

THE MORPHOMETRIC AND MERISTIC ANALYSIS OF SOME *PUNTIUS* SPECIES FROM CENTRAL INDIA

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ABSTRACT

Four species of genus *Puntius*, collected from central India, were studied for twenty six morphometric measurements and seventeen meristic counts. The minimum and maximum range, mean, standard deviation, percentage of various parameters in total length and head length were estimated. The correlation and regression analysis was carried out for some important characters in relation to total length and head length. The coefficients of correlation (r) for various characters ranged from 0.240-0.994 for *Puntius conchoni*, 0.567-0.996 for *P. chola*, 0.786-0.997 for *P. sophore* and 0.237-0.997 for *P. ticto*. This indicates that *P. chola* and *P. sophore* exhibited a high degree of interdependence of the various characters, while *Puntius conchoni* and *P. ticto* have a lower degree of interdependence. The meristic characters showed very limited or no variation in all the four species. The dorsal fin rays counted as 9 in all four species which revealed deviation from earlier studies (10 or 11) of different workers. .

.Key words : Morphometric, meristic, correlation, regression, length

INTRODUCTION

The *Puntius* or barb fishes are tropical freshwater fishes belonging to the Cyprinidae family. *Puntius conchoni*, *P. chola*, *P. sophore* and *P. ticto* are commonly known as rosy barb, swamp barb, pool barb and two spot barb respectively. Morphometric and meristic characters are helpful in easy & correct identification of fish species in laboratory as well as at natural places (Jayaram, 1999). Morphometric characters are important for identifying fish species and their habitat as well as ecological criteria in any stream, lake or sea. It is common to use morphometric measurements to identify and classify fishes (Begenal and Tesch, 1978).

Morphometric study is a powerful tool for

characterizing strains / stocks of the same species, which involves detection of subtle variation of shape, independent of size. The complete set of measurements used to describe a form is a morphometric character set (Strauss and Bond, 1990). The studies of morphological and meristic characters of a fish give substantial information with regard to exact identification key of the species (Dhanya *et al.*, 2004) and such identification is prerequisite for cytogenetic and molecular investigations.

The weed fishes are found in most of the water bodies. Four species of genus *Puntius*, viz., *Puntius conchoni*, *P. chola*, *P. sophore* and *P. ticto* are easily available in water bodies of Central India (Saksena and Verma, 1993; Agarwal and Saksena, 1977 and Saksena, 2007; Garg *et al.*, 2007; Lakra *et al.*, 2010 and

Uchchariya *et al.*, 2012). The morphometric and meristic characterization has been carried out to identify them correctly and to determine the relationship between various characters as well as to estimate various statistical values on the basis of morphometric data.

In present study, relationships between the various body measurements to the total length and head length have been calculated. The range of total length, mean, standard deviation and correlation of coefficient (r) were calculated for characters under study. The specimens of various sizes were selected for morphometric study of *P. chola*, *P. conchoni*, *P. sophore* and *P. ticto*.

MATERIAL AND METHODS

The sufficient number of fish specimens of *Puntius conchoni*, *Puntius chola* and *Puntius ticto* were collected from Pahuj river at site of village Pohra on the border of Datia (M.P.) and Jhansi (U.P.) and fish specimens of *Puntius sophore* were collected from Ramsagar reservoir at Barauni, near Datia (M.P.). Specimens of *Puntius sp.* were identified up to species level following Talwar and Jhingran (1991), Srivastava (1980), Datta Munshi & Srivastava (1988) and Jayaram (1999).

The methods of Dwivedi and Menezes (1974), and Jayaram (1981, 2002) were followed for morphometric measurements and meristic counts. In the present study, 26- morphometric and 17-meristic characters were taken to study all four species of the genus *Puntius*. The various statistical values, correlation coefficients, regression analysis and charts were made using Microsoft Office Excel.

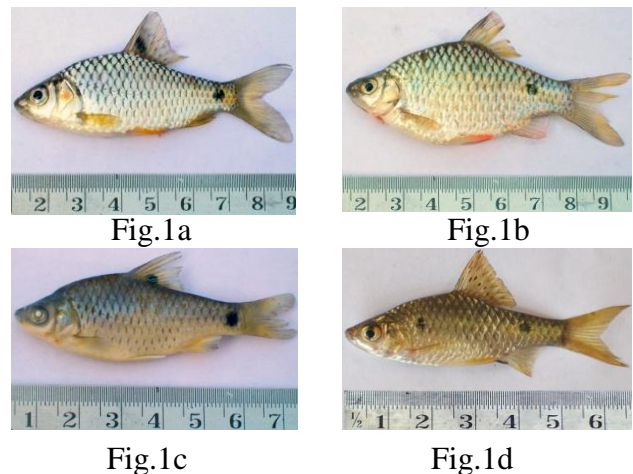
RESULTS AND DISCUSSION

Morphometric analysis

Puntius chola – The body of this fish is elongated, deep and compressed. The body colour is silver bright and has a bright reddish strip along the entire mid body in breeding season (Fig.1). The minimum and maximum total length was 7.3 cm and 9.0 cm, mean and

standard deviation 8.13 ± 0.56 . The mean percentage of fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 87.34, 77.26, 28.89, 22.49, 17.09 and 12.29 respectively in total length mean percentage. The total length quotient shows that fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 1.14, 1.29, 3.46, 4.44, 5.85 and 8.13 times in total length respectively. The mean percentage of head depth, head width, width of gape of mouth, eye diameter, snout length, preorbital and postorbital length is 75.96, 48.91, 29.23, 29.78, 27.05, 56.83 and 43.17 respectively in head length mean percentage.

Fig.1- Lateral view of selected specimens of *Puntius* species: *P. chola* (a), *P. conchoni* (b), *P. sophore* (c) and *P. ticto* (d).



In *P. chola*, the higher values of coefficient of correlation (r) of fork length (0.996), standard length (0.971), head length (0.956), head width (0.868), pre-pectoral length (0.960), pre-anal length (0.948), snout length (0.844), pre-dorsal length (0.936), pre-ventral length (0.919) and depth of caudal peduncle (0.833) showed high degree of correlation and values of body depth (0.678), head depth (0.607), eye diameter (0.567), indicated low degree of correlation in relation to total length. In relation to head length, the higher values of coefficient of correlation (r) of total length (0.956), body depth (0.752), head depth (0.705), head width (0.771), snout length (0.838), and length of pectoral fin (0.911) showed higher degree of

correlation and eye diameter (0.581) showed low degree of correlation.

The linear regression analysis (fig.2) showed that among all the characters compared with total length, fork length ($b=0.978$), standard length ($b=0.751$) showed high growth rate and head length ($b=0.341$), pre-dorsal length ($b=0.441$), pre-pectoral length ($b=0.301$), pre-ventral length ($b=0.326$), pre-anal length ($b=0.281$) showed slow growth rate while body depth ($b=0.173$), head depth ($b=0.192$), head width ($b=0.154$), eye diameter ($b=0.051$), snout length ($b=0.091$), and depth of caudal peduncle ($b=0.152$) indicated very slow growth rate. Linear regression analysis of some characters when compared with head length (fig.2), the total length ($b=2.675$) showed very high growth rate, body depth ($b=0.538$), head depth ($b=0.624$) showed good growth rate while head width ($b=0.384$), eye diameter ($b=0.148$), snout length ($b=0.253$), and length of pectoral fin ($b=0.387$) showed slow growth rate. From this data, it can be inferred that these characters showed an allometric growth.

Puntius conchoni – The body of this fish was short to moderately elongated, deep and compressed. Abdomen is rounded. Head was short. The body colour was coppery reddish in lower half and blackish in upper half of the body and the upper part of dorsal fin was black during breeding season while bright silvery colour in other period (Fig.1).

The minimum and maximum total length was 5.6 cm and 10.0 cm, mean and standard deviation 6.95 ± 0.89 . The mean percentage of fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 89.50, 77.62, 35.64, 20.97, 17.09 and 11.94 respectively in total length mean percentage. The total length quotient shows that fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 1.12, 1.29, 2.81, 4.77, 5.85 and 8.37 times in total length respectively. The mean percentage of head depth, head width, width of gape of mouth, eye diameter, snout length, preorbital and postorbital length is 81.48, 52.54, 29.90, 30.31, 27.29, 57.61 and 42.94 respectively in head length mean percentage.

Table 1. Meristic characters in *Puntius* species.

S. No.	Meristic characters	<i>P. chola</i>	<i>P. conchoni</i>	<i>P. sophore</i>	<i>P. ticto</i>
1.	Dorsal fin rays (<i>DFR</i>)	9 (1/8)	9 (1/8)	9 (1/8)	9 (1/8)
2.	Pectoral fin rays (<i>PcFR</i>)	14-16	11-12	15	11-12
3.	Ventral/pelvic fin rays (<i>VFR</i>)	9	9	9	9
4.	Anal fin rays (<i>AFR</i>)	6(1/5)	7-8(2/5-6)	8(2/6)	6(1/5)
5.	Caudal fin rays (<i>CFR</i>)	19(2/17)	19(2/17)	19(2/17)	19(2/17)
6.	Lateral line scales (<i>LLS</i>)	25	24	23-25	22-25
7.	Lateral line inforations (<i>LII</i>)	25	7-11	23-25	7-9
8.	Scales from dorsal fin to lateral line	5 _{1/2}	4-5 _{1/2}	5	3 _{1/2} -4 _{1/2}
9.	Scales from lateral line to pelvic fin	3 _{1/2}	3 _{1/2} -5	3	4-4 _{1/2}
10.	Scales from anal fin to lateral line	4 _{1/2}	3-4	3	3 _{1/2}
11.	Pre-dorsal scales	8-9	8-11	9	10-11
12.	Pre-ventral scales	9-11	10-12	10	10-11
13.	Pre-anal scales	15-18	15-19	15	15-16
14.	Circumpendicular scales	11-13	12	12	11
15.	Barbels	1 pair	0	0	0

Fig.2 - Relationship of various morphometric measurements compared with total length (a, b) and head length (c) in *Puntius chola*.

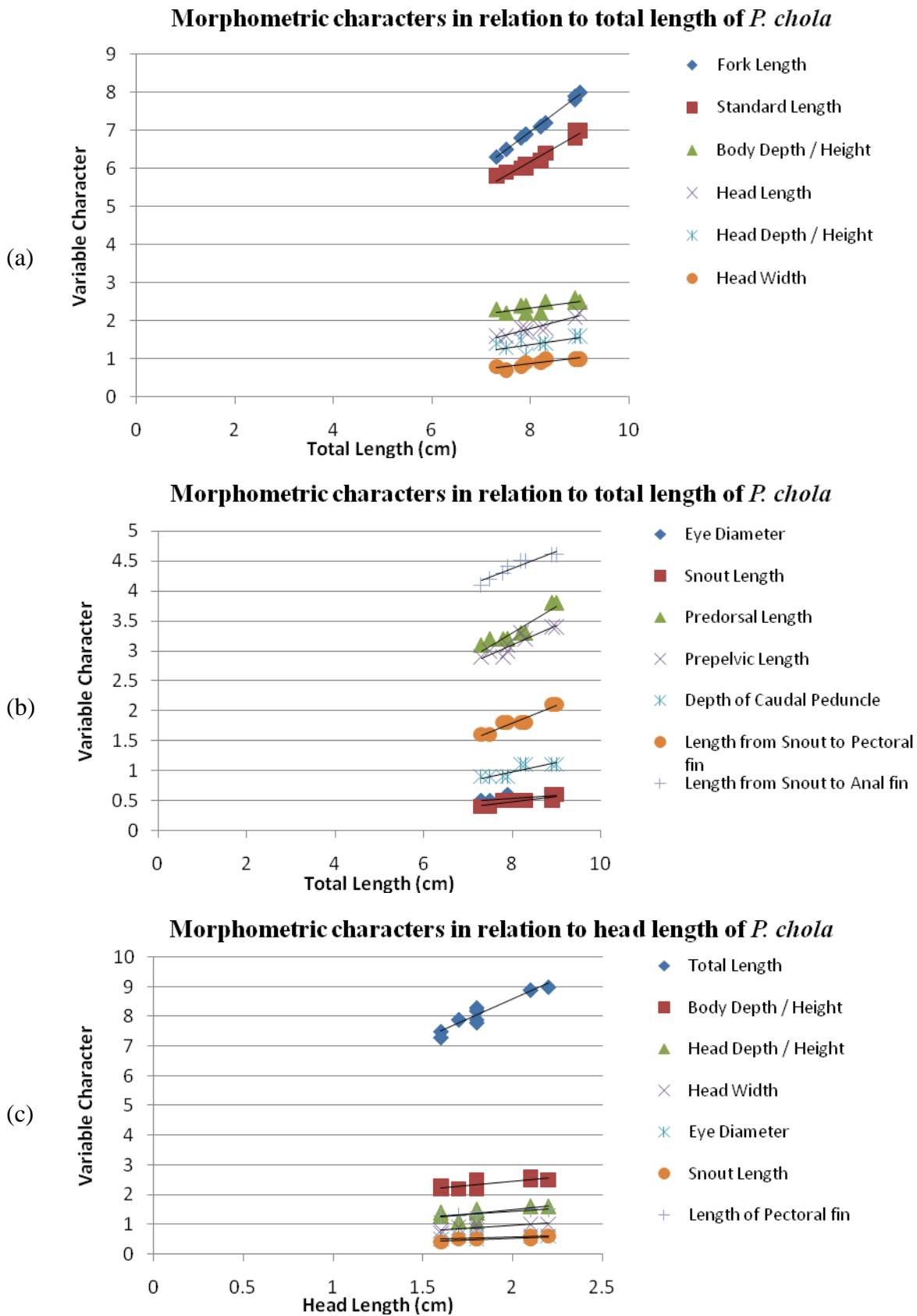


Fig.3 - Relationship of various morphometric measurements compared with total length (a, b) and head length (c) in *Puntius conchoni*.

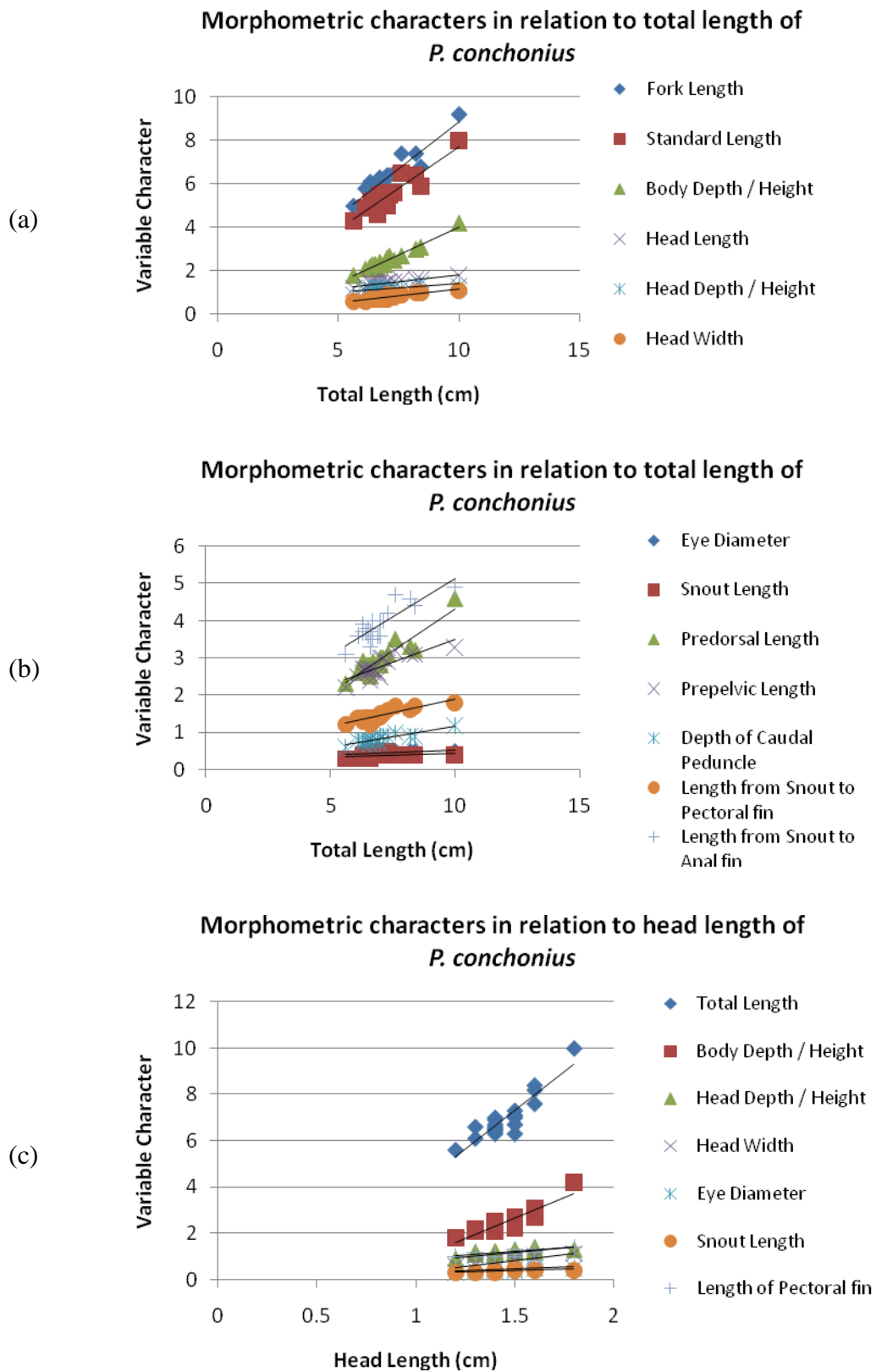
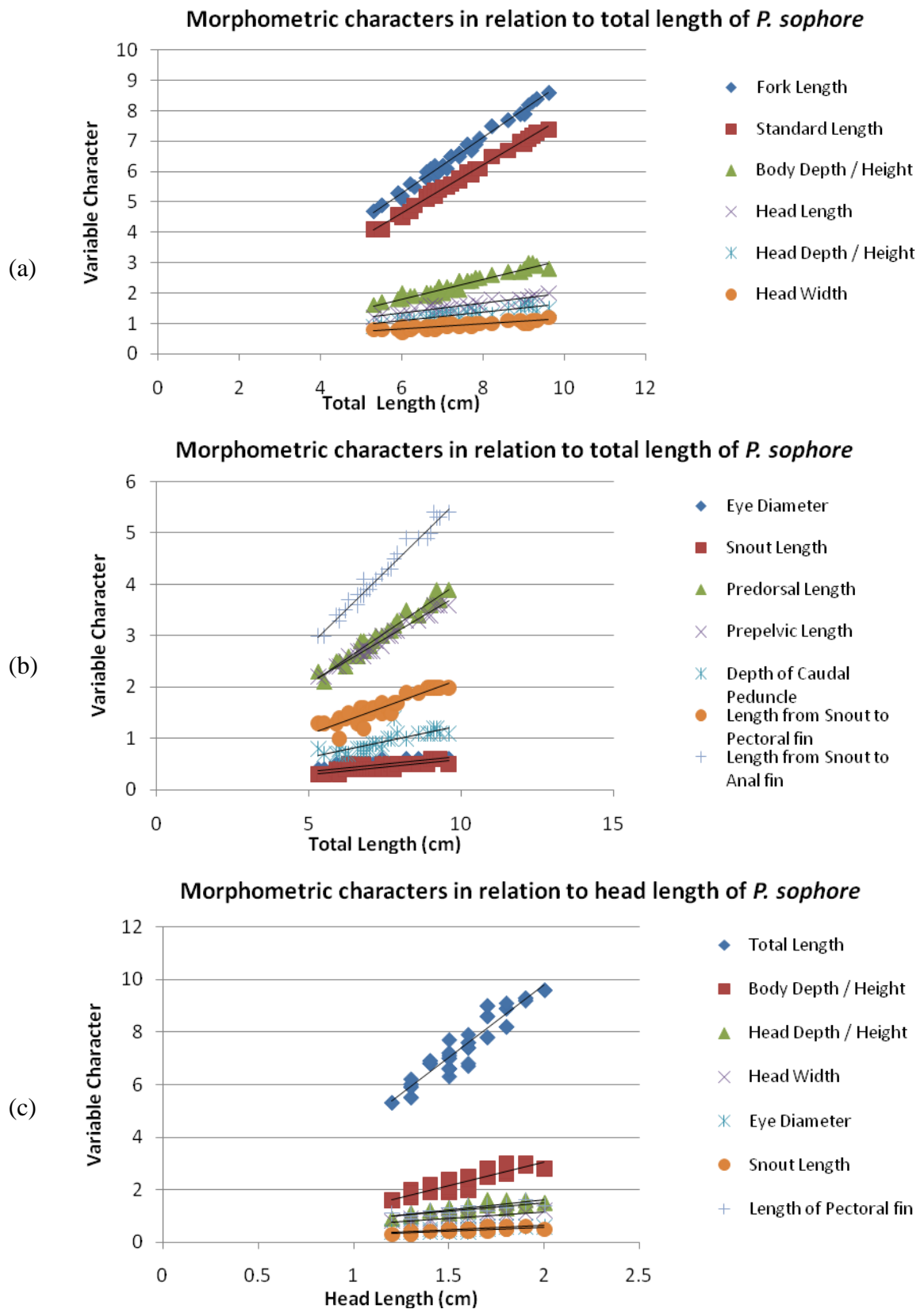


Fig.4 - Relationship of various morphometric measurements compared with total length (a, b) and head length (c) in *Puntius sophore*.



In *P. conchoni*, the higher values of coefficient of correlation (r) of fork length (0.989), standard length (0.994), body depth (0.975), head length (0.867), head depth (0.689), head width (0.919), pre-pectoral length (0.899), pre-anal length (0.948), pre-dorsal length (0.970), pre-ventral length (0.903) and depth of caudal peduncle (0.916) showed high degree of correlation or interdependence and values of snout length (0.240) and eye diameter (0.458) indicated low degree of correlation in relation to total length. In relation to head length, the higher values of coefficient of correlation (r) of total length (0.867), body depth (0.880), head depth (0.754), head width (0.864), eye diameter (0.647) and length of pectoral fin (0.702) showed higher degree of correlation and snout length (0.480) showed low degree of correlation.

The linear regression analysis (Fig.3) showed that among all the characters compared with total length, fork length ($b=0.935$), standard length ($b=0.827$), body depth ($b=0.507$) showed high growth rate and pre-dorsal length ($b=0.475$), pre-anal length ($b=0.454$) showed slow growth rate, while pre-pectoral length ($b=0.148$), pre-ventral length ($b=0.263$), head length ($b=0.122$), head depth ($b=0.075$), head width ($b=0.133$), eye diameter ($b=0.032$), snout length ($b=0.018$), and depth of caudal peduncle ($b=0.120$) indicated very slow growth rate. Linear regression analysis of some characters when compared with head length (fig.3), the total length ($b=6.679$), body depth ($b=3.476$) showed very high growth rate and head depth ($b=0.596$), head width ($b=0.963$), length of pectoral fin ($b=0.732$) showed good growth rate while eye diameter ($b=0.321$) and snout length ($b=0.215$) showed slow growth rate. From this data, it can be inferred that these characters showed an allometric growth. This explained the moderately elongated and compressed body, rounded abdomen and short head of *P. conchoni*.

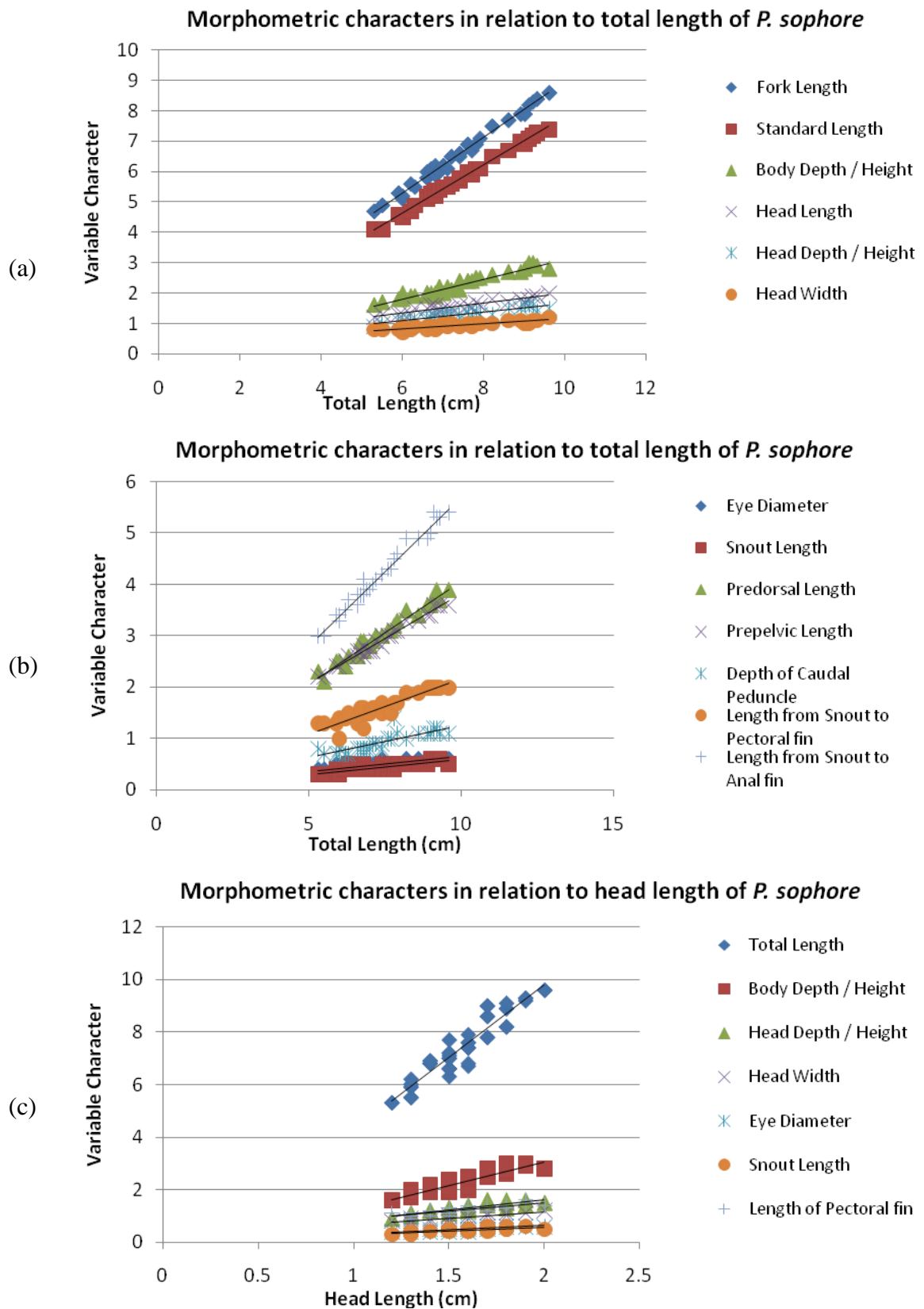
Puntius sophore – The body of this fish was elongated, deep and compressed. The body colour was silver bright and had a bright reddish strip along the entire mid body from

snout to fork in breeding season (Fig.1). The minimum and maximum total length was 5.3 cm and 9.6 cm, mean and standard deviation 7.73 ± 1.19 . The mean percentage of fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 88.96, 77.73, 30.60, 21.21, 17.30 and 12.50 respectively in total length mean percentage. The total length quotient shows that fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 1.12, 1.29, 3.27, 4.71, 5.78 and 7.99 times in total length respectively. The mean percentage of head depth, head width, width of gape of mouth, eye diameter, snout length, preorbital and postorbital length is 81.58, 60.10, 30.56, 31.33, 28.13, 59.46 and 40.41 respectively in head length mean percentage.

The higher values of coefficient of correlation (r) in *P. sophore* revealed that fork length (0.995), standard length (0.997), head length (0.945), head width (0.877), pre-pectoral length (0.913), pre-anal length (0.989), snout length (0.848), pre-dorsal length (0.984), pre-ventral length (0.988), body depth (0.968), head depth (0.928), eye diameter (0.860) and depth of caudal peduncle (0.817) showed high degree of correlation in relation to total length. In relation to head length, the higher values of coefficient of correlation (r) of total length (0.945), body depth (0.912), head depth (0.844), head width (0.868), snout length (0.791), eye diameter (0.786) and length of pectoral fin (0.824) showed high degree of correlation or interdependence. All characters indicated very high degree of interdependence.

The linear regression analysis (Fig.4) showed that among all the characters compared with total length, fork length ($b=0.917$), standard length ($b=0.797$), pre-anal length ($b=0.580$), showed high growth rate and pre-dorsal length ($b=0.400$), pre-pectoral length ($b=0.214$), pre-ventral length ($b=0.348$), body depth ($b=0.326$) showed slow growth rate, while head length ($b=0.161$), head depth ($b=0.139$), head width ($b=0.087$), eye diameter ($b=0.060$), snout length ($b=0.059$), and depth of caudal peduncle ($b=0.123$) indicated very slow growth rate.

Fig.5 - Relationship of various morphometric measurements compared with total length (a, b) and head length (c) in *Puntius ticto*.



Linear regression analysis of some characters when compared with head length (fig.4), the total length ($b=5.527$), showed very high growth rate and body depth ($b=1.795$), head depth ($b=0.742$), head width ($b=0.507$), showed slow growth rate while eye diameter ($b=0.096$), snout length ($b=0.140$) and length of pectoral fin ($b=0.123$) showed very slow growth rate. From this data, it can be inferred that these characters showed an allometric growth. This explained the moderately elongated and compressed body of *P. sophore*.

Puntius ticto – The body of this fish was short, deep and compressed. The body colour was light coppery reddish in lower half and light greenish in upper half of the body during breeding season while bright silvery colour in other period (Fig.1). The minimum and maximum total length was 5.0 and 6.8, mean and standard deviation 5.88 ± 0.63 .

The mean percentage of fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 89.12, 76.53, 29.42, 20.92, 16.67 and 11.22 respectively in total length mean percentage. The total length quotient shows that fork length, standard length, body depth, head length, head depth and depth of caudal peduncle is 1.12, 1.31, 3.40, 4.78, 6.0 and 8.91 times in total length respectively. The mean percentage of head depth, head width, width of gape of mouth, eye diameter, snout length, preorbital and postorbital length is 79.67, 57.72, 27.64, 31.30, 24.79, 56.09 and 43.49 respectively in head length mean percentage.

In *P. ticto*, also the higher values of coefficient of correlation (r) of fork length (0.997), standard length (0.987), body depth (0.965), head length (0.958), head depth (0.918), head width (0.862), pre-pectoral length (0.976), pre-anal length (0.990), pre-dorsal length (0.949), pre-ventral length (0.966) and depth of caudal peduncle (0.921) showed high degree of correlation and values of snout length (0.344), eye diameter (0.237) indicated low degree of correlation in relation to total length. In relation to head length, the higher values of coefficient

of correlation (r) of total length (0.958), body depth (0.913), head depth (0.812), head width (0.768) and length of pectoral fin (0.892) showed high degree of correlation or interdependence while snout length (0.250), eye diameter (0.196) showed low degree of correlation.

The linear regression analysis (Fig.5) in *P. ticto* showed that among all the characters compared with total length, fork length ($b=0.910$),

standard length ($b=0.782$), pre-anal length ($b=0.575$), showed high growth rate and pre-dorsal length ($b=0.399$), pre-pectoral length ($b=0.304$), pre-ventral length ($b=0.299$), body depth ($b=0.379$) showed slow growth rate, while head length ($b=0.100$), head depth ($b=0.161$), head width ($b=0.277$), eye diameter ($b=0.013$), snout length ($b=0.012$), and depth of caudal peduncle ($b=0.120$) indicated very slow growth rate. Linear regression analysis of some characters when compared with head length (fig. 5), the total length ($b=9.170$), showed very high growth rate and body depth ($b=3.439$), head width ($b=2.365$), showed slow growth rate while head depth ($b=1.365$), eye diameter ($b=0.109$), snout length ($b=0.085$) and length of pectoral fin ($b=0.682$) showed very slow growth rate. From this data, it can be inferred that these characters showed an allometric growth. This explained its short, small and compressed body.

Meristic analysis

The seventeen meristic characters were analyzed in these species. The fifteen characters were given in table 1. The number of black spots and their position was a distinguishing character in these fishes.

P. chola had 3 black spot and 1-band. The each spot was located on 20/21/22nd scales – 22/23/24th scales, on posterior end of the operculum and on base of the dorsal fin. The black band was present on upper part of dorsal fin. In *P. conchoni* one black spot was present and located on 17/18th scales – 19/20th scales, in *P. sophore* two spots were present and one located on 21/22nd scales – 22/23rd scales and

another on base of dorsal fin and *P. ticto* also had two spots, each was located on 3/4th scales – 4/5th scales and 16/17/18th scales – 17/18/19/20/21th scales.

The meristic counts of all four species indicated no or less variation. It shows that the fish specimens so collected were of homogenous group and 9 dorsal fin rays, 9 ventral fin rays, and 19 caudal fin rays were found to be a common and non-variable character in all four species. The dorsal fin rays counted as 9 revealed deviations from earlier studies as 10 (Hamilton, 1981) or 11 (Day, 1958; Srivastava, 1980; Datta Munshi & Srivastava, 1988; Talwar and Jhingran, 1991).

CONCLUSION

It can be concluded that the fish specimens so collected were homogenous. It is clear that number of dorsal fin rays, pectoral fin rays, ventral fin rays, anal fin rays, and caudal fin rays of particular *Puntius* species remained constant in all fish specimens having different body length. It shows that in present study, the meristic counts are independent of body size and there is no change in meristic counts with increase in body length. This corroborates with the studies in other fishes by Vladykov (1934), Talwar and Jhingran (1992) and Muhammad Zafar *et al.* (2002). The study of morphometric and meristic characters are important for identification of specimens and for experimental studies.

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REFERENCES

1. **Agarwal, S.S. and Saksena, D.N. 1977.** A checklist of fishes from Gwalior, Madhya Pradesh. *J. Jiwaji Univ.*, 2: 164-169.
2. **Bagenal, J. B. and Tesch F. W. 1978.** Methods for assessment of fish production in freshwaters. Oxford, Blackwell Scientific publication, p. 361.
3. **Datta Munshi, J. S. And Srivastava, M. P. 1988.** Natural history of fishes and systematic of freshwater fishes of India. Narendra publishing house, Delhi, pp.178-193.
4. **Day, F. 1878.** The fishes of India being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon. Vol. 2, Reprinted 1978. Today & Tommarrow's book agency, New Delhi.
5. **Dhanya, V.M.R., Jaiswar, A.K., Palaniswamy, R. and Chakraborty, S.K. 2004.** Morphometry and length-weight relationship of *Coilia dussumieri*, Valenciennes, 1848 from Mumbai waters. *J. Ind. Fish. Asso.*, 31: 65-70.
6. **Dwivedi, S. N. and Menezes, M. R. 1974.** A note on the morphometry and ecology of *Brachirus orientalis* (Bloch and Schneider) in the estuaries of Goa. *Geobios*, 1: 80-83.
7. **Garg, R.K., Rao, R.J. and Saksena, D.N. 2007.** Checklist of fishes of Ramsagar reservoir, Datia district, Madhya Pradesh, India. *Zoos' Print Jour-nal*, 22(8): 2801-2803.
8. **Hamilton, F. 1981.** An account of the fishes found in the river Ganges and its branches. Bishen Singh Mahendra Pal Singh, Dehradun. pp.310-315.
9. **Jayaram, K.C. 1981.** The Freshwater fishes of India, Pakistan, Burma and Sri-Lanka. A Handbook. Zoological Survey of India. 475 pp.
10. **Jayaram, K.C. 1999.** The Freshwater Fishes of the Indian Region. Narendra Publishing House, Delhi.
11. **Jayaram, K. C. 2002.** Fundamental of fish taxonomy. Narendra publishing house, Delhi. pp.01-121.
12. **Lakra, W.S., Sarkar, U.K., Kumar, R.S., Pandey, A., Dubey, V.K. and Gusain, O.P. 2010.** Fish diversity, habitat ecology and their conservation and management issues of a tropical River in Ganga basin, India. *Environmentalist*, DOI 10.1007/s10669-010-9277-6.

13. **B. Laxma Reddy and G. Benarjee 2013.** Intestinal Histopathology of Trematode Infected Fish, *Channa Striatus*. *Biolife*. 1(1);29-31, 2013. DOI:<https://dx.doi.org/10.5281/zenodo.7192688>
Received: 1 October 2013;
Accepted; 2 November 2013;
Available online : 3 December 2013
14. **Muhammad Zafar, A., Nasim, N., Mechdi, A., Naqvi, S.M.H. and Zia- Ur Rehman, M. 2002.** Studies on meristic counts and morphometric measurements of mahseer (*Tor putitora*) from a spawning ground of Himalayan foot- hill river Korang, Islamabad, Pakistan, *Pakistan J. Biol. Sci.*, 5 (6): 733-735.
15. **Saksena, D.N. and Verma, M.N. 1993.** Ecodistribution des barbeaux des genres *Tor et Puntius* (Cyprinidae) au Madhya Pradesh, *Inde. Cahiers d' Ethologie*, 13: 235-238.
16. **Saksena, D.N. 2007.** Fish Diversity of northern Madhya Pradesh (Gwalior and Chambal divisions). In: Fresh water fish diversity of central India (Lakra, W.S. and Sarkar, U.K. Eds.), pp.50-57, National Bureau of Fish Genetic Resources, Lucknow.
17. **Srivastava, G. 1980.** Fishes of U.P. and Bihar. Vishwavidyalaya Prakashan, Varanasi.
18. **Strauss, R.E. and Bond, C.E. 1990.** Taxonomic methods: Morphology. In: Schreck, C.B. and Moyle (Eds.) *Methods for fish biology*. American Fisheries society, Bethesda, Maryland, pp. 109-140.
19. **Talwar, P.K. and Jhingran, A.G. 1991.** Inland Fishes of India and Adjacent Countries, Vol. 1, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi-Calcutta, pp. 263-264.
20. **Talwar, P. K. and Jhingran, A. G. 1992.** Inland fishes of India. *Rec. Ind. J.*, 3: 19-24.
21. **Uchchariya, D.K., Saxena, M. and Saksena, D.N. 2012.** Fish biodiversity of Tighra reservoir of Gwalior, Madhya Pradesh, India. *J. Fish. & Aqua.*, 3 (1): 37-43.
22. **Vladykov, V. D. 1934.** Environmental and taxonomic characters of fishes. *Trans. R. Can. Inst.*, 20: 99- 144.