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Studies on Morphometric Measurements and Meristic Counts of Hill Trout (*Barilius Bendelisis*, Hamilton) From the River Buroi at the Boundary Areas of Assam and Arunachal Pradesh, India

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ABSTRACT

Thirty specimens of hill trout *Barilius bendelisis* (Hamilton) were collected from the river Buroi. Morphometric measurements and meristic counts of different size groups of the fishes were studied. The mean ratios of morphometric measurements among the size groups in relation to the body length and weight showed the isometric growth pattern. All the meristic characters remained constant with increasing body length and weight.

Key words: *Barilius bendelisis*, morphometric measurements, meristic counts, isometric growth, morphological systematics.

INTRODUCTION

Identification of a species is a primary step towards any research work and plays a key role for the behavioral study. Morphometric measurements and meristic counts are considered as easiest and authentic methods for the identification of specimen which is termed as morphological systematics (Nayman, 1965). Morphometric measurement is measurements of different external body parts of an organism and meristic counts mean anything that can be counted (Talwar and Jhingran, 1991). The hill trout *Barilius bendelisis* (Hamilton) has recently drawn the attention as one of the potential candidates for aquaculture and captive breeding in hilly areas of North East India (Suresh and Mandal, 2001). This fish is also considered as one of the principal commercial hill stream fishes in the rivers of Jammu and perhaps for other areas of the eastern Himalaya (Talwar & Jhingran, 1992). The fish species was further enlisted as suitable member for farming in water harvesting pond of North Eastern Region (Suresh and Mandal, 2001). It was also reported that this fish forms very good captive resource in most of the streams and rivers of Arunachal Pradesh, India and locally it is known as Rebio Tapio or Ngaba Ngata (Nath & Day, 2000; Talwar & Jhingran, 1992; Jayaram & Majumdar, 1964; reported). In total six species of hill trout under the cyprinid genus *Barilius* were reported from the Arunachal Pradesh (Nath and Dey 1997). They are *B. barna* (Hamilton), *B. bendelisis* (Hamilton),*B. bola* (Hamilton), *B. shacra* (Hamilton), *B. tileo* (Hamilton) and *B. vagra* (Hamilton). However, in regard to abundance and distribution , the species *Barilius bendelisis* (Hamilton) is found frequently in the drainage system and seems to be the most promising candidate for future development of aquaculture in the entire North East.

As a non-conventional proposed candidate for aquaculture, very limited information are available on the morphometric measurements and meristic counts of *Barilius bendelisis* from the water bodies of the Assam and Arunachal Pradesh. Further, recognition or identification of a species is necessary and must be done in all types of biological studies where morphological systematics is used for quick identification and confirmation. Therefore, the present study is designed to generate data on morphometry and diagnostics for the species *Barilius bendelisis* and also to confirm the constancy of size specific ratio of certain morphometric measurements of fishes existing in river Buroi at boundary areas of Assam and Arunachal Pradesh.

MATERIALS AND METHODS

Thirty specimens of *Barilius bendelisis* (50 mm-135 mm in body length) were collected from the river Buroi located in boundary areas of Assam and Arunachal Pradesh with the help of cast net (circumference =2.0-2.5 m and mesh size =1.0 cm.) Fishes were preserved in 10% formalin solution. The fishes of different sizes were also tagged by using suitable tagging material in the dorsal fin and were grouped accordingly for convenience of study as follows:

Group A: 4.0-7.0 cm   (10 Specimens)

Group B: 7.0-10.0 cm   (10 Specimens)

Group C: 10.0-Above (10 Specimens)

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Table1: Morphometric measurements (mm) of *Barilius bendelisis*.

Parameters	Group-A	Group-B	Group-C
Weight of Fish (gm)	19.3807 ± 6.2360	8.23 ± 1.7169	2.06 ±0.7944
Total length	120.9 ± 9.9601	90.7 ± 6.4126	56.4 ±8.0304
Standard Length	97.5 ±9.0210	76 ± 5.0552	46.6 ±6.7032
fork Length	110.4 ±10.904	81.8 ±5.0066	50.9 ±8.1034
Body Depth	25.1 ± 4.1496	19 ±1.7638	10.7 ±2.0575
Post Orbital Length of Head	9.5 ±0 .8401	7.3 ±0.6749	5.3 ±1.4491
Diameter of Eye	4.1 ±0.3162	4.0 ±0	3.0 ±0
Inter Orbital Distance	9.1 ±4.4575	3.9 ±0.7378	3.6 ±0.8595
Inter Nostril Distance	3.9 ±0.3162	1.9 ±0.3944	1.9 ±0.6324
Head Length	21.7 ±2.2135	17 ±1.7919	11.3 ±1.4944
Head depth	18.5 ±3.1710	13.6 ±1.2649	7.6 ±1.7125
Head Width	10.1 ±0.8755	4.9 ±0.7378	4.65 ±0.5795
Length of Caudal peduncle	15.8 ±3.6757	13.6 ±1.4298	8.7 ±1.0488
Depth of Caudal Peduncle	9.6 ±1.3498	7.3 ±0.6749	4.6 ±0.6992
Length of Upper Jaw	14.7 ±2.8248	12.8 ±1.6865	5.1 ±0.3162
Length of Lower Jaw	12.4 ±3.4253	10.1 ±1.1972	4.85 ±0.2415
Length of Dorsal Fin	17.8 ±2.4404	13.2 ±1.6193	9.3 ±1.0593
Length of Pectoral Fin	18 ±2.5819	13.9 ±1.6193	9.2 ±1.5599
Length of Pelvic Fin	13.39 ±3.7389	10.3 ±0.8232	7 ±0
Length of Anal Fin	13.1 ±1.1005	10.4 ±0.8432	8 ±1.0540
Length of Caudal Fin	21.8 ±4.4671	18.3 ±1.1595	11.7 ±0.9486
Length of Dorsal Fin Base	11.3 ± 1.8885	9.2 ±0.6324	5.2 ±0.4216
Length of Anal Fin base	12.4 ±1.7126	9.1 ±0.5676	5.2 ±0.4216
Pre Dorsal Length	57.3 ±2.3593	42.7 ±2.5407	24.9 ±7.9435
Post Dorsal Length	28.9 ±7.1717	24.4 ±3.1692	15.6 ±2.9514
Pre Pectoral Length	25.8 ±4.2895	20.3 ±1.2516	12.8 ±1.4757
Pre Pelvic Length	51.5 ±10.7108	40.8 2.2509	25.5 ±3.5668
Pre Anal Length	71.8 ±14.9532	55.9 ±3.1428	33.8 ±8.9913

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Table 2: Ratios among the Size Groups

Proportions	Mean Ratios		
	Group-A	Group-B	Group-C
Standard Length/ Body Depth	3.874, ± 1.1338	4.011, ± 0.2017	4.382, ± 0.2296
Standard Length / Head Length	4.498, ± 0.2093	4.44 ± 0.1836	4.126, ± 0.2879
Standard Length / Pre Dorsal Length	1.698, ± 0.1436	1.779, ± 0.0575	1.824, ± 0.0777
Standard Length / Post Dorsal Length	3.5, ± 0.5887	3.149, ± 0.3309	2.894, ± 0.3389
Inter Orbital Distance / Diameter of Eye	2.23, ± 0.2658	0.975, ± 0.9922	1.214, ± 0.1934
Head Length / Diameter of Eye	5.425, ± 0.8164	4.275, ± 0.4479	3.764, ± 0.4980
Head Length / Head Width	2.185, ± 0.4402	3.5, ± 0.3771	2.432, ± 0.1701
Head Length / Head depth	1.189, ± 0.1416	1.254, ± 0 .0864	1.513, ± 0.1586
Head Length / Length of Caudal peduncle	1.407, ± 0.1854	1.256, ± 0.0976	1.294, ± 0.1095
Head Length / Depth of Caudal Peduncle	2.271, ± 0.1441	2.339, ± 0.1416	2.463, ± 0.0783
Length of Caudal peduncle / Depth of Caudal Peduncle	1.624, ± 0.1562	1.863, ± 0.1188	1.911, ± 0.1696

Table 3: Significance test of variation of characters among group-A, group-B and group-C

Proportions	t-Test			
	Bet[n] Group-A & Group-B		Bet[n] Group-B & Group-C	
Standard Length / Body Depth	(0.1878)	Not Significant	(0.0012)	Not Significant
Standard Length / Head Length	(0.4895)	Not Significant	(0.0012)	Not Significant
Standard Length /Pre Dorsal Length	(0.1340)	Not Significant	(0.0106)	Not Significant
Standard Length / Post Dorsal Length	(0.1222)	Not Significant	(0.2336)	Not Significant
Head Length / Head depth	(0.23455)	Not Significant	(0.0004)	Not Significant
Head Length / Length of Caudal peduncle	(0.0332)	Not Significant	(0.3156)	Not Significant
Head Length / Depth of Caudal Peduncle	(0.2950)	Not Significant	(0.0392)	Not Significant
Length of Caudal peduncle / Depth of Caudal Peduncle	(0.0013)	Not Significant	(0.4741)	Not Significant

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Table 4: Meristic Counts of *Barilius bendelisis*

Distribution Group	Meristic Counts					
	Dorsal fin rays	Pectoral fin rays	Pelvic fin rays	Anal fin rays	caudal fin rays	Lateral line scales
Group A	1, 7	1, 13	1, 8-10	1, 8	18-20	41
Group B	1, 7	1, 13	1, 8-10	1, 8	18-20	41
Group C	1, 7	1, 13	1, 8-10	1, 8	18-20	41

Figure 1: Photograph of *Barilius bendelisis*

The morphometric measurements and meristic counts were performed following standard methods (Jayaram, 2002 and Kottelat, 2001).Various equipments like magnifying glass, Stage microscope, Electric balance, Scales, Dividers and Vernier Caliper were used during the study and measurements. The ratios of different morphometric parameters were compared among the groups and level of significance were tested accordingly (Medhi, 2000).

RESULTS AND DISCUSSION
The morphometric measurements of fish species i.e. Weight, Total length (TL), Standard length (SL), Fork length, Body depth, Pre orbital length of Head, Post orbital length of Head, Eye diameter, Inter Orbital Distance, Inter Nostril Distance, Head Length , head depth, head width, Length of Caudal peduncle, Depth of Caudal Peduncle, Length of Upper Jaw, Length of Lower Jaw, Length of Dorsal Fin, Length of Pectoral Fin, Length of Pelvic Fin, Length of Anal Fin, Length of Caudal Fin, Length of Dorsal Fin Base, Length of Anal Fin Base, Pre Dorsal Length, Pre Pectoral Length, Pre Pelvic Length, Pre Anal Length and post dorsal length were found to increase among three different size groups viz.   group-A, group-B and Group-C

proportionately with the body length of the fishes (Table1). The ratio of morphometric measurements among the three size groups revealed the isometric growth pattern of the fish along with their increasing body sizes. The values of the morphometric parameters of the fish species changed partly in growth rate of body parts. The body depth of each of the individual specimen was 3.8 to 4.3 times of standard length as reported earlier (Talwar &Jhingran, 1992).The total (**68.6,51.9,30.1**) of pre dorsal length (**57.3,42.7,24.9**) and length of dorsal fin base (**11.3,9.2,5.2**) is less than that of the pre anal length (**71.8,55.9,33.8**) of group-A, group-B and group-C respectively which indicates preposition of dorsal fin in advance to the anal fin (Nath and Dey, 2000). The slight variation of mean ratios among the size groups may be due to range effect in groupings (Table 2). However the t-Test among the three different size groups revealed no significant differences exist in growth rate at 5% probability level of significance among them supporting isometric growth pattern (Table3).The meristic counts of the fish Species showed that dorsal fin rays, pectoral fin rays, Pelvic fin rays, Lateral line scales remained constant in all size groups (Table 4). The meristic counts were independent of body size as well as weight (Talwar and Jhingran,

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(Talwar and Jhingran, 1992; Negi Ram Krishan and Negi Tarana 2010; Muhammad Zafar et. al. 2002). The numbers of lateral line scales were found forty one (41) and remained constant in all the three groups of studied fish species (Talwar and Jhingran, 1992; Nath & Dey, 2000). The diagonostic features showed that the Head is compressed, snout pointed , mouth oblique and superior, Barbels four (two rostral and two maxillary)and short, Lateral line complete, body colour silvery, scales tinged with black spots at the base. All the characteristics among the groups were found similar to each other even at individual level. Moreover these features were same as reported earlier from rivers of Arunachal Pradesh (Jayaram and Mazumdar, 1964; Choudhury and Sen, 1977). The barbels were also very short, rostral and maxillary almost of equal length (Nath & Dey, 2000) and lateral line scales with two black spots at their base (Talwar and Jhingran, 1992).

CONCLUSION

The morphometric measurements and meristic counts confirmed that the test organism is *Barilius bendelisis* and it predominantly exists in river Buroi.

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