

Physico-chemical characteristics of habitat and morphometric analysis on *Barilius bendelisis* of bariliine cyprinids in Torsa river of West Bengal, India: A potential area of new research

Gobinda Chandra De^{1*}, Abhisek Saha¹, Debashis Das²

De GC, Abhisek S, Das D. Physico-chemical characteristics of habitat and morphometric analysis on *Barilius bendelisis* of bariliine cyprinids in Torsa river of West Bengal, India: A potential area of new research. *AGBIR*. 2021; 37(6):226-229.

Genus *Barilius*, an interesting group of Cyprinid fish, is mostly a resident of the hill streams. The present work is an attempt to document a systematic account of morphometric character of a species namely *Barilius bendelisis* under the genus *Barilius* from the Torsa River flowing in the northern part of West Bengal, India along with proper illustrations and to reevaluation the

general taxonomy of the Indian bariliine cyprinids in the beam of accessible information. The mean value, the physico-chemical parameters (water temperature-26°C, pH-7.4, dissolved oxygen-6.8 g/l, etc.) of the habitat was suitable to survive the species. Findings of the result suggests to go for further study to find the huge possibility that the studied species may show cryptic diversity of already reported *Barilius bendelisis* of this region.

Key Words: *Barilius*; Morphometric; *Barilius bendelisis*; Cyprinid fish; Physico-chemical parameter

INTRODUCTION

Barilius bendelisis (Hamilton) is a highlands water fish of the South East Asia region which belongs to the Cyprinidae family which lives in low, clear, and chill water [1]. There is a concern that the species is extremely widespread besides endangered in of Himalayan Region Rivers [2]. Generally distributed in hilly streams and rivers of the Himalayan region in northeast India. Generally, fish show a high degree of variation among all the vertebrates and are more vulnerable to environmentally induced morphological variation [3]. The reason for morphological variation between the populations is complicated to explain [4]. Suggestions were made that these alterations can be genetically interrelated or might be linked with phenotypic plasticity in rejoinder to environmental surroundings [5].

Hamilton-Buchanan proposed the genus *Barilius* and documented twelve species from the Gangetic system, India [6]. McClelland proposed Opsarius based on features like broad mouth, spots on the body, anal fin elongated and lower edge of the body extra arched than the upper portion, small dorsal fin placed behind the middle part [7]. Latter on Hora pointed out that Hamilton preserved no specimens and his drawings are the source of information of various species of genus *Barilius* [8]. Day documented 14 species, Jayaram enlisted 16 species from India, Talwar and Jhingran documented 14 species, Menon mentioned 15 species in his study of the genus *Barilius* [9-12]. Day considered Hamilton's cocs, chedra and tila as synonyms for bendelisis and chedrio and goha as barila and bola respectively [13]. Observation of Day based on barbels was challenged by Hora who mentioned that barbels may be hidden under the folds of skin and there is a chance of unnoticed [14]. Howes in his study reported other criteria like mycological and osteological factors as a diagnostic tool for the detection of the bariliine cyprinids [15]. Chu considered the

pharyngeal bones, scales, teeth in some Chinese cyprinids [16]. Nag considered caudal anatomy in his study [17]. Verma studied on the appendicular skeleton of *Barilius* [18]. At this point mentioned above, the review of the genus is an urgent need to clarify the ambiguities to draw attention to an accurate representation. The present study has documented *Barilius bendelisis* under *Barilius* sp. from the Northern part of West Bengal, India which has close proximity with the eastern region of the Himalayan Biodiversity hotspot. *Barilius bendelisis* occurs throughout India through morphometric features of the species are given in addition with keys for identification.

MATERIALS AND METHODS

Materials for the present investigation are the species namely *Barilius bendelisis* under the genus *Barilius*, occurring from the Torsa river (26°17'13.93"N, 89°27'33.05"E) of Cooch Behar district of West Bengal, India. Few attenuated specimens were preserved in formaldehyde solution (10%) for further studies. The instrument used for X-ray study of the *Barilius bendelisis* was Siemens-500 ma X-ray machine. The morphometric details of the species are given in Table 1. Which has a good agreement with the report given by Hamilton, Rahman, Jayaram, Shafi and Quaddus [19-22]. But we have observed few variations in characteristics which are very special for the studied species. Meristic characters of the majority bariliines are highly conventional and illustrate small variations, therefore observations were made, therefore, with great care to stay away from errors, to avoid specimen being referred to the incorrect species. Specimen of *Barilius bendelisis* (Figures 1 and 2). Was collected from Torsa River by using cast net during October 2020 (Figure 1). The colour in fresh specimens was taken before fixation and preservation. All counts and measurements i.e. lateral line scale count, anatomical measurements. Vertebral counts were done by using standard procedures [23-26].

TABLE 1

Morphometric measurement of nine sps of *Barilius bendelisis*

	Sp 1Bb	Sp 2Bb	Sp 3Bb	Sp 4Bb	Sp 5Bb	Sp 6Bb	Sp 7Bb	Sp 8Bb	Sp 9Bb
Total length	6.5 cm	7.1 cm	6.3 cm	8.2 cm	7 cm	8 cm	7.8 cm	7.7 cm	7.6 cm
Standard length	5.2 cm	5.3 cm	5.1 cm	6.6 cm	5.3 cm	6.5 cm	5.4 cm	5.3 cm	5.2 cm
Fork length	5.9 cm	6.4 cm	5.7 cm	7.5 cm	6.2 cm	7.4 cm	6.6 cm	6.5 cm	6.4 cm

¹ Department of Chemistry, Cooch Behar Panchanan Barma University, West Bengal, India; ² Department of Zoology, Tufanganj College, Cooch Behar, West Bengal, India

Correspondence: Gobinda Chandra De, Department of Chemistry, Cooch Behar, Panchanan Barma University, P. O. Box 736101, West Bengal, India, E-mail: degobinda@yahoo.com

Received: 05 November, 2021; **Accepted:** 19 November, 2021; **Published:** 23 November, 2021



This open-access article is distributed under the terms of the Creative Commons Attribution Non-Commercial License (CC BY-NC) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits reuse, distribution and reproduction of the article, provided that the original work is properly cited and the reuse is restricted to noncommercial purposes. For commercial reuse, contact reprints@pulsus.com

Weight	2.62 gm	3.31 gm	2.60 gm	4.37 gm	3.29 gm	4.35 gm	3.35 gm	3.34 gm	3.32 gm
Post dorsal length	1.5 cm	1.7 cm	1.4 cm	2 cm	1.6 cm	1.9 cm	1.9 cm	1.9 cm	1.8 cm
Length of pelvic fin	1.4 cm	1.4 cm	1.3 cm	1.6 cm	1.2 cm	1.7 cm	1.6 cm	1.6 cm	1.6 cm
Length of dorsal fin	0.7 cm	0.8 cm	0.5 cm	1.1 cm	0.9 cm	1.2 cm	0.9 cm	1 cm	1 cm
Head length	1.3 cm	1.5 cm	1.4 cm	1.7 cm	1.4 cm	1.6 cm	1.7 cm	1.7 cm	1.7 cm
Distance between pectoral and pelvic fin	0.7 cm	0.8 cm	0.6 cm	1.1 cm	0.7 cm	1.2 cm	0.9 cm	0.8 cm	0.8 cm
Length of anal fin	0.8 cm	0.9 cm	0.6 cm	1 cm	0.8 cm	1.1 cm	1 cm	1 cm	0.9 cm
Length of caudal peduncle	0.6 cm	0.7 cm	0.5 cm	0.9 cm	0.5 cm	0.8 cm	0.9 cm	0.9 cm	0.9 cm
Scales on lateral line	43	44	43	44	43	42	43	42	43
Scales on pre-dorsal line	18	19	18	19	20	18	19	18	19

Note: Bb means *Barilius bendelisis*

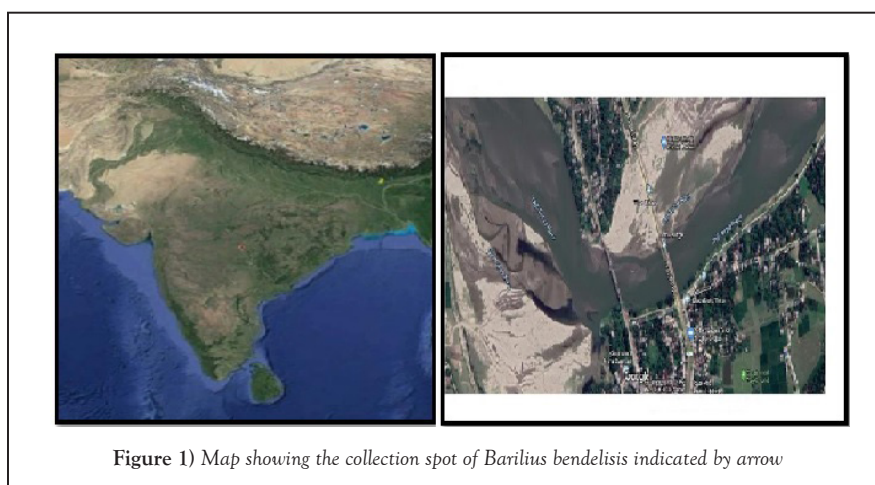


Figure 1) Map showing the collection spot of *Barilius bendelisis* indicated by arrow

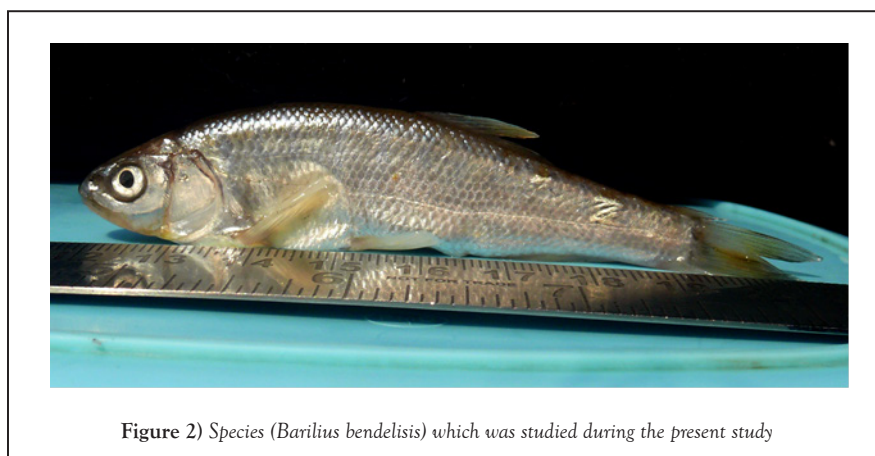


Figure 2) Species (*Barilius bendelisis*) which was studied during the present study

RESULTS

The body of *Barilius bendelisis* is silvery with greyish black dark bands descending towards the lateral line. The body is elongated with Mouth moderate and Jaws are long. The vertical color bands almost disappear. The distance of the post-orbital part of the head is less than twice the snout distance. The third sub-orbital bone differs in depth from being identical to twice as elevated as the exposed part of the cheek beneath it. Observed fin formula by the radiology (X-ray) study of the studied species recorded as D ii 7; P 13-14; V 9; A ii 8; C 18 Scales moderate size with many radii (Figures 3 and 4). Scales on lateral line: 43 (Average of nine samples taken). Scales on pre-dorsal line: 19 (Average of ten samples taken) (Figure 5). Dorsal surface light-dark and sides silvery grey. The dorsal profile is less convex than that of ventral. Dorsal fin entirely inserted in advance of the anal fin. The dorsal fin is with dark edged. The dorsal profile is less convex than that of ventral. Dorsal fin higher than the length of its base; it commences nearer the base of the caudal fin than the tip of snout and does extend to over the anal fin and is inserted posterior to the ventral. Dorsal fin entirely inserted in advance of

the anal fin. Dorsal fin inserted entirely in advance of the anal fin, nearer to the base of caudal fin than to snout trip. Edges of dorsal and caudal fins grayish. The lower lobe of caudal fin dusky. The bases of pectorals and the region in front of them are highly muscular and robust. The colour of the species is Silvery with a grayish back. 10-12 dark bands descending towards the lateral line were noted, the band size is descending at the lower part of the lateral line. Generally, Fins of *Barilius bendelisis* shows yellowish tinged with orange, but in the present study, we found that fins are tinged with yellow. Another remarkable feature is that all the scales of *Barilius bendelisis* bear black dots and double spots on the lateral line but in the present study we did not find any black dots [27]. The basis of difference in the morphometric and meristic characters may choice from genetic variability to the influence of environmental parameters [28-30]. This occurs because a number of body parts are liable to develop at different rates under the changeable environmental or habitat situation. The role of environmental, surroundings temperature, altitude, gradient, watercourse velocity, food available, length, sex, and age has also been verified [31].

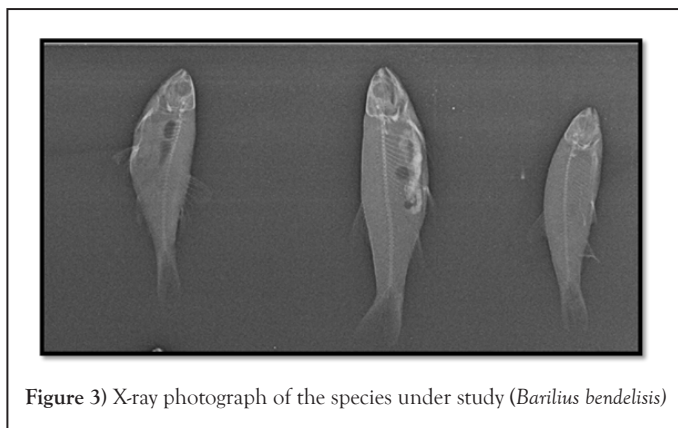


Figure 3) X-ray photograph of the species under study (*Barilius bendelisis*)

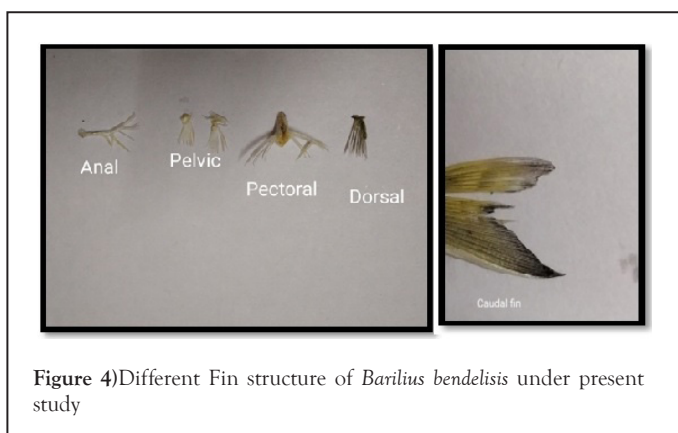


Figure 4) Different Fin structure of *Barilius bendelisis* under present study



Figure 5) Scales of *Barilius bendelisis* under present study

Habitat and ecology

The Torsa river is a transboundary river. The sampling location is situated very nearby to Cooch Behar's main district town of West Bengal, India. The mean value physico-chemical parameters of the sampling location were water temperature -26°C, pH-7.4, conductivity-140.3 µs/cm, and dissolved oxygen-6.8 g/l. The downstream of the river is extremely disturbed due to anthropogenic actions e.g., boating, bathing, washing, construction activities, unscientific fishing, fishing with poison and electric shock, etc.

CONCLUSION

In the present study, *Barilius bendelisis* of the genus *Barilius* from the Torsa River, West Bengal, India, have been examined in detail and described from

this region. The morphometric and meristic characteristics of the specimens collected have been found to be similar to a large extent when compared with already reported specimens of *Barilius bendelisis*. From our extensive literature survey, the diagnostic features also distinctly show that the species under report, *Barilius bendelisis* could be easily separated from all the already reported species and the synonymies of the Genus *Barilius*. But we observed a few characteristics which are not in matching with other reported *Barilius bendelisis* species which will open a promising area for new research in this field. *Barilius bendelisis* was one of the widespread species caught in the Torsa River during the month of April, May and in the month of October, November after the post-monsoon period. It is admired in the region for its taste. Our present piece of work has thrown new light on the distribution of Indian hill trout in the lower stretches unlike its restricted distribution to the upper stretches of Himalayan Rivers. However, more research is required to carry out in the field of DNA barcoding of the species, habitat preference, feeding habit, and reproductive behavior of the species so that any variability of the reported species shows cryptic diversity of *Barilius bendelisis* in this region could be further observed.

DECLARATION OF COMPETING INTEREST

We are thankful to the Department of Chemistry, Cooch Behar Panchanan Barma University, West Bengal, India and Department of Zoology, Tufanganj College, West Bengal, India to carry out the research work.

REFERENCES

- Gurung TB, Wagle SK, Bista JD, et al. Participatory fisheries management for livelihood improvement of fishers in Phewa Lake, Pokhara, Nepal. *Himalayan J H Sci.* 2005;3(5):47-52.
- Kurup BM, Radhakrishnan KV, Manojkumar TG, et al. Biodiversity status of fishes inhabiting rivers of Kerala (South India) with special reference to endemism, threats and conservation measures. *Himalayan J H Sci.* 2004; 2(1):1-7.
- Wimberger PH. Plasticity of fish body shape. The effects of diet, development, family and age in two species of *Geophagus* (Pisces: Cichlidae). *Biol J Linn Soc.* 1992;45(3):197-218.
- Cadrin SX. Advances in morphometric identification of fishery stocks. *Rev Fish Biol Fish.* 2000;10(1):91-112.
- Murta AG. Morphological variation of horse mackerel (*Trachurus trachurus*) in the Iberian and North African Atlantic: implications for stock identification. *ICES J Mar Sci.* 2000;57(4):1240-1248.
- Hamilton F. An account of the fishes found in the river Ganges and its branches. *Archibald Constable;* 1822;3(4):1-6.
- McClelland J. Indian Cyprinidae. *Asiat Res.* 1839;19 (2): 217-471.
- Hora SL. An aid to the study of Hamilton Buchanan's Gangetic Fishes. *Mem Indian Mus.* 1929; 9(1):169-192.
- Day F. Fauna of British India, including Ceylon and Burma. *Fishes.* 1889;1(2):1-54.
- Jayaram KC. Freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka. 1981;1(2):1-4.
- Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries. Oxford & IBH publishing. 1991;2(4):1158.
- Menon AGK. Check list-Freshwater fishes of India. *Rec Zool Surv.* 1999; 175(6):366.
- Day F. The fishes of India, being a natural history of the fishes known to inhabit the seas and freshwaters of India, Burma and Ceylon. 1879;32(5):553-778.
- Hora SL. On some new or rare species of fish from the eastern Himalayas. *Rec Indian Mus.* 1921;22(5):731-744.
- Howes GJ. The anatomy, phylogeny and classification of the bariliine cyprinid fishes. *Bull Br Mus Nat Hist.* 1980;37(3):129-198.
- Chu YT. Comparative studies on the scales and the pharyngeals and their teeth in Chinese cyprinids, with particular reference to taxonomy and evolution. *Biol Bull St John's Univ.* 1935;2(4):81-221.
- Nag AC. Functional morphology of the caudal region of certain clupeiform and perciform fishes with reference to the taxonomy. *J Morphol.* 1967;123(4):529-538.

18. Shukla GR, Verma SR. Appendicular skeleton of *Barilius bola* (MAM) with remark of phylogenetic. *Consideration Anat Anaz.* 1972;2(6):568-578.
19. Rahman AA. *Freshwater fishes of Bangladesh.* ZSB. 1989.
20. Jayaram KC. *The Freshwater Fishes of the Indian Region*, 2nd Editon. Narendra Pub.2010;10(4):616.
21. Shafi M, Quddus MAA. *Bangladesher Matsho Sampad (Fisheries of Bangladesh)* (in Bengali). Kabir Publication. 2001; 5(2):38-46.
22. Weitzman SH. The osteology of *Brycon meeki*, a generalized Characid fish, with an osteological definition of the family. *Standford Ichthyol Bull.* 1962;8(1):1-77.
23. Kottelat M. Indochinese namacheilines. A revision of nemacheiline loaches (Pisces: Cypriniformes) of Thailand, Burma, Laos, Cambodia and Southern Viet Nam. 1990;262.
24. Kottelat M. *Fishes of Laos.* Wildlife Heritage Trust, Colombo. 2001;198.
25. Vishwanath WA, Manojkumar WA. A new bariline cyprinid fish of the genus *Barilius* Hamilton, from Manipur, India. *J Bombay Nat Hist Soc.* 2002;99(1):86-89.
26. Rahman AK. A taxonomic account of the fishes of the genus *barilius* hamilton from rivers of Bangladesh. *Bangladesh Scient. Ind. Res.*1977; 12(1-2): 68-75.
27. Hubbs CL. Geographical variation of *Notemigonus crysoleucas*: An American minnow. *Trans Ill State Acad Sci.* 1921;11:147-51.
28. Vladykov VD. Environmental and taxonomic characters of fishes. *Trans Roy Can Inst.* 1934;20(3):99-140.
29. McHugh JL. Geographic variation in the Pacific herring. *Copeia.* 1954; 4(2):139-151.
30. Hubbs CL. The structural consequences of modifications of the developmental rate in fishes, considered in reference to certain problems of evolution. *Am Nat.* 1926;60(666):57-81.
31. Barlow GW. Causes and significance of morphological variation in fishes. *Syst Zool.* 1961;10(3):105-117.