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Studies on the Population of *Labeo dussumieri* (Val.) from the Rivers of Central Kerala

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Population of *Labeo dussumieri* (Val.) inhabiting Pampa, Manimala, Achankoil and Meenachil rivers in Kerala, South India, were compared in respect of selected morphological characters by means of ANACOVA and ANOVA. The results of the present study revealed that the populations of *L. dussumieri* inhabiting Pampa, Manimala and Achankoil constitute a morphologically homogeneous stock and are not distinguishable by most of the morphometric and meristic characters while that of Meenachil river is distinguishable as a separate stock.

Key words : ***Labeo dussumieri*, morphological characters, Kerala.**

Labeo dussumieri (Valenciennes, 1842), known as *Thooli* or *Pullan* in vernacular, is the only species of the genus *Labeo* Cuvier (Family: Cyprinidae) indigenous to Kerala waters. The distribution of this species is confined to penisular India and Sri Lanka (Hora & Law, 1941). Although Johal & Tandon (1979) reported this species from Punjab, Talwar & Jhingran (1991) have expressed doubt about its occurrence in Punjab. In recent years its regional availability in Kerala is restricted to four rivers of Travancore and upstream portions of Vembanad lake (Kurup & Kuriakose, 1990). In view of some morphological variations noticed in the specimens of *L. dussumieri* collected from different landing centres of Kerala and also noticing some disagreement with the descriptions given by Day (1865), the present investigation was undertaken to elucidate whether this species formed distinguishale stocks on the basis of selected morphometric and meristic studies. Racial analysis of fish population is widely employed for ascertaining the homogeneity of the populations, inhabiting same or different localities and such information forms a prerequisite for investigations on bionomics and stock assessment. A fish may have either a homogeneous population or may have different races which differ from each other in several morphometric and meristic characters. Comparison of meristic counts and regressions of body measurements of fishes collected from different localities by ANOVA and ANACOVA respectively are generally used as tools for identification of fish populations (Pillai, 1957; Jayaram, 1959; Rao & Chattopadhyay, 1970; Rao, 1982; Hameed & Kurup, 1982).

Materials and Methods

Materials for this study were collected from the commercial catches from the landing centres such as Parumalakadavu, Korethukadavu and Payipad of the river Pampa; Pallikkadavu, Payipad and Cherua bridge of river Achankoil; Neerettupuram, Pulikezh and Muttar of river Manimala and Muttam, Kottayam, Kanjiram, Thiruvatta and Nagampadam of river Meenachil (Fig. 1). A total of 297 specimens in the size range 152 - 458 mm total length were examined (234 from Pampa, 13 from Manimala, 5 from Achankoil and 45 from

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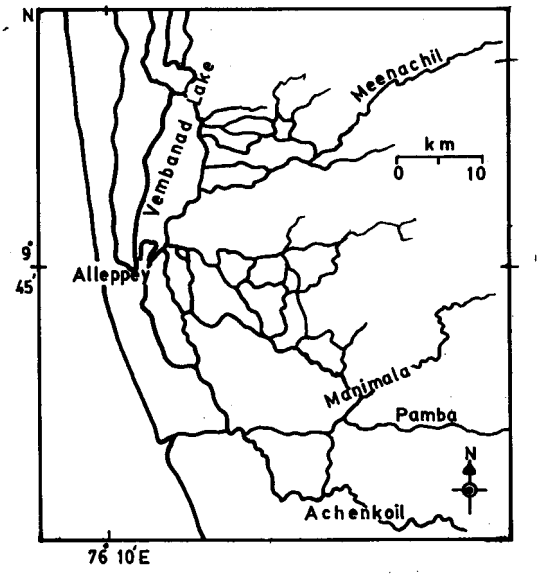

Fig. 1. Map showing Vembanad lake and confluent rivers

Meenachil), during the period 1987-1990. Fifteen morphometric characters viz., head length, pre-orbital, eye diameter, post-orbital, inter-orbital, body depth, caudal peduncle depth, snout to I dorsal, snout to pelvic, snout to pectoral, snout to anal, pectoral, pelvic & anal fin lengths, and length of longest dorsal fin ray, were considered in addition to the total length. Measurements were taken with the help of a dial reading caliper to the nearest mm on the left side on the 5% formalin preserved specimens as described by Rao (1982). The meristic counts studied were the number of rays in dorsal, anal and caudal fins and number of scales in lateral line and transverse series.

Linear regression equations, given by the formula $Y = a + bX$ where Y is the variable character, X the independent character (total length), a the constant and b (slope), the regression coefficient, were fitted for each of the variables on total length for the fishes from different rivers. The regression coefficients so obtained were compared by the method of analysis of covariance (ANACOVA) while comparison of meristic characters was done by applying analysis of variance (ANOVA) (Snedecor & Cochran, 1967).

Results and Discussion

The results of the regression analysis on morphometric data showed that the correlation coefficient values were found to be highly significant in all the cases (Table 1). A sex wise analysis of the data revealed that there was no significant difference between the two sexes and therefore, the data were pooled and a common regression was fitted without reference to sexes.

The results of the analysis of covariance revealed that, of the 15 regressions computed on total length of the samples collected from four rivers, no significant difference was noticed in the following characters, viz. pre-orbital, post-orbital, inter-orbital, body depth, snout to pelvic, pelvic and anal fin lengths. However, differences among head length, eye diameter, caudal peduncle depth, snout to I dorsal, snout to pectoral, snout to anal and length of the longest dorsal fin ray were highly significant at 1% level while significant difference at 5% level could be noticed in respect of pectoral fin length (Table 2). Therefore, the results of the pair-wise analysis revealed that those samples collected from Pampa and Meenachil differed at 1% level in respect of head length, eye diameter, caudal peduncle depth, snout to pectoral, snout to anal and length of the longest dorsal fin ray (Table 2). Significant difference at 5% level was also observed in the case of head length between the samples collected from Pampa and Manimala whereas significant difference at 1% level was noticed between samples collected from Manimala and Meenachil in respect of snout to I dorsal. Difference at

Table 1. Results of regression analysis of various morphometric measurements of *Labeo dussumieri* collected from four rivers

Sl. No.	Morphometric characters	Pampa		Manimala		Achankoil		Meenachil	
		b	r^2	b	r^2	b	r^2	b	r^2
1.	Head length	0.171	0.97	0.103	0.59	0.165	0.88	0.139	0.77
2.	Pre orbital	0.055	0.90	0.048	0.25	0.057	0.76	0.052	0.49
3.	Eye diameter	0.034	0.89	0.026	0.53	0.040	0.85	0.019	0.35
4.	Post orbital	0.080	0.86	0.034	0.41	0.070	0.87	0.058	0.49
5.	Inter orbital	0.101	0.94	0.098	0.67	0.092	0.80	0.095	0.77
6.	Body depth	0.221	0.95	0.165	0.54	0.253	0.87	0.192	0.78
7.	Caudal peduncle depth	0.131	0.96	0.645	0.64	0.850	0.68	0.804	0.68
8.	Snout to I dorsal	0.350	0.99	0.321	0.80	0.327	0.94	0.247	0.79
9.	Snout to pectoral	0.172	0.98	0.156	0.80	0.108	0.95	0.122	0.67
10.	Snout to pelvic	0.425	0.79	0.417	0.78	0.232	0.93	0.547	0.19
11.	Snout to anal	0.639	0.98	0.574	0.76	0.407	0.93	0.482	0.75
12.	Pectoral fin length	0.142	0.96	0.097	0.66	0.119	0.89	0.117	0.64
13.	Pelvic fin length	0.134	0.97	0.099	0.60	0.118	0.93	0.122	0.75
14.	Anal fin length	0.138	0.97	0.113	0.76	0.138	0.95	0.139	0.81
15.	Longest dorsal fin ray	0.158	0.97	0.103	0.54	0.113	0.87	0.113	0.70

Table 2. Results of the analysis of covariance in respect of regression of morphometric measurements of *Labeo dussumieri* between rivers

Sl. No.	Morphometric characters	All localities (*F* Value)	Pampa vs. Manimala (*t*)	Manimala vs. Achankoil (*t*)	Achankoil vs. Meenachil (*t*)	Pampa vs. Meenachil (*t*)	Manimala vs. Meenachil (*t*)	Pampa vs. Achankoil (*t*)
1.	Head length	5.35**	2.45*	1.53	0.88	2.91**	1.27	0.05
2.	Pre orbital	0.12	0.48	0.28	0.26	0.38	0.21	0.04
3.	Eye diameter	4.47**	0.86	1.20	2.08*	3.49**	0.77	0.11
4.	Post orbital	2.43	1.84	1.28	0.51	1.90	1.11	0.74
5.	Inter orbital	0.23	0.17	0.19	0.15	0.69	0.14	0.09
6.	Body depth	1.85	1.46	1.27	1.49	1.68	0.67	0.16
7.	Caudal peduncle depth	4.95**	2.20*	0.69	0.21	2.99**	0.82	0.21
8.	Snout to I dorsal	13.29**	0.49	0.87	0.89	1.59	6.39**	0.12
9.	Snout to pectoral	11.94**	0.82	1.51	0.44	5.24**	1.15	0.83
10.	Snout to pelvic	0.77	0.05	2.07*	0.74	1.21	0.34	0.21
11.	Snout to anal	10.83**	0.98	1.27	0.71	4.84**	0.90	0.66
12.	Pectoral fin length	2.79*	1.88	0.69	0.04	2.11*	0.66	1.06
13.	Pelvic fin length	1.89	1.92	0.55	0.16	1.36	0.89	0.17
14.	Anal fin length	0.49	1.21	0.89	0.04	0.08	1.06	0.01
15.	Longest dorsal fin ray	8.51**	2.20*	0.24	0.02	4.16**	0.36	0.36

*Significant at 5% level; ** significant at 1% level

Table 3. Frequency distribution of different meristic characters of *Labeo dussumieri* from various rivers

	Number of fish having lateral line scales counts of						
1. Lateral line scales	50	51	52	53	54	55	56
Pampa	1	13	46	87	52	22	13
Manimala	-	2	4	6	1	-	-
Achankoil	-	-	-	2	2	1	-
Meenachil	3	6	4	7	9	8	8

	Number of fish having transverse scales counts of			
2. Transverse scales	14	15	16	17
Pampa	62	87	81	5
Manimala	-	6	7	-
Achankoil	-	1	4	-
Meenachil	3	22	20	-

	Number of fish having dorsal fin ray counts of		
3. Dorsal fin rays	14	15	16
Pampa	75	150	9
Manimala	6	7	-
Achankoil	-	4	1
Meenachil	17	28	1

	Number of fish having pectoral fin ray counts of			
4. Pectoral fin rays	14	15	16	17
Pampa	90	46	59	39
Manimala	-	4	7	2
Achankoil	-	4	1	-
Meenachil	9	11	16	19

	Number of fish having pelvic fin ray counts of		
5. Pelvic fin rays	8	9	10
Pampa	9	197	28
Manimala	-	13	-
Achankoil	-	4	1
Meenachil	7	31	7

	Number of fish having anal fin ray counts of		
6. Anal fin rays	6	7	8
Pampa	48	60	126
Manimala	2	1	10
Achankoil	-	5	-
Meenachil	10	10	25

	Number of fish having caudal fin ray counts of				
7. Caudal fin rays	20	21	22	23	24
Pampa	44	33	55	55	39
Manimala	2	4	3	2	2
Achankoil	4	4	-	-	1
Meenachil	-	6	13	17	8

5% level could be noticed between the samples collected from Pampa and Manimala in respect of caudal peduncle depth and length of the longest dorsal fin ray while similar difference was observed between Achankoil and Meenachil in respect of eye diameter. Difference at 5% level could also be seen in the case of pectoral length fin between Pampa and Meenachil. It would thus appear that out of 15 characters studied, highly significant difference could be encountered in respect of seven characters and one character showed difference at 5% level whereas 7 characters showed no significant difference at all. Results of the pair wise analysis showed that samples collected from Pampa and Meenachil differed at 1% level in respect of six characters while no similar difference could be seen between the samples collected from Manimala and Meenachil in all morphometric characters except that of snout to I dorsal.

The frequency distribution of different meristic characters are given in Table 3 and the summary of the results of analysis of variance of the meristic counts is shown in Table 4. The results of the ANOVA showed that, of the seven characters studied, the number of caudal fin rays and transverse scale counts showed significant difference at 1% level while 5% difference was observed in the case of number of pectoral fin rays (Table 4.) However, no significant difference was noticed in respect of number of dorsal, pelvic and anal fin rays and lateral line scale counts. In order to find out which of the sample contributed to the variations, pair-wise analysis was done and the results revealed that significant difference at 1% level could be observed in respect of number of scales in transverse series and rays in caudal fin between the samples collected from Pampa and Meenachil. Similar difference was also observed in the case of caudal fin rays between Achankoil and Meenachil. At 5% level Pampa sample differed significantly from that of Meenachil as well as Manimala in respect of number of pectoral rays. Similarly, Achankoil sample also differed significantly from that of Meenachil as well as Manimala at 5% level in respect of caudal fin rays.

The results of the present study showed no significant difference in the samples between Pampa and Achankoil in any of the 15 morphometric and seven

Table 4. Results of analysis of variance in respect of meristic counts of *Labeo dussumieri* between rivers

Meristic characters	All localities (*F*)	Pampa vs. Manimala (*t*)	Manimala vs. Achankoil (*t*)	Achankoil vs. Meenachil (*t*)	Pampa vs. Meenachil (*t*)	Manimala vs. Meenachil (*t*)	Pampa vs. Achankoil (*t*)
1. Dorsal fin rays	1.55	NS	NS	NS	NS	NS	NS
2. Anal fin rays	0.69	NS	NS	NS	NS	NS	NS
3. Pectoral fin rays	2.80*	2.05*	1.77*	1.43	1.99**	0.83	0.78
4. Pelvic fin rays	0.59	NS	NS	NS	NS	NS	NS
5. Caudal fin rays	4.30**	1.69*	2.47*	2.86**	5.75**	0.35	2.17*
6. Scales in lateral line	2.38	NS	NS	NS	NS	NS	NS
7. Scales in transverse series	8.19*	1.87*	0.63	0.29	2.85**	0.60	1.91

*Significant at 5% level ** significant at 1% level; NS - Not significant

meristic characters studied. Therefore, it would appear that populations of *L. dussumieri* inhabiting these two rivers are homegeneous and belong to the same stock. Similarly, the fact that Achankoil and Manimala samples did not show difference in any of the morphometric and meristic characters at 1% level and significant difference at 5% level could be seen only in respect of one each of morphometric and meristic characters, indicates that Achankoil and Manimala samples may also have originated from a single stock. Significant difference at 1% level was observed between samples from Manimala and Meenachil in respect of one out of 15 morphometric characters shows that these samples might have originated from different stocks. Since the Pampa and Manimala samples also did not show difference at 1% level in respect of any of the morphological characters, it can reasonably be assumed that these samples also belong to the same stock. The highly significant difference between samples of Pampa and Meenachil at 1% level in six out of 15 morphometric and one out of seven meristic characters may substantiate the view that Pampa and Meenachil samples belong to difference stocks.

It would thus appear that populations of *L. dussumieri* inhabiting Pampa, Achankoil and Manimala might have originated from a single stock as none of the morphological characters showed difference at 1% level among them. On the contrary, samples collected from Meenachil differed from that of Pampa to the maximum extent since they showed highly significant difference at 1% level in six morphometric characters. These four rivers originate from Western Ghats, flow in a westerly direction and join the Vembanad lake. The Manimala and Achankoil are confluent with that of Pampa, the former at Neerettupuram and the latter at Veeyupuram and thereafter form a criss-cross canal system before influxing into the vembanad lake (Fig. 1). The confluent nature of these rivers and the intricate canal systems prevalent in the downstream regions may facilitate the chance of intermingling of the populations. On the contrary, though the Meenachil river also ends at the Vembanad lake further down (Fig. 1), it has no direct connection with that of other rivers except at the point of influx into the lake. The results of the present study is in full agreement with that of Pillay (1957), Royce (1964) and Sinha (1981) who reported that populations resemble each other more if the distribution is closer and differ more if the distance become greater. Ghosh *et al.* (1968) reported that *Hilsa ilisha* inhabiting Gangetic system comprised of subpopulations while Gupta (1989) established the fact that *Eleutheronema tetradactylum* inhabiting Chilka lake and Hooghly-Matlah system belonged to different stocks.

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