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# A Comparative Study of Morphometric and Meristic Characters of *Botia dario* and *Botia lohachata* in Bangladesh

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**ABSTRACT**

The present study aims to analyze and determine the differences in morphometric and meristic characters of *Botia dario* and *B. lohachata* using systematics study (morphometric measurements, meristic counts and external morphology). Twenty-two morphometric and five meristic characteristics were measured and analysed, and significant differences were observed between the two species. The findings of the present study will assist for accurate species identification and are able to help to distinguish *B. dario* and *B. lohachata*. Thus, present study will be useful in systematic classification, stock conservation and management of these two important species in Bangladesh.

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## Introduction

*Botia dario* (Hamilton, 1822) and *B. lohachata* (Chaudhuri, 1912) are two most important and high demanding loaches in Bangladesh, having commercial as well as food value. Among 260 freshwater fish species of Bangladesh, 143 species are considered small indigenous species (SIS) and *B. dario* and *B. lohachata* are two of the easily available and nutritionally enriched SIS (Thilsted *et al.*, 1997). Though, *B. dario* and *B. lohachata* was previously abundant in all the open water bodies (rivers, streams and seasonal low-lying floodplains) throughout Bangladesh but recent studies have reported a severe reduction in its population size and abundance due to human exploitation, habitat destruction, pollution and categorized as endangered in Bangladeshi waters (Hossain *et al.*, 2015; IUCN, 2015). Therefore, conservation of loaches is extremely needful due to its endangerment and vulnerability status. In Bangladesh, queen loach or Bengal loach *B. dario* locally known as 'Rani Mach' or 'Bou Mach' and reticulate loach *B. lohachata* which is also known as 'Rani Mach' are often mixed with each other as the appearance of *B. dario* and *B. lohachata* is almost similar. To overcome this confusion and conflict between these two important species, a comparative study is urgent. Therefore, a systematics study (morphometric measurements, meristic counts and external morphology) of *B. dario* and *B. lohachata* was conducted. Morphometric investigations enable the study of morphological (or phenotypic) changes between populations. Taxonomic precision enhanced by meristic analysis, which emphasizes quantifiable characteristics like fin rays or scale counts (Strauss & Bookstein, 1982). Therefore, the present findings will provide keys and field guides to facilitate identification of *B. dario* and *B. lohachata*.

## MATERIALS AND METHODS

### Sample collection

About 30 individuals of each species were collected for the study. Individuals of *B. dario* and *B. lohachata* (Fig. 1) were sampled from the Someshwari River located in Netrokona District, Bangladesh (25°1'0" N and 90°46'0" E) (Fig.2). Someshwari River known as Simsang River in the Indian state of Meghalaya is a major river in the Garo Hills of Meghalaya and Netrokona District of Bangladesh. The samples were immediately preserved with ice and then fixed into 10% buffered formalin upon arrival at the laboratory.

a) *B. dario*

b) *B. lohachata*

**Figure 1.** (a) ***B. dario*** and (b) ***B. lohachata*** having similar external appearance

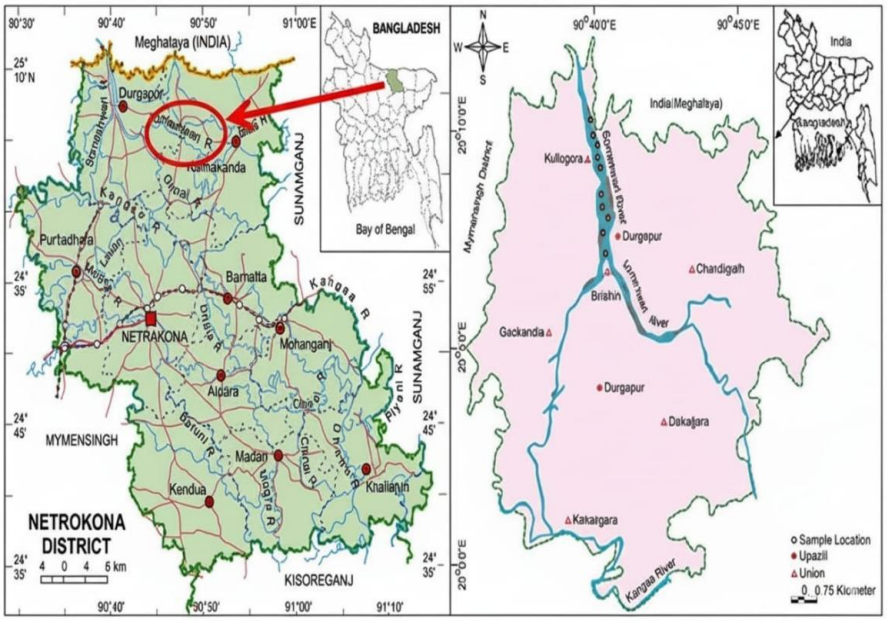


**Figure 2.** Sampling site of *B. dario* and *B. lohachata* at Someshwari River, Netrokona, Bangladesh (Source: Google map)

**Morphometric measurements**

A total of 22 linear dimensions were selected for morphometric measurements for each individual fish. Total length (TL), standard length (SL), fork length (FL), eye diameter (ED), body depth (BD), head depth(HD), operculum length( OmL), pre-dorsal length (PrDL), post-dorsal length (PoDL), dorsal fin base length (DFBL), pre-pectoral fin length (PrPcFL), pectoral fin base length (PcFBL), pectoral fin length (PcFL), pre-pelvic fin length( PrPvFL), pelvic fin base length(PvFBL), pelvic fin length (PvFL), pre-anal fin length ( PrAFL), post-anal fin length ( PoAFL), Anal fin base length (AFBL), caudal fin length (CFL), caudal peduncle length(CPdL), and caudal fin base length(CFBL) were measured. All the above linear dimensions were measured to the nearest 0.01 mm using a digital slide caliper (Table 1).

**Meristic counts**

Five meristic counts were made for each fish. Among meristic characters, dorsal fin rays, pectoral fin rays, pelvic fin rays, anal fin rays, and caudal fin rays were counted under a stereo microscope (Nikon-SMZ-1270). *Meristic counts of B. Dario and B. lohachata* are shown in Table 2.

***Description of the meristic counts of the collected specimens:***

| Counts | Description |
|---|---|
| Dorsal fin rays | Number of soft fin rays in dorsal fin |
| Pectoral fin rays | Number of soft fin rays in pectoral fin |
| Pelvic fin rays | Number of soft fin rays in pelvic fin |
| Anal fin rays | Number of soft fin rays in anal fin |
| Caudal fin rays | Number of soft fin rays in caudal fin |

## RESULTS

***Morphometric measurements of collected specimens of B. dario and B. lohachata***

The mean values and standard deviations of the different morphometric measurements of *B. dario* and *B. lohachata* are presented in Table 1.

**Table 1.** Morphometric characters of *B. dario* and *B. lohachata*

| **Characters** | **Mean± SD (mm)** | |
|---|---|---|
| | ***B. Dario*** | ***B. lohachata*** |
| TL | 72.77±10.890 | 66.00±17.046 |
| FL | 64.80±8.719 | 59.03±15.258 |
| SL | 56.40±7.578 | 51.00±14.384 |
| ED | 3.83±0.497 | 3.18±0.565 |
| HD | 15.37±1.847 | 13.20±3.033 |
| BD | 16.47±1.925 | 13.03±4.062 |
| OmL | 16.87±2.000 | 15.10±3.263 |
| PrDL | 30.07±3.750 | 27.47±7.450 |
| PoDL | 40.70±4.721 | 35.03±8.771 |
| DFBL | 10.63±1.299 | 7.57±1.547 |
| PrPcFL | 15.97±1.474 | 14.75±4.061 |
| PcFBL | 4.12±1.127 | 3.15±0.645 |
| PcFL | 13.50±3.138 | 10.70±2.037 |
| PrPvFL | 31.33±3.387 | 19.22±10.594 |
| PvFBL | 3.05±0.514 | 2.93±0.612 |
| PvFL | 10.10±1.348 | 8.80±1.755 |
| PrAFL | 47.50±6.766 | 39.33±12.158 |
| PoAFL | 52.58±7.485 | 42.87±12.830 |
| AFBL | 5.08±0.938 | 3.48±1.197 |
| CPdL | 15.70±4.154 | 15.97±7.902 |
| CFL | 15.63±2.965 | 14.93±3.814 |
| CFBL | 9.17±1.997 | 8.02±2.561 |

**Note**: TL=total length, SL=standard length, FL=fork length, ED=eye diameter, BD=body depth, HD=head depth, OmL=operculum length, PrDL=pre-dorsal length, PoDL=post-dorsal length, DFBL=dorsal fin base length, PrPcFL= pre-pectoral fin length, PcFBL= pectoral fin base length, PcFl= pectoral fin length, PrPvFL=pre-pelvic fin length, PvFBL= pelvic fin base length, PvFL= pelvic fin length, PrAFL= pre-anal fin length, PoAFL=post-anal fin length, AFBL= anal fin base length, CPdL= caudal peduncle length, CFL= caudal fin length, CFBL= caudal fin base length

### *Meristic counts of collected specimens of B. Dario and B. lohachata*

The values of mean and standard deviation of each meristic characters of *B. dario* and *B. lohachata* are presented in Table 2.

**Table 2.** M**eristic counts of *B. dario* and *B. lohachata***

| **Parameters** | **Mean± SD** | |
|---|---|---|
| | ***B. dario*** | ***B. lohachata*** |
| Dorsal fin rays | 11.70±0.466 | 11.47±0.730 |
| Pectoral fin rays | 14.00±0.00 | 8.27±0.450 |
| Pelvic fin rays | 8.00±0.00 | 8.00±0.00 |
| Anal fin rays | 7.00±0.00 | 7.43±0.817 |
| Caudal fin rays | 18.73±0.980 | 21.40±0.932 |

## Discussion

The information of both morphometric and meristic characters was useful for the identification of *B. dario* and *B. lohachata*. For taxonomic work, the information on morphometric measurements of fishes is essential (Mcconnel, 1978). Moreover, morphometric characters are frequently used to know the origin and separation of stocks, and identification of commercially important species of fishes (Pillay, 1957; Royce, 1963). Meristic data have also advantaged like morphometric data, and most meristic counts can be easily measured from live fish. Our main purpose of the study was to determine morphometric and meristic character and the analysis of morphometric measurements and meristic counts of *B. dario* and *B. lohachata* confirmed that significant differences existed between them (Table 3).

In the present study, the total length of *B. dario* ranged from 56 mm to 102 mm whereas *B. lohachata* ranged from 42 mm to 97 mm. The body depth ranged from 14 mm to 21 mm in *B. dario* and from 7 mm to 19 mm in *B. lohachata,* respectively. Mojumder *et al.* (2020) reported the minimum and maximum body lengths of *B. dario* were 66 mm and 129 mm respectively. Sarker *et al.* (2021) reported the maximum total length of *B. dario* as 129 mm and Hasan *et al.,* (2013) documented a higher value of 151 mm. In the present study, the maximum total length recorded for this species was 102 mm. The maximum length of a species is a critical parameter for estimating population dynamics including asymptotic length and growth coefficient which are essential for effective fisheries resource assessment, planning and management. Hossen *et al.* (2016) reported maximum and minimum total lengths of *B. lohachata* were 68 mm and 37 mm respectively, maximum and minimum body depth were 12.5 mm and 8 mm respectively, Hasan *et al.* (2013) documented the maximum total length of *B. lohachata* was 110 mm. In the present study, maximum and minimum total lengths of *B. lohachata* were 97 mm and 42 mm respectively, maximum and minimum body depth length were 19 mm and 7 mm respectively.

Among the five meristic characters examined, significant differences were observed, particularly in the number of pectoral fin rays and caudal fin rays between *B. dario* and *B. lohachata*. In the present study, *B. dario* was found to possess 11–12 (II/9–10) dorsal fin rays, 14 (II/12) pectoral fin rays, 8 (I/7) pelvic fin rays, and 7 (I/6) anal fin rays and 18–20 (IV/14–16) whereas *B. lohachata* was found to possess 10–14 (II–IV/8) dorsal fin rays; 8–10 (IV–VI/4) pectoral fin rays; 7–8 (II–III/5) pelvic fin rays; 6–8 (II/4–6) anal fin rays; 20–24 (VI–VIII/14–16) caudal fin rays.

Hasan *et al.*, (2013) documented 11 (II/9) dorsal fin rays; 14 pectoral fin rays; 8 pelvic fin rays; 7 (II/5) anal fin rays in *B. lohachata.* According to Hossen *et al.* (2016) the species exhibited 10–11 (II–III/8) dorsal fin rays; 8–10 (IV–VI/4) pectoral fin rays; 7–9 (II–III/5–6) pelvic fin rays; 6–7 (II/4–5) anal fin rays; 20–24 (VI–VIII/14–16) caudal fin rays. Talwar and Jhingran (1991) reported 10-11 (I/9–10) dorsal fin rays; 14 pectoral fin rays; 9 (I/8) pelvic fin rays; 6–7 (I/5–6) anal fin rays in *B. lohachata.*

**Table 3. Distinguishing characters between *B. dario* and *B. lohachata***

| **Characters** | ***B. Dario*** | ***B. lohachata*** |
|---|---|---|
| Picture |  |  |
| Body form | *B. dario* exhibited a comparatively larger and more elongated body form. | *B. lohachata* exhibited a smaller and more compact body form. |
| Eye size | Eyes were relatively larger. | Eyes were relatively smaller. |
| Head and body depth | Possessed a larger head and greater body depth, indicating a more robust body form. | Possessed a smaller head and shallower body depth, indicating a comparatively slender body form. |
| Operculum | Operculum was comparatively larger. | Operculum was relatively shorter. |
| Dorsal fin base length | Dorsal fin base length was broader. | Dorsal fin base length was narrower. |
| Pectoral fin length | Pectoral fin length was relatively larger. | Pectoral fin length was smaller. |
| Pelvic fin length | Pelvic fin length was comparatively larger. | Pelvic fin length was smaller. |
| Pelvic fin base length | Possessed a larger pelvic fin base length. | Possessed a smaller pelvic fin base length. |
| Anal fin base length | Anal fin base length was relatively longer. | Anal fin base length was relatively shorter. |
| Caudal fin length | Caudal fin length was larger. | Caudal fin length was smaller. |
| Caudal fin base length | Caudal fin base length was comparatively larger. | Caudal fin base length was comparatively smaller. |
| Caudal peduncle length | Possessed a smaller caudal peduncle length. | Possessed a larger caudal peduncle length. |
| Pectoral fin rays | Contained a higher number of pectoral fin rays, averaging 14 rays. | Contained fewer pectoral fin rays, ranging from 8 to 10 rays. |
| Caudal fin rays | Contained fewer caudal fin rays, ranging from 18 to 20 rays. | Contained a higher number of caudal fin rays, ranging from 20 to 24 rays. |

## Conclusion

*B. dario* demonstrated relatively larger body dimensions, deeper body depth and higher fin length values compared to *B. lohachata*. These differences coupled with distinct meristic features confirm that morphometric and meristic traits are effective tools for distinguishing between these two species. Such differentiation is particularly valuable for ecological monitoring and conservation studies given that *Botia* species often coexist in similar freshwater systems and are subject to misidentification due to overlapping morphological traits. The findings of the present study will help to establish the comparison key between *B. dario* and *B. lohachata* and could helpful to the fisheries biologists for the correct identification and classification of these two important loaches of Bangladesh.

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