope (Olympus SZ40) with transmitted light. Counts and measurements followed Kullander & Britz (2002), clearing and staining of specimens for osteology after Hollister (1934) and identification and nomenclature of bones

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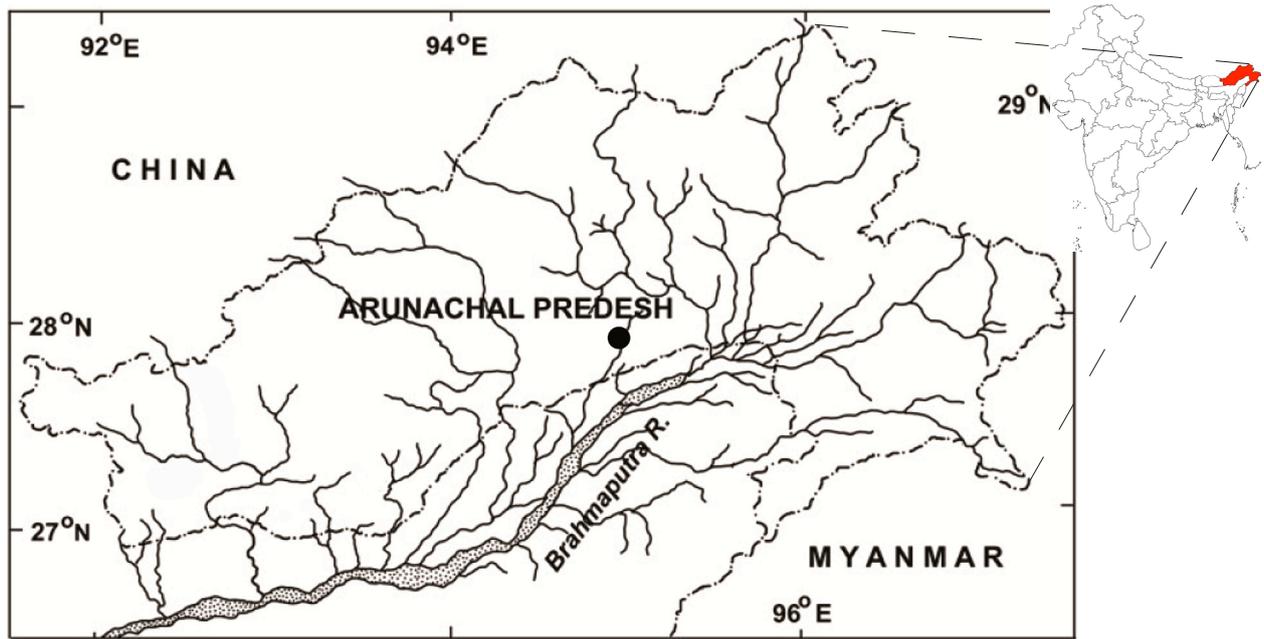


Figure 1. Map showing distribution of *Badis singenensis* sp. nov.

and vertebral counts after Greenwood (1976). For branchial toothplate count, the first gill arch on the left side of the specimens was taken and plates starting from hypobranchial to epibranchial of the outer side were counted. Type specimens are deposited in the Manipur University Museum of fishes (MUMF) and Rajiv Gandhi University Museum of Fishery (RGUMF)

***Badis singenensis* sp. nov.**
(Image 1a-c)

Type material

Holotype: 25.ii.2008, 22.3mm SL, 27°54'18.72"N & 94°55'21.12"E, Brahmaputra drainage, Singen River, Saku-Kadu Village, Arunachal Pradesh, India, coll. Rikge Kadu & Kento Kadu (MUMF-Per 112).

Paratypes: 26 exs., RGUMF 0218-0225, 27.0–37.0 mm SL, same data as of holotype; MUMF-Per 113-131, 19, 24.4-42.0 mm SL, data as for holotype; MUMF Per-119-120, 2, dissected, cleared and stained for osteology.

Diagnosis

The new *Badis singenensis* sp. nov. is with the following combination of characters: a conspicuous black blotch posterodorsally on opercle, at the base of opercle spine, round and usually covering portion

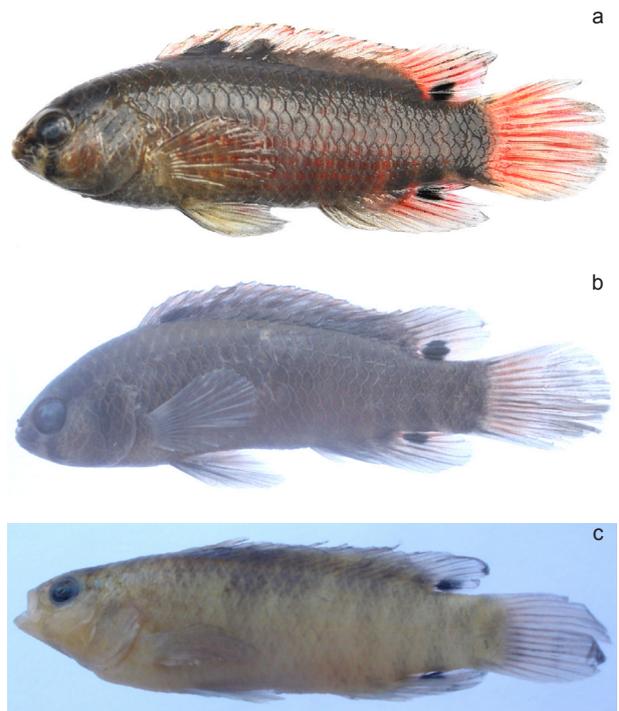


Image 1. a - Side view of *Badis singenensis* sp. nov. (uncat.) showing colouration; b - (RGUMF- 0218, paratype, female); c - (RGUMF- 0219, paratype, male)

of several scales; three distinct dark blotches at dorsal fin base, first blotch behind third spine, second behind sixth dorsal spine and third behind the fifth and sixth soft dorsal ray; another distinct black blotch at the base of anal fin behind the fifth soft anal fin ray; tooth plate count 5; scales in lateral row 25-26; interorbital width 9.2–13.3% SL; upper jaw length 7.6–8.8% SL; lower jaw length 9.4–10.2% SL; head length 30.2–34.6% SL.

Description

Morphometric data and counts are in Tables 1 & 2, respectively. Frequency distributions of meristic characters are in Table 3 and comparison with related species, in Table 4. Body elongate, moderately compressed laterally. Predorsal profile in small specimens straight, sloping at some angle similar prepelvic profile in larger specimens and more strongly as the size increases. Head pointed in lateral aspect. Orbit situated in anterior half of head at about mid-lateral axis of body and moderately large, diameter about one-third of head length. Mouth oblique and moderately large, protrusible, lower jaw slightly projecting beyond upper, maxilla reaching to $\frac{1}{3}$ of orbit. Opercular spine slender, with a sharp tip. Palatine, vomer and parasphenoid toothed.

Pores: dental three, anguloarticular two, preopercular six, nasal three, supraorbital three, extrascapular two, supracleithral two, posttemporal two, coronalis one, lachrymal three, infraorbital pores three. A row of free neuromasts extending across the gap between lachrymal and anteriormost infraorbital.

Scales strongly ctenoid on sides, cycloid on top of head. On the ventral side, the sizes of the scales become reduced towards the posterior side. Predorsal scales anterior to coronalis pore 4-5, posteriorly 8-9. Cheek and opercular scales ctenoid, 4-5 rows of scales on cheek. Three rows of scales on opercle, one row each on preopercle, subopercle and interopercle, a few scales anterior to cheek cycloid. Lateral line divided into two segments, with anterior segment more dorsally located than posterior segment. Upper lateral line begins at dorsal origin of operculum. Lower lateral line begins at vertical through the posterior end of anal fin origin, vertically centered along length of caudal peduncle. Circumpeduncular scale rows nine above, nine below lateral line, totaling 19. Dorsal fin scale cover up to 3-4 scales wide; anal fin scale cover three

Table 1. Proportional measurements of *Badis singenensis* sp. nov. in percentage of standard length except standard length.

	Holotype	Paratypes N=26			
		Mean	Min.	Max.	S.D.
Standard length (mm)	0.85				
Head length	32.9	32.0	30.2	34.6	1.6
Snout length	7.1	7.8	6.9	9.2	0.9
Orbital diameter	12.9	10.4	8.1	12.9	1.9
Interorbital width	9.4	10.7	9.2	13.3	1.5
Upper jaw length	8.2	8.3	7.6	8.8	0.4
Lower jaw length	9.4	9.8	9.4	10.2	0.4
Body depth	29.4	30.2	29.4	30.6	0.5
Pelvic fin length	25.9	24.7	23.4	25.9	0.9
Pelvic to anal fin distance	29.4	30.9	27.6	37.2	3.3

Table 2. Counts of *Badis singenensis* sp. nov.

Counts	Holotype	Paratypes	
		Min.	Max.
D	15/7	15/7	15/8
P	14	14	14
A	iii,6	6	7
Lateral scale rows	32	29	32
Lateral line count	21/5	21/4	21/5
Lateral transverse scales	1½/1/7	1½/1/7	1½/1/7
Circumpeduncular scales	19	19	20
Toothplate count		5	5
Vertebrae		28	28

scales wide. Scales in vertical row 1½ above, seven below lateral lines. Toothplates on the first branchial arch five, vertebra 28 (16/12).

Dorsal fin with long base, anterior insertion vertically above the pectoral fin insertion and posterior insertion at vertical through base of last anal-fin ray. Soft dorsal and anal fins with rounded tips reaching to almost about $\frac{1}{2}$ or $\frac{1}{3}$ of caudal fin. Caudal fin rounded. Pectoral fin rounded, extending about $\frac{2}{3}$ distance to anal- fin origin. Pelvic fin elongated and pointed, inner branch of second soft ray longest, not reaching up to vent, but terminating close to vent in some large specimens. Head length, orbital diameter, interorbital width, upper jaw length and lower jaw length respectively (30.2–34.6), (8.1–12.9), (9.2–13.3), (7.6–8.8) and (9.4–10.2) % SL.

Table 3. Frequency distribution of meristic characters

a	Dorsal fin counts (spines/soft rays) Specimens	15/8 1	15/7 8	16/9 3	17/8 3	
b	Anal fin counts Specimens	5 2	6 7	7 3	8 3	
c	Pectoral fin counts Specimens	13 4	14 11			
d	Lateral scale rows Specimens	29 1	30 3	31 9	32 -	33 2
e	Lateral line scale counts (upper/lower scales) Specimens	20/5 1	21/4 1	20/6 1	21/5 10	22/4 2
f	Tooth plate Specimens	5 3	6 1			
g	Vertebrae number Specimens	15/13 2	15/14 1			

Table 4. Comparison of proportional measurements in % SL and counts of *Badis singenensis* sp. nov. with related species.

Proportions	<i>B. singenensis</i> sp.nov.	<i>B. assamensis</i>	<i>B. blosyrus</i>
Tooth plate count	5	7–9	10–13
Interorbital width	11.25(9.2–13.3)	5.4(4.8–6.0)	7.4(6.4–8.0)
Upper jaw length	8.2(7.6–8.8)	10.3(9.7–10.9)	12.8(12.0–13.6)
Lower jaw length	9.8(9.4–10.2)	13.7(12.7–14.6)	17.4(16.3–18.5)
Head length	32.4(30.2–34.6)	31.9(29.2–34.5)	37.4(36.0–38.8)
Scales in lateral row	26(25–26)	28–29	27(27–28)

Colouration

Live colours: body dark slaty gray dorsally, paler on sides, each scale with reddish tinge; dorsal fin reddish, tips of fin rays black. Caudal fin orange, paired fins and anal fin slaty gray with reddish tinge. Posterodorsally on opercle, at base of opercular spine, a rounded black spot covering 3–4 scales. Three distinct dark black blotches surrounded by red coloration at dorsal fin base: the first behind the third dorsal spine, the second behind the sixth dorsal spine and the third, behind the fifth dorsal soft ray. A black blotch at the base behind the fifth soft anal fin ray.

In 10% formalin: supraorbital stripe prominent, rounded black opercular spot prominent. Body with 5–6 broad black bars. Black bar on caudal peduncle well separated from the preceding bar between posterior ends of dorsal and anal fin bases. Black blotches on dorsal fin base and soft anal fins prominent. Dorsal fin gray with narrow, contrasting white margin, and each lappet with a blackish submarginal stripe.

Sexual dimorphism

Males have brighter body colour than their female

counterpart. In the male vertical bars on posterior portion of lateral body are more distinct than on the female which are less distinct or absent. During the breeding season (April to June) males develop a red coloured mark on their soft dorsal and soft anal fin and in some female specimens red coloured marks were observed in lateral scales. Females have a deeper body height than the males.

Etymology

The species is named after the Singen River, Arunachal Pradesh, type locality of the species.

Distribution

Presently known only from Singen River at Saku-Kadu Village, East Siang District, Arunachal Pradesh, Brahmaputra drainage, northeastern India.

Discussion

Badis singenensis is distinguished from all its congeners by the presence (vs. absence) of black blotches on the dorsal fin and one on the soft anal fin. It further differs from its nearest congener, *B. assamensis*

in having fewer tooth plates (5 vs. 7–9), scales in lateral row (25–26 vs. 28–29); wider interorbital region (9.2–13.3 vs. 4.8–6.0% SL); shorter upper jaw (7.6–8.8 vs. 9.7–10.9% SL) and lower jaw (9.4–10.2 vs. 12.7–14.6% SL). It is also distinguished from *B. blosyrus* in having fewer tooth plates (5 vs. 10–13); less scales in lateral row (25–25 vs. 27–28); shorter head length (30.2–34.6 vs. 36.0–38.8% SL); wider interorbital space (9.2–13.3 vs. 6.4–8.0% SL); shorter upper jaw (7.6–8.8 vs. 12.0–13.6% SL) and lower jaw (9.4–10.2 vs. 16.3–18.5% SL).

Badis singenensis differs from its congeners from the Brahmaputra basin, viz., *B. badis*, *B. dibruensis*, *B. kanabos* and *B. tuivaiei* by the presence (vs. absence) of black blotch on the soft anal fin. It further differs from *B. badis* in having wider interorbital space (9.2–13.3 vs. 6.5–8.3% SL) and shorter lower jaw (9.4–10.2 vs. 11.3–14.5% SL). It also differs from *B. dibruensis* in having longer upper jaw (7.6–8.8 vs. 6.1–6.9% SL) and lower jaw (9.4–10.2 vs. 7.8–8.3% SL). It further differs from *B. kanabos* in having wider interorbital space (9.2–13.3 vs. 7.3–8.6% SL) and shorter lower jaw (9.4–10.2 vs. 11.0–13.5% SL). It also further differs from *B. tuivaiei* in having wider interorbital space (9.2–13.3 vs. 5.6–7.2% SL) and shorter lower jaw (9.4–10.2 vs. 10.9–16.4).

The new species differs from all the five species of the Irrawaddy drainage in the presence (vs. absence) of opercle blotch and in the presence (vs. absence) of black blotch on the soft dorsal fin. It further differs from *B. ferrarisi* in having longer interorbital width (9.2–13.3% SL) and longer lower jaw (11.3–12.8 vs. 9.4–10.2% SL).

Badis singenensis also differs from *B. siamensis* and *B. khwae* in the absence (vs. presence) of opercle blotch and from *B. chittagongis* in absence (vs. presence) of opercle blotch.

Kullander & Britz (2002) classified the species of *Badis* into five groups viz., *B. ruber*, *B. assamensis*, *B.*

corycaeus, *B. kyar* and *B. badis* group. They reported *B. assamensis* group to be characteristic in having an opercle blotch and believed that more numbers of undescribed species of the group exist in the region. The new species under description belongs to the *B. assamensis* group.

Comparative materials

Badis assamensis: MUMF Per-51-54, 4, 41.6–55.8 mm SL; India; Assam, Dibrugarh, Dibru River; *Badis assamensis*: RGUMF-0180, 2, 49–52 mm SL, Dibang river, Lohit, Arunachal Pradesh, India; *B. badis*: MUMF Per-55-65, 11, 23.5–28.7 mm SL; India; Manipur, Barak River; *Badis badis*: RGUMF- 0149, 5, 23–40 mm SL, Mebang River, Arunachal Pradesh, India; *B. blosyrus*: MUMF Per-66-68, 3, 36.8–38.9 mm SL; India; Arunachal Pradesh, Lohit River; *B. dibruensis*: MUMF- Per 95, Holotype, 1, 37.3mm SL; India; Assam, Dibrugarh, Dibru River; *B. ferrarisi*: MUMF Per- 69-75, 7, 32.0–44.0 mm SL; India; Manipur, Lokchao River; *B. kanabos*: MUMF Per-76-81, 6, 48.7–54.9 mm SL; India; Manipur, Barak River; *B. tuivaiei*: MUMF 5125-5132, 8, 53.5–59.4 mm SL; India; Manipur, Tuivai and Irang River.

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