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ON A NEW SPECIES *BADIS TRIOCELLUS* (PISCES : PERCIFORMES : BADIDAE) FROM NORTH EAST INDIA

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INTRODUCTION

Badids are small freshwater fish normally inhabit small streams or hill streams with slow to moderate flow. In the past, the genus *Badis* was generally treated as a member of the family Nandidae together with other genera like *Nandus*, *Polycentrus*, *Monocirrhus*, *Afronandus* and *Polycentropsis* (Ruber et al., 2004). Barlow et al. (1968) erected a separate family, Badidae for the genus *Badis* alone based on morphological and behavioral data. Following Kullander and Britz (2002), the family Nandidae is now restricted to the genus *Nandus* and the other genera like *Polycentrus*, *Monocirrhus*, *Afronandus* and *Polycentropsis* are classified in the family Policentridae.

Kullander and Britz (2002) in their taxonomic revision revealed that the family Badidae currently assigned to two genera *Badis* (with 12 species) and *Dario* (with 3 species). The distribution of the Badidae includes the Indian subcontinent, Pakistan, Nepal, Bangladesh, Myanmar, Peninsular Thailand, the Mae Khlong drainage and part of the Mekong basin in South East Asia as well as the Upper Irrawaddy in southern Yunnan, China.

Under the genus *Badis*, currently there are 13 described species known so far in the world. These are *Badis assamensis*, *Badis badis*, *Badis blokyrus*, *Badis chittagongis*, *Badis corycaeus*, *Badis ferrarisi*, *Badis kanabos*, *Badis khwae*, *Badis kyar*, *Badis pyema*, *Badis ruber*, *Badis siamensis* and *Badis tuivaiei*. Of these, 5 were described from India mostly from North East India viz. *Badis assamensis*, *Badis blokyrus*, *Badis kanabos* and *Badis tuivaiei*. *Badis badis* is cosmopolitan in distribution. *Badis chittagongis* is described from Chittagong Division, Bangladesh. *Badis corycaeus*, *Badis ferrarisi*, *Badis kyar*, *Badis pyema* and *Badis ruber* from Myanmar. *Badis*

ruber was also reported to occur in Laos and Thailand. *Badis siamensis* and *Badis khwae* were described from Thailand. (Vishwanath and Shanta, 2004; Kullander and Britz, 2002).

While studying the *Badis* specimens collected from Subansiri river, Lower Subansiri district Arunachal Pradesh; Dilpai river, Dhemaji district Assam and Mynsor river, Jaintia Hills district Meghalaya, the authors came across some interesting specimens which were strikingly different from other known species of the region having three prominent spots (two on dorsal fin and one on anal fin). A detailed morphological study reveals its identity as new to science.

MATERIALS AND METHODS

The specimens are preserved in 5% formaldehyde. Twenty four morphological characters have been taken into consideration and measurements were done with a digital caliper, expressed in percentage in relation to standard length. The range, mean values and standard deviation (SD) are also incorporated. Counts and measurements were done according to Jayaram, 1999.

Badis triocellus sp. nov.

(Plate-I A, B; Table-1)

Material Examined : *Holotype* : 38.63 mm SL, India, Arunachal Pradesh, Lower subansiri district, Subansiri river below damsite, 2-vii-2007, Alt. 100 mtr. 27°32'82.0'' N. 94°15'35.0'' E. Coll. R. Mathew & Party (Reg. No. ERS-V/F- 2806).

Paratypes : 3 specimens, 30.73-39.09 mm TL, India, Arunachal Pradesh, Lower subansiri district, Subansiri river below damsite, 2-vii-2007, Alt. 100 mtr. 27°32'82.0'' N. 94°15'35.0'' E. Coll. R. Mathew & Party (Reg. No. ERS-V/F-2807).

4 specimens, 29.78 - 43.61 mm TL, India, Assam, Dhemaji District, Dilpai River, Gerukamukh, 2-vii-2007,

Alt. 106 mtr. Coll. R. Mathew & Party (Reg. No. ERS-V/F-2808).

4 specimens, 36.67-45.27 mm TL, India, Assam, Dhemaji District, Dilpai River downstream, 3-vii-2007, Alt. 103 mtr. Coll. R. Mathew & Party (Reg. No. ERS-V/F-2809).

20 specimens, 25.42-48.74 mm TL, India, Arunachal Pradesh, Lohit District, Panbari village near Tezu, 2-vii-2007, Alt. 204 mtr. 27°54'56.7" N. 96°11'7.8" E. Coll. R. Mathew & Party (Reg. No. ERS-V/F-2810).

Diagnosis : *Badis triocellus* sp. nov. is characterized by the presence of three distinct black blotches on fins; two on anterior and posterior end of dorsal fin respectively and one on anal fin; anterior blotch on dorsal fin is present in between 3rd-5th dorsal spine, posterior one present slightly above base of last 3-4 soft rays. On anal fin, blotch is present a little above the base of last 3 soft rays. A light to dark brown blotch on middle of the opercle, a brownish blotch at middle of the base of caudal fin and a faint pattern of alternating light to brown irregular stripes along the sides of the body are additional combination of characters.

Description : D 15/9; P 12; V 1/6; A 3/8; C 14.

Body moderately elongated, slightly compressed laterally, its depth 27.67% in SL. Head laterally compressed its length 27.44%, width 16.05%, and depth 18.48% of SL. Dorsal profile gradually rising from tip of snout to the base of 3rd-4th dorsal spine, then sloping gently towards the end of dorsal fin and slightly concave or straight on caudal peduncle; ventral profile almost horizontal from end of opercle to the origin of anal fin, then almost straight on the caudal peduncle. Mouth small and slightly protrusible; lower jaw slightly projecting and maxilla extending beyond anterior margin of orbit. The eye is situated laterally in anterior half of head, its diameter 5.70%, interorbital space 8.65%, length of snout 6.86% of SL. Operculum triangular with slender spine projecting posteriorly (Table-1).

Dorsal fin single and large with the spinous portion being of much greater extent than the soft part; length of dorsal fin base 55.01%, height of spinous dorsal fin 12.89%, soft dorsal fin 17.32 % of SL. Anal fin with 3 spines, its rayed portion (17.53% of SL) similar to that of the dorsal fin; tips of soft dorsal and anal fins are rounded. Tip of pectoral fin is rounded and its length slightly shorter (22.11% of SL) than pelvic fin (23.01% of SL) which is pointed and not reaching anus. Distance between pectoral and pelvic fins (7.17%) is more than four times the distance between pelvic and anal fins

(30.29%). Distance between anus and anal fin (3.13% of SL) is more than eight times the distance between pelvic fin and anus (26.22% of SL). Caudal fin is rounded, its length 21.36% of SL, length of caudal peduncle is more (16.26% of SL) than its height (14.96% of SL) (Table-1).

Lateral line scales 28; Lateral transverse scales 8; Predorsal scales 9; scales around caudal peduncle 14.

Colouration : Body brownish dorso-laterally, pale brown to white ventrally. Brownish irregular stripes present along lateral side. Thin brown preorbital stripe runs through chin. Postorbital stripe thicker and darker than preorbital stripe. Brownish suborbital stripe run across the underside of the head. A light to dark brown blotch present on middle of opercle. Spinous portion of dorsal fin dark brown, soft part lighter. One blotch present anteriorly in between the base of 3rd-5th dorsal spine and another at slightly above the base of the last 3-4 soft dorsal rays. Spinous part of anal appears lighter and paler than the soft part with a prominent black blotch a little above base of the last 3 soft anal fin rays. Caudal fin with a brown blotch at middle of its base. Pelvic fin slightly brownish (Plate-I A, B).

Etymology : The species is named based on the presence of 3 (Three) distinct blotches on fins.

Paratypes are almost similar to holotypes with a few meristic and morphological differences. D 14-16/ 8-9; P 12; V 1/5-6; A 3/6-8; C 13-14; Lateral line scales 28-29; Lateral transverse scales 8; Predorsal scales 9; scales around caudal peduncle 12-15. Other morphological measurements have been given in Table-1.

Distribution : Arunachal Pradesh, Assam and Meghalaya in North East India.

DISCUSSION

The new species has been compared with its related species of North East India including Bangladesh (Table-2 and 3).

Badis triocellus sp. nov. shares similarity with *Badis badis* (Plate-II A, B) in head length, head width, snout length, distance between tip of snout and origin of anal fin, distance between origin of pectoral and pelvic fin, distance between origin of pelvic and anal fin, anal fin base, distance between anus and anal fin and least height of caudal peduncle, but differs in head depth, eye diameter, inter orbital distance, body depth, distance between tip of snout and origin of pectoral fin, distance between tip of snout and origin of pelvic fin, height of spiny dorsal fin and height of soft dorsal fin, length of anal fin, dorsal fin base, length of pectoral fin, length

Table-1 : Proportional length (in millimeter), counts of rays and scales and different morphological measurements in percentage of Standard length in different specimens of *Badis triocellus* sp.nov.

	HOLOTYPE	RANGE (HOLOTYPE + PARATYPES) N=32	Mean	SD
Total Length	46.86	25.42-48.74	34.52	
Standard Length	38.63	20.66-39.84	28.16	
COUNTS				
Spinous dorsal fin rays	15	14-16		
Soft dorsal fin rays	9	8-9		
Pectoral fin rays	12	12		
Pelvic fin rays	1/6	1/6		
Anal fin rays	3/8	3/6-8		
Caudal fin rays	14	13-14		
Lateral scale rows	28	28-29		
Lateral transverse scale rows	8	8		
Predorsal scale	9	9		
Scales around caudal peduncle	14	12-15		
MEASUREMENTS (%)				
Head Length	27.44	26.78-33.01	29.42	1.35
Head width	16.05	14.49-20.02	16.69	1.50
Head depth	18.48	13.68-26.31	19.08	2.78
Eye diameter	5.70	5.70-10.20	8.52	0.97
Inter orbital distance	8.65	7.05-10.52	8.54	0.80
Snout length	6.86	5.50-9.05	7.20	0.82
Body depth	27.67	25.47-34.97	29.16	2.18
Distance between tip of snout and origin of pectoral fin	29.87	26.67-37.08	31.49	2.16
Distance between tip of snout and origin of pelvic fin	34.84	32.70-44.16	36.32	2.37
Distance between tip of snout and origin of anal fin	64.35	62.08-70.30	65.70	2.06
Distance between origin of pectoral and pelvic fin	7.17	5.45-9.29	6.81	0.80
Distance between origin of pelvic and anal fin	30.29	23.04-33.21	28.96	2.72
Height of Spiny dorsal fin	12.89	10.14-17.85	13.80	1.76
Height of soft dorsal fin	17.32	10.74-22.09	15.38	2.19
Length of anal fin	18.20	11.67-21.46	16.80	2.22
Dorsal fin base	55.01	45.22-57.48	53.43	2.79
Anal fin base	17.53	11.91-18.80	15.29	1.63
Length of pectoral fin	22.11	18.52-26.77	22.05	1.81
Length of pelvic fin	23.01	18.45-26.57	23.03	1.58
Distance between pelvic fin and anus	26.22	16.40-31.14	24.57	3.24
Distance between anus and anal fin	3.13	1.42-6.28	3.92	0.90
Length of caudal peduncle	16.26	14.42-22.37	17.56	1.90
Least height of caudal peduncle	14.96	13.61-16.41	14.81	0.73
Length of caudal fin	21.36	17.15-25.60	21.49	1.73

of pelvic fin, distance between pelvic fin and anus, length of caudal peduncle and length of caudal fin (Table-2). Moreover, dorsal fin spines and soft rays are relatively fewer in *B. triocellus* sp. nov. than *B. badis*; depth of body, circumpeduncular scales (12-15 versus

14-20) are relatively less than that of *B. badis*. Inter orbital width is relatively more in *B. triocellus* sp. nov. than *B. badis*. The number of pectoral fin rays is generally constant (12) in *B. triocellus* sp. nov. but varies in *B. badis* (11-14) (Table-3).

Table 2 : Range and Mean value of proportional measurements in percentage of Standard length of *Badis triocellus* sp.nov. with related species from North East India.

	Range <i>B triocellus</i> (n = 32)	Mean %	SD	Range <i>B badis</i> (n = 6)	Mean %	SD	Range <i>B assamensis</i> (n = 10)	Mean %	SD	<i>Badis tuivaiei</i> (n = 1)	Mean % <i>B tuivai</i>
Standard Length	20.66-39.84	28.16	5.12	16.12-29.01	22.41	4.79	31.35-51.16	41.43	5.94	47.96	47.96
Head Length	26.78-33.01	29.42	1.35	25.12-32.13	29.19	2.17	26.60-31.24	29.02	1.63	26.67	26.67
Head width	14.49-20.02	16.69	1.50	15.48-18.22	16.68	1.13	14.43-16.85	15.56	0.69	14.66	14.66
Head depth	13.68-26.31	19.08	2.78	14.96-21.69	18.14	2.38	17.16-19.87	18.38	0.82	15.80	15.80
Eye diameter	5.70-10.20	8.52	0.97	8.35-10.73	9.47	0.79	5.75-9.25	7.18	0.89	7.21	7.21
Inter orbital distance	7.05-10.52	8.54	0.80	7.93-9.66	9.18	0.60	6.49-8.48	7.26	0.56	7.26	7.26
Snout length	5.50-9.05	7.20	0.82	5.89-7.56	6.92	0.64	5.29-8.58	7.10	1.15	7.03	7.03
Body depth	25.47-34.97	29.16	2.18	25.90-33.22	28.57	2.47	23.98-31.91	27.83	1.99	28.57	28.57
Distance between tip of snout and origin of pectoral fin	26.67-37.08	31.49	2.16	29.96-31.89	30.77	0.67	30.28-32.61	31.26	0.81	28.57	28.57
Distance between tip of snout and origin of pelvic fin	32.70-44.16	36.32	2.37	22.39-37.41	33.12	4.95	34.77-37.51	35.83	0.74	35.07	35.07
Distance between tip of snout and origin of anal fin	62.08-70.30	65.70	2.06	64.03-67.12	65.46	1.06	65.71-69.48	67.32	1.14	68.29	68.29
Distance between origin of pectoral and pelvic fin	5.45-9.29	6.81	0.80	5.72-8.93	7.13	0.97	5.15-6.87	5.98	0.53	6.26	6.26
Distance between origin of pelvic and anal fin	23.04-33.21	28.96	2.72	26.06-31.29	28.89	1.89	31.40-34.54	32.79	0.94	35.30	35.30
Height of Spiny dorsal fin	10.14-17.85	13.80	1.76	11.72-16.53	14.84	1.73	9.75-16.36	13.07	2.03	18.97	18.97
Height of soft dorsal fin	10.74-22.09	15.38	2.19	11.29-15.65	13.90	1.63	14.48-20.70	17.15	1.61	14.22	14.22
Length of anal fin	11.67-21.46	16.80	2.22	14.19-18.72	16.17	1.40	13.36-20.76	18.20	2.52	18.41	18.41
Dorsal fin base	45.22-57.48	53.43	2.79	48.78-55.92	52.00	2.62	54.74-58.39	56.66	1.25	55.73	55.73
Anal fin base	11.91-18.80	15.29	1.63	13.86-16.16	14.94	0.80	15.16-18.97	17.27	1.12	15.76	15.76
Length of pectoral fin	18.52-26.77	22.05	1.81	13.83-23.33	19.36	2.90	18.38-22.25	20.16	1.24	21.31	21.31
Length of pelvic fin	18.45-26.57	23.03	1.58	18.33-24.34	22.35	2.02	19.52-24.98	22.70	1.49	24.02	24.02
Distance between pelvic fin and anus	16.40-31.14	24.57	3.24	25.01-28.93	26.27	1.32	26.61-28.46	27.28	0.58	30.65	30.65
Distance between anus and anal fin	1.42-6.28	3.92	0.90	2.36-6.92	4.16	1.47	2.93-5.93	5.01	0.97	6.32	6.32
Length of caudal peduncle	14.42-22.37	17.56	1.90	13.40-17.18	14.70	1.26	12.01-16.52	14.08	1.35	15.39	15.39
Least height of caudal peduncle	13.61-16.41	14.81	0.73	13.21-16.31	14.42	1.15	12.81-16.04	14.56	1.19	14.45	14.45
Length of caudal fin	17.15-25.60	21.49	1.73	18.18-22.89	20.80	1.94	20.09-26.33	23.09	2.19	23.35	23.35

Table-3 : Comparison of proportional measurements in percentage of standard length and counts of *Badis triocellus* sp. nov. with related species.

Proportions	<i>B. triocellus</i> sp.nov. (Range)	<i>B. badis</i> (Range)	<i>B. assamensis</i> (Range)	<i>B. tuivaiei</i> (Range)	<i>B. chittagongis</i> (Range)	<i>B. kanabos</i> (Range)	<i>B. blosyrus</i> (Range)
Body depth	25.47-34.97	25.90-38.9	23.98-31.91	25.9-29.2	29.8-34.0	29.9-35.4	–
Interorbital width	7.05-10.52	6.50-9.66	6.49-8.48	5.60-7.26	5.5-6.7	7.3-8.6	6.4-8.0
Counts							
Dorsal fin rays (Spiny)	14-16	14-18	15-17	16-18	16-18	15-17	16-17
Dorsal fin rays (Soft)	8-9	7-10	9-11	9-9	9-11	8-10	8-11
Pectoral fin rays	12	11-14	12-14	12-14	12-14	11-13	–
Anal fin rays(soft)	6-8	6-8	6-8	6-10	6-9	6-8	7-8
Lateral scales rows	28-29	25-29	29-32	26-32	27-29	25-26	27-28
Circumpeduncular scales	12-15	14-20	12-14	14-20	20	16-17	–

Badis triocellus sp. nov. shares similarity with *Badis assamensis* (Plate-III & IV A, B) in head length, length of snout, length of pelvic fin, distance between tip of snout and origin of pectoral fin, distance between tip of snout and origin of pelvic fin and least height of caudal peduncle, but differs in head width, head depth, eye diameter, inter orbital distance, body depth, distance between tip of snout and origin of anal fin, distance between origin of pectoral and pelvic fin, distance between origin of pelvic fin and anal fin, height of spiny dorsal fin and height of soft dorsal fin, length of anal fin, dorsal fin base, anal fin base, length of pectoral fin, distance between pelvic fin and anus, distance between anus and anal fin, length of caudal peduncle and length of caudal fin (Table-2). Moreover, dorsal fin spines and soft rays are relatively less in *B. triocellus* sp. nov. than *B. assamensis*; depth of body (25.47-34.97% versus 23.98-31.91%), interorbital width (7.05-10.52% versus 6.49-8.48%) are more than that of *B. assamensis*. Lateral line scales are less (28-29 versus 29-32) in *B. triocellus* sp. nov. than *B. assamensis* (Table-3).

Badis triocellus sp.nov. shares similarity with *Badis tuivaiei* (Plate-V A, B) in length of snout, anal fin base and least height of caudal peduncle but differs in head length, head width, head depth, eye diameter, inter orbital distance, body depth, distance between tip of snout and origin of pectoral fin, distance between tip of snout and origin of pelvic fin, distance between tip of snout and origin of anal fin, distance between origin of pectoral and pelvic fin, distance between origin of pelvic fin and anal fin, height of spiny dorsal fin and height of soft dorsal fin, length of anal fin, dorsal fin base, length of pectoral fin, length of pelvic fin, distance

between pelvic fin and anus, distance between anus and anal fin, length of caudal peduncle and length of caudal fin (Table-2). Moreover, dorsal fin spines (14-16 spines versus 16-18), anal fin rays, circumpeduncular scales (12-15 versus 14-20) are relatively less than *Badis tuivaiei*; depth of body, interorbital width (7.05-10.52% versus 5.60-7.26%) are relatively more than that of *B. tuivaiei*. The number of pectoral fin rays is generally constant (12) in *B. triocellus* sp. nov. but varies in *B. tuivaiei* (12-14) (Table-3).

The *Badis triocellus* sp. nov. differs from *B. kanabos* in having relatively less number of dorsal spines, less soft dorsal (9-9 versus 8-10), less body depth (25.47-34.97% versus 29.9-35.4%), less circumpeduncular scales (12-15 versus 16-17); more interorbital width and more lateral line scales (28-29 versus 25-26) (Table-3).

The *Badis triocellus* sp. nov. differs from *B. chittagongis* in having less number of dorsal spines (14-16 versus 16-18), soft dorsal fin rays (8-9 versus 9-11) and soft anal fin rays; relatively less body depth (25.47-34.97% versus 29.8-34%), less circumpeduncular scales (12-15 versus 20) and more interorbital width (7.05-10.52% versus 5.5-6.7%) (Table-3).

The *Badis triocellus* sp. nov. is similar to *B. blosyrus* in numbers of soft anal fin rays but differs from it in having more interorbital width (7.05-10.52 % versus 6.4-8.0 %), less number of dorsal spines (14-16 versus 16-17) and less number of soft dorsal fin rays. *B. triocellus* sp. nov. has relatively more number of lateral scales rows than *B. blosyrus* (Table-3).

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PLATE-I



A : *Badis triocellus* sp. nov. (Lateral view)

B : Dorsal and Anal fins showing three spots

PLATE-II



A



B

(Varieties of *Badis badis*)

PLATE-III

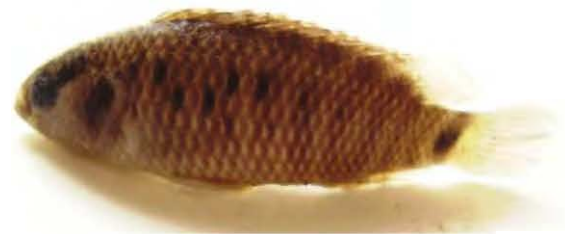


A : *Badis assamensis* (Lateral view)



B : Showing distinct caudal spot

PLATE-IV



A and B (Varieties of *Badis assamensis*)

PLATE-V



A : Lateral view of *Badis tuivaiei*



B : Showing distinct blotch above pectoral fin