



LENGTH-WEIGHT AND ALLOMETRIC RELATIONSHIP IN *CHICOREUS VIRGINEUS* AND *MURICANTHUS VIRGINEUS* (GASTROPODA: MURICIDAE) DISTRIBUTED IN CUDDALORE COAST OF BAY OF BENGAL

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ABSTRACT

Length-weight and various allometric relationships between different morphological parameters in two muricid gastropods of *Chicoreus virgineus* and *Muricanthus virgineus* were studied. The correlation coefficient of the two species was found to be significant ($P < 0.001$). Significant difference was observed in the analysis of variance for various morphological measurements in males and females of *Muricanthus virgineus*. Highly significant results were also obtained for both the species in allometry and its correlation coefficient.

INTRODUCTION

The family Muricidae revealed that the existence of some species is already known to occur in the geographical area of the south east coast of India. Generally, the animals were collected from the local fisherman who had trawled them off the coastal area of Cuddalore coast. The economic importance of these two species can hardly be emphasized from the stand point of food and medicinal, and cosmetic properties have been of tremendous importance to humans. The present study was carried out from Cuddalore coastal waters of Bay of Bengal. Length-weight relationship of gastropods is not well documented. However, the earlier studies on length-weight in *Ancylus fluviatilis* (Geldiay 1956), growth and seasonal changes of *Lymnacea stagnalis* (Berrie 1966), allometric relationship in *Umbonium vestiarium* and *Nassa stolatus* (Thivakaran 1984), age and growth and length-weight relationship in *Littorina scabra* (Maruthamuthu & Kasinathan 1985) and length-weight relationship in *Chicoreus ramosus* (Paninee 1991, Benny & Ayyakkannu 1992) are available.

The growth rate of various organisms is not uniform and the growth of some dimensions of a body component in relation to the whole body is termed as allometric growth. It is useful in knowing the variations from the expected weight for various length groups, as some organisms are known to change their form or shape during growth (Lacren 1951). The present study was carried out in *Chicoreus virgineus* and *Muricanthus virgineus* in order to understand the length-weight and other allometric relationship between various morphological characters.

MATERIALS AND METHODS

Random samples of two species were collected from their respective habitats in the littoral zone. The collection of these species was made from 10 to 15 fathoms line, which is about 6 km off Cuddalore coast (Lat. 11°43.344'N, Long. 79°46.698'E) and has an average depth of 21 m with a muddy bot-

tom during January to September 2007. These species normally live in sandy-mud benthic zones. The length, width, aperture length and width of two species were measured by using vernier calipers to the nearest 0.1mm. The live wet weight of the species was determined after washing off the sediment particles adhering to the shell. Soft body of the animal was removed and blotted to remove excess moisture and weighed using a single pan electrical balance to the nearest 0.1mg. In the present study *Chicoreus virgineus* ranging in size from 4.0 to 10.7 cm, and *Muricanthus virgineus* from 4.0 to 12 cm in total length were utilized.

The parabolic equation, $W = aL^n$, used in the study can be expressed in the logarithmic form as:

$$\text{Log } W = \log_a + n \log L$$

$$\text{(i.e.) } Y = a + bx$$

Where,

$$a = \log_a$$

$$b = n$$

$$Y = \log_n$$

$X = \log_L$ which is a linear relationship between X and Y

RESULTS AND DISCUSSION

Length-weight relationship: The comparison of regression lines between male and female of two species is presented in Tables 1, 2 and 3. Correlation coefficient of two species was found to be significant ($p < 0.001$). In the present study, the changes in the constant allometry of length-weight relationship are associated with increase in size and sexual maturity as observed in *Anadara rhombea* (John 1980) and *Pythia plicata* (Shanmugam 1987). The lower 'b' values were obtained in *Chicoreus virgineus* of both male and females may be attributed to heavy shell weight with less meat weight.

Allometric relationship between various morphological characters: The relationship between total length (TL), total width (TW), aperture length (AL), aperture width (AW) and weight of the whole animal (WA) in male and female of *Chicoreus virgineus* was studied in all possible combinations using the linear regression and the results are presented in Tables 4 and 5. In males, the correlations between the variables were calculated as, TL & TW ($r = 0.7636$), TL & QL ($r = 0.6640$) and

Table 1: Regression parameters and results of statistical point from length-weight relationship of *Chicoreus virgineus* and *Chicoreus muricanthus*.

Species	N	b	a	r	S.E of b	t-value Beta=3
<i>Chicoreus virgineus</i>						
(a) Male	181	0.6919	0.3052	0.4198	0.1117	20.6661*
(b) Female	360	0.4451	0.8299	0.3090	0.0724	29.9738*
<i>Muricanthus virgineus</i>						
(a) Male	205	2.2885	-2.5351	0.8124	0.1154	6.1655*
(b) Female	308	2.3448	-2.6602	0.7704	0.0992	6.6048*
Combined	513	2.2671	-2.5060	0.8103	0.0725	10.1090*

N= number of animals, a, b = constant of regression equation, S.E. = standard error, r = correlation coefficient, *indicates the significance ($p < 0.001$).

Table 2: Comparison of regression lines between males and females of *Chicoreus virgineus*.

	df	Σx^2	Σxy	Σy^2	Regression coefficient	Deviation from regression		
						Df	SS	MS
L. within								
1. Male	180	3.2856	2.2724	8.9169	0.6916	179	7.3453	0.0410
2. Female	359	6.4610	2.8761	13.4057	0.4451	358	12.1254	0.0339
3.						537	19.4707	0.0363
4. Pooled W	539	9.7466	5.1485	22.3226	0.5282	538	19.6030	0.0364
5.		Difference between slopes				1	0.1323	0.1323
6. Between B	1	0.2088	0.4864	1.1327				
7. W+B	540	9.9554	5.6349	23.4553		539	20.2659	
		Between adjacent error				1	0.6629	0.6629

Comparison of slopes $F = 0.1323/0.0363 = 3.6446$ (df = 1,537) N.S.
 Comparison of elevation $F = 0.6629/0.0364 = 18.2115$ (df= 1,538) (Significant $p < 0.01$)

Table 3: Comparison of regression lines between males and females of *Muricanthus virgineus*.

	df	Σx^2	Σxy	Σy^2	Regression coefficient	Deviation from regression		
						Df	SS	MS
L. within								
1. Male	204	1.1573	2.6485	9.1828	2.29	203	3.1217	0.0154
2. Female	307	1.6158	3.7888	14.9697	2.34	306	6.0856	0.0159
3.						509	9.2073	0.0181
4. Pooled W	511	2.7731	6.4373	24.1525	2.32	510	9.2074	0.0181
5.		Difference between slopes				1	0.0021	0.0021
6. Between B	1							
7. W+B	512	304425	7.08046	26.9482		28	9.2541	
		Between adjacent error				1	0.0447	0.447

Comparison of slopes $F = 0.0021/0.0181 = 0.1160$ (df = 1,509) N.S.
 Comparison of elevation $F = 0.0442/0.0181 = 2.4696$ (df = 1,510) N.S.

Table 4: Correlation coefficient and results of t-test in males and females of *Chicoreus virgineus*.

Variables	r	Co-efficient	T	D.F.
Male				
TL=TW	0.7636	9.0985	16.95*	169
TL=AL	0.7200	1.4593	13.49*	169
TL=AW	0.6640	1.3673	11.55*	169
TL=WA	0.4447	2.9594	10.48*	169
Female				
TL=TW	0.7099	7.4948	19.07*	358
TL=AL	0.6309	1.2726	15.38*	358
TL=AW	0.5812	1.1598	13.51*	358
TL=WA	0.7559	3.6185	21.85*	358

*Indicates significant at $p < 0.001$

Table 5: Correlation coefficient and results of t-test in males and females of *Muricanthus virgineus*.

Variables	r	Co-efficient	T	D.F.
Male				
TL=TW	0.6673	7.0863	12.58*	197
TL=AL	0.6179	2.9689	11.03*	197
TL=AW	0.3528	5.0944	5.29*	197
TL=WA	0.8045	3.7065	19.01*	197
Female				
TL=TW	0.7936	6.0298	22.81*	306
TL=AL	0.2268	8.6321	4.07*	306
TL=AW	0.4811	7.8132	9.60*	306
TL=WA	0.7425	2.8290	19.39*	306

*Indicates significant at $p < 0.001$

Table 6: Analysis of variance among various morphometric measurements of males and females of *Chicoreus virgineus* (*P < 0.001).

Variables	S.S	D.F	M.S	F ratio
Male				
TL=TW				
Between	1.084	34	318.7	11.09*
Within	3.908	136	28.74	
TL=AL				
Between	8.677	22	394.4	9.62*
Within	6.068	148	41.00	
TL=AW				
Between	8.551	24	356.3	8.40*
Within	6.193	146	42.42	
TL=WA				
Between	9.033	53	170.4	3.49*
Within	5.712	117	48.82	
Female				
TL=TW				
Between	2.160	46	469.6	10.64*
Within	1.381	313	44.12	
TL=AL				
Between	1.819	25	727.4	14.10*
Within	1.723	334	51.58	
TL=AW				
Between	1.721	26	661.8	12.10*
Within	1.821	333	54.67	
TL=WA				
Between	2.410	81	297.5	7.31*
Within	1.131	278	40.70	

TL & WA ($r = 0.4447$), and in females TL & TW ($r = 0.7099$), TL & AL ($r = 0.6308$), TL & AW ($r = 0.5812$) and TL & WA ($r = 0.7559$). It is evident that the correlation coefficient values for various combinations of both forms of *Chicoreus virgineus* are statistically significant.

In the males of *Muricanthus virgineus*, total length influences the other variables; TL & TW ($r = 0.6673$), TL & AL ($r = 0.6179$), TL & AW ($r = 0.3528$) and TL & WA ($r = 0.8045$), also in

Table 7: Analysis of variance among various morphometric measurement of males and females of *Chicoreus muricanthus* (*P< 0.001).

Variables	S.S	D.F	M.S	F ratio
Male				
TL=TW				
Between	1.624	43	377.6	6.09*
Within	9.611	155	62.01	
TL=AL				
Between	1.341	24	558.6	7.81*
Within	1.244	174	71.50	
TL=AW				
Between	1.312	19	690.8	9.72*
Within	1.272	179	71.08	
TL=WA				
Between	1.990	70	284.2	6.11*
Within	5.950	128	46.49	
Female				
TL=TW				
Between	4.225	66	640.1	12.06*
Within	1.279	241	53.07	
TL=AL				
Between	3.663	25	1.465	22.46*
Within	1.840	232	65.25	
TL=AW				
Between	3.781	25	1.512	24.76*
Within	1.722	282	61.08	
TL=WA				
Between	4.318	110	392.5	6.52*
Within	1.186	197	60.18	

females TL & TW (r = 0.7936), TL & AL (r = 0.2268), TL & AW (r = 0.4811) and TL & WA (r = 7425). It is evident that the correlation coefficient values for various combinations in both the sexes are highly significant.

Results of analysis of variance for various parameters of two species of males and females are presented in the Tables 6 and 7. It is evident that there are significant differences between males and females of *Muricanthus virgineus* and there are significant differences in the intercepts between males and females of *Chicoreus virgineus*.

Changes in allometric relations between different shell characters with respect to growth were observed between shell characters and total weight of the animal in both males and females of two species. The results were found to support variations in growth between males and females of *Chicoreus virgineus*. Kasinathan et al. (1987) also observed a significant difference in growth between the male and female of *Oliva oliva*. Even though positive allometric growth was observed between shell height and weight in *Chicoreus virgineus*, the difference was observed to be significant between the sexes (males F = 3.49, Females F = 7.31). Maruthamuthu & Kasinathan (1985) reported significant difference in length weight relationship between male and female of *Littorina scabra* from Parangipettai waters. Kasinathan et al. (1987) also reported significant difference between length-weight, and opined that the difference appears to be due to sexual maturity and also due to increase in size of both sexes. Kuenzler (1961) also reported changes in the allometry to

length-weight relationship associated with sexual maturity in mussels. Allometric relationship in all the combinations showed that all these factors are significantly related to each other as observed by earlier workers (John 1980).

In the present study, the length weight relationship of both the species, the correlation coefficient was found to be significant. The analysis of variance revealed significant difference between males and females of both *Chicoreus virgineus* and *Muricanthus virgineus*, the significant difference were found in the intercept between sexes. The allometric relationship between various morphological attributes revealed that the correlation coefficient values for various combinations of body as well as characters taken from males and females of both the species are highly significant ($p < 0.001$).

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