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Morphometric characteristics and length-weight relationship of cultivated *Labeo rohita* (Hamilton, 1822) from an aquaculture farm in Latur District, Maharashtra, India

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Abstract
A study of variation among populations of *Labeo rohita* based on morphometric parameters was conducted. The samples were collected from a fish farm having different weight groups of the same age. The parameters, including body weight, fork length, total length, and the lengths of the dorsal, caudal, anal, pectoral, and pelvic fins of each individual, were measured. The genus Labeo, which belongs to the family *Cyprinidae*, is of great importance, as many species in this genus are used as ornamental fish, food species, some used for extracting oil, and some considered to be of medicinal value. All measurements were taken on a continuous scale using a measuring scale parallel to the anterior-posterior body axis except for body depth, which was taken perpendicular to the body axis between the dorsal and ventral margins. The statistical parameters were analysed using independent and dependent variables. The morphometric characters showed a gradual increase in body length and weight. A positive correlation was observed between total length and other morphometric characters.

Keywords: Morphometric parameters, variations, *Labeo rohita, Cyprinidae*

Introduction

Morphometric analysis is a fundamental tool for understanding the growth and development of organisms, variations and the structural characteristics of a fish population [9]. Morphometry is the study of the geometric form of organisms, which shows differences in growth and maturity patterns that are sensitive to environmental changes. In fishes, morphometric analysis is very important for the study of fish biology, and it helps in determining the relationships among various body parts. The relative change in the growth of various parts of the body of fishes occurs at different stages and at sexual maturity during their life [3]. Proportionally, it shows that a positive increase occurs in the total length and growth of the other body parts. Hence, morphometric measurements and the statistical relationship among them are necessary to study growth and development variability in fishes [14]. Morphometric relationships among various body parts of fish can be used to distinguish the separate unit stocks of the same individual species of fishes [11].

The length and weight relationship can be determined; measurements of length are used in fishes as they can be obtained under a larger range of circumstances than weight measurements [11]. Fishes are very sensitive to environmental changes, so they adapt by making necessary morphometric changes [6]. Compared to other vertebrates, fishes indicate high variations in morphological characters both within and between populations [4]. In vertebrates, fishes are cold-blooded, aquatic, freshwater or marine and jaw-bearing species. The characteristic features of this group of species are the presence of a streamlined body which is covered with scales. For respiration, external as well as internal gills are present, so they live in clean water. In fishes, paired fins are also present for swimming as a locomotory organ.

Labeo rohita belongs to the superclass Pisces and the Cyprinidae family. This fish is consumed as it is a good source of protein in the diet. It is a warm-water teleost commonly as rohu. These are column-feeding herbivores that can be mainly identified by a depressed snout, and the mouth is subterminal with thick lips. At the mouth region, small thread-like sensory maxillary barbels are present. The body of *Labeo rohita* is divided into head, trunk and tail. The colouration of the body is grey to blackish on the back side, while silver in colour on the sides of the body and also on the belly region. In the last decades maximum age was reported as 10 years, and they attain 200 cm in length and 45 kg in weight [5, 8].

In this research, it has been demonstrated that morphometric characteristics are good indicators of population isolation and environmental adaptation. Therefore, the present study aimed to find the morphometric characters of *Labeo rohita* collected from Shivapur Fish Breeding Centre farm, Latur district, Maharashtra. *Labeo rohita* of different sizes were collected for morphometric study.

The present study aimed to find the morphometric characters of Indian Carp such as *Labeo rohita*, collected from Shivapur Fish Breeding Centre in Latur district. *Labeo rohita* specimens of various sizes were collected for morphometric study. The Mean, range, range difference, standard deviation, correlation coefficient and regression equation between total length and all other morphometric characters of *Labeo rohita* were analysed. This study determines the relationships among the morphometric

parameters, identifies the environmental factors that influence these differences and provides baseline data for improved aquaculture.

Materials and methods

Study Area

The present study was conducted at Shivapur Fish Breeding Centre Farm in Latur district. From the site, sufficient numbers of *Labeo rohita* fish were collected to study the morphometric variation.

Fish sample collection

Fish specimens of different sizes were randomly collected from the selected fish breeding centre farm and were brought to the laboratory for morphometric measurements. The measurements were taken using a measuring scale, and body weight was measured using a digital weighing balance. The species *Labeo rohita* was identified, and morphometric measurements of each sample fish were obtained; all measurements were taken in centimetres and weight in grams [13]. The growth rate of *Labeo rohita* was studied using various morphological body parts in relation to its total length and weight.

Morphometric characters

The parameters for morphometric measurements, such as total length of the fish, standard length, head-snout length, eye diameter, and the length of the pre-dorsal, pre-pectoral, pre-pelvic and caudal fins, were measured in centimetres.

Statistical Analysis

Statistical analyses included the mean, range difference, standard deviation, regression equation and correlation coefficient. Microsoft Excel software was used for all statistical values and charts. The regression equation has been used for morphometric measurements by the formula: $Y= a + bX$

Where 'Y' is the dependent variable such as standard length, body depth, head length, etc.; 'a' is a constant value to be determined; 'b' is the regression coefficient; and 'X' is the independent variable such as total length.

The length-weight relationship was determined using the equation $W = aL^b$ [10], where W is total weight (g), L is total length (cm), a is the intercept (i.e., the coefficient related to the body), and b is the slope. The growth pattern is isometric when $b = 3$, positive allometric when $b > 3$, and negative allometric when $b < 3$ [1].

Table 1: Descriptive morphometric parameters of *Labeo rohita*:

Sr. No	Parameters	Description
1	Total length (L)	Measurement of body length from the tip of the snout to the end of the caudal fin
2	Standard length (SL)	Length from the snout to the base of the tail bone
3	Head length (HL)	Length from the snout to the posterior part of the operculum
4	Snout length (SnL)	Length measured from the tip of the snout to the most anterior part
5	Eye diameter (ED)	Length of eye orbit from one margin to the other
6	Pre-dorsal length (PDL)	Length from snout to origin of the dorsal fin
7	Pre-pectoral length (PPL)	Length from snout to origin of pectoral fin
8	Pre-pelvic length (PPvL)	Length from snout to the origin of pelvic fin
9	Body depth (BL)	Maximum vertical distance between the dorsal and ventral margins of the fish body
10	Caudal length (CL)	Total length- Standard Length
11	Body weight (BW)	Total body mass of fish measured in grams

Table 2: Mean, Standard Deviation, Range, Range difference, Correlation coefficient (r) and Regression equation (Y=a+bX) between different morphometric characters of *Labeo rohita*

Sr. No	Parameters	Mean	SD	Range (Min-Max)	Range difference	Correlation coefficient	Regression equation
1	Total length	26.40	8.50	15.00-35.00	20	-	-
2	Standard length	21.10	6.80	12.00-28.00	16.0	0.982	Y=1.520+0.742X
3	Head length	5.85	2.10	3.50-8.00	4.5	0.961	Y=0.350+0.086X
4	Snout length	1.60	0.85	0.90-2.50	1.6	0.961	Y=-0.620+0.086X
5	Eye diameter	0.75	0.28	0.50-1.20	0.7	0.825	Y=-0.050+0.030X
6	Pre-dorsal length	6.20	2.45	4.00-8.50	4.5	0.915	Y=0.720+0.208X
7	Pre-pectoral length	9.80	3.15	7.00-13.00	6.0	0.958	Y=0.850+0.339X
8	Pre-pelvic length	10.25	3.40	6.50-13.00	7.0	0.962	Y=1.620+0.327X
9	Body depth	4.75	1.95	3.20-7.00	3.8	0.899	Y=-0.580+0.202X
10	Caudal length	5.30	2.30	3.00-8.20	5.2	0.912	Y=-1.850+0.271X
11	Body weight	145.50	22.40	85.00-185.00	100.0	0.865	Y=42.150+3.915X

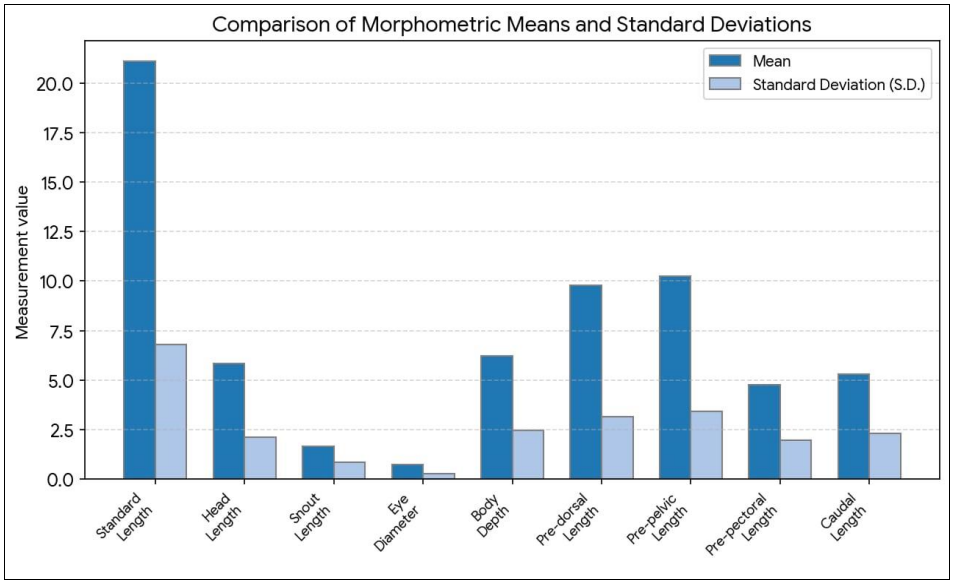

Fig 1: Comparison of the average size (Mean) and population variation (Standard Deviation) across nine parameters of Labeo rohita. Standard length shows both the largest physical dimensions and the widest variation range. In contrast, eye diameter represents the smallest physical parameter with the most stable and uniform measurements among all sampled specimens.

It has been observed that characters like standard length, snout length, and pre-dorsal length in relation to total fish length show high values of the correlation coefficient, and characters like head length, pre-pelvic length, and body depth show moderate correlation coefficients. Characters like eye diameter, pre-pectoral length, and caudal length show the lowest correlation coefficients.

Fishes adapt by changing necessary morphometric characters, as they are very sensitive to environmental conditions. Morphological characters in fishes show high tolerance to changes in environmental conditions, such as abundance of food, temperature and salinity [2, 15]. Fishes adjust themselves according to environmental conditions by adapting in different ways to improve their sustainability [12]. It is known that different fish populations exhibit differences in their morphometric characters [7].

Conclusion

The present study corroborates the relationship of total length with other morphometric characters, viz., standard length, snout length, head length, body depth, eye diameter, pre-dorsal length, pre-pelvic length, pre-pectoral length, and caudal length of Labeo rohita. The results concluded that the total length and other morphometric parameters of Labeo rohita were significantly correlated. The positive correlation coefficient indicated a proportional increase in the morphometric parameters in comparison with the total length. A linear relationship was observed between all the independent and dependent variables. The study of morphometric characters is important for the identification of specimens and for experimental studies.

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Disclosure of conflict of interest:

All authors declare that they have no conflicts of interest.

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