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Morphometric relationships of the monkey river prawn *Macrobrachium lar* (Fabricius, 1798) (Decapoda, Palaemonidae) from the Andaman islands

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ABSTRACT

The morphometric relationships of endemic species of the palaemonid prawn *Macrobrachium lar* collected from the rivers of Andaman Islands, India, were studied. A total of 57 specimens (27 and 30 males and females) were examined using 8 morphometric measurements. Significant difference in the pattern of growth was observed in males and females with regards to most of the characters. Coefficient of variation values estimated revealed a low intra-group variation (CV < 25%) for all characters. Mean size of all the parameters show higher values in males compared to females. The morphometric traits of female individuals showed more positive and significant correlations compared to their male counterparts. In general, few parameters showed similar patterns of relative growth in both sexes. The total length was significantly related with telson length, carapace width and body weight while telson length was positively correlated with carapace width and body weight. The species clearly exhibits sexual dimorphism.

Keywords: Andaman Islands, *Macrobrachium lar*, Monkey river prawn, Morphometric relationship

Knowledge on morphometric relationships is of great importance in fishery biology investigations and stock structure assessments. Morphometric and meristic studies have provided useful results for identifying marine fish stocks and describing their spatial distributions (Ihssen *et al.*, 1981). This relationship is used for fixing minimum legal size in many developed countries for managing fishery (Thomas, 1973). The relative growth patterns of different decapod crustaceans have been studied extensively which can provide important informations to explain the links between processes of growth and evolution (Blackstone, 1987).

Macrobrachium lar (Fabricius, 1798) is a freshwater prawn which is distributed ubiquitously throughout the tropical Indo-Pacific high islands. *Macrobrachium* spp. are found in most inland freshwater areas including ponds, lakes, rivers and irrigation ditches, as well as in estuarine areas (New, 2002). A major revisionary on the area where *M. lar* has been reported or collected is given by Holthuis (1950). This prawn has been reported as an endemic and native species of Andaman and Nicobar Islands (A & N Islands) by several workers (Costa, 1979; Sarangi *et al.*, 2001).

Several studies have been made on the morphometric relationships of other prawns and shrimps elsewhere (Ragonese *et al.*, 1997 in *Aristaeomorpha foliacea*; Anger

and Moreira, 1998 in *Macrobrachium acanthurus* and *Macrobrachium olfersii*; Diaz *et al.*, 2001 in *Farfantepenaeus duorarum*; Kapisris and Conides, 2009 in *Melicertus kerathurus*). Besides few studies on morphometric characteristics of prawns/lobster (Jayachandran and Joseph, 1985; 1988, Mariappan and Balasundaram, 2004; Dineshbabu, 2008), the literature on this aspect is scanty in India. No study on morphometric relationship on the species, *M. lar* has been undertaken so far. The present study was aimed at examining morphometric relationships of both sexes from the streams and rivers of Andaman Islands and to discuss any possible significant differences in relation to selected body parts.

Specimens of *Macrobrachium lar* were collected with the assistance of fishermen using cast net from 3 sites *viz.*, Burmanallah (lat. 11° 35' 55.615" N and long. 92° 43' 11.539" E), Rangat (lat. 12° 38' 17.196" N and long. 92° 45' 55.635" E), Lamiya Bay (lat. 13° 11' 8.007" N and long. 93° 5' 38.122" E) during January 2008 to December 2008. Specimens were (segregated according to sex), preserved, weighed to nearest 0.01 g, measured all the selected morphometric characteristics to the nearest 0.1 mm. A total of 27 males and 30 females in the length range of 82 - 123 mm and 73 - 118 mm respectively were used for the seven linear measurements of different body parts. The measurements taken are defined in Table 1.

Table 1. Details of morphometric parameters of *Macrobrachium lar* used in the study.

Parameters	Measurements
Total length (TL)	Length from tip of the antennule's plate to end of the telson
Carapace length (CL)	Length from the base of the eye stalk to posterior end of the carapace
Rostral length (RL)	Length from the tip to the end of the rostrum
Telson length (Tel L)	Maximum length of the telson
Abdominal length (AL)	Length from the posterior end of the carapace to end of the telson
Eye diameter (ED)	Maximum diameter of the eye
Carapace width (CW)	Length of the maximum depth of the carapace
Body weight (BW)	Weight of the body

Mean, standard error, standard deviation, maximum and minimum of all measurements were recorded for each sex separately. The coefficient of variation (CV%) was computed as: $CV\% = 100 \times S.D. / X$, where S.D. is the standard deviation and X is the mean of the measurements of morphometric characters in each sex. The correlation coefficient (r) was determined to know the strength and pattern of relationship between the two variables (Ivanov and Krylov, 1980). Analysis of covariance (Snedecor and Cochran, 1967) was performed to test the significant difference in the relationship between the sexes at 1% level.

Various morphometric characteristics such as total length, carapace length, rostral length, eye diameter, carapace width, telson length and weight of the individual specimens were analysed to elucidate relationships. The descriptive statistical results of all the selected morphometric traits of male and female are presented in Table 2. The coefficients of variation (CV) values of male population were relatively low (CV<25%) for all the measured variables (between 9.46 and 20.48%). The lowest value (13.55%) was recorded for total length (TL) while the highest (20.48%) was registered for carapace length (CL). The CV values of female were also found relatively low (CV<25%) for all standardised variables (between 11.41% and 19.33%). The lowest value (11.41%) was noted for rostral length (RL) while the highest (19.33%) was recorded for total length (TL). The coefficients of variation (CV) values of combined sex were also relatively low (CV<25%) for all the measured variables (between 13.55% and 19.67%). The lowest value (13.55%) was recorded for rostral length whereas the highest (19.67%) was observed for carapace length (CL). Mean sizes of all selected traits were found higher in males compared to those of females throughout the sampling period.

The correlation of various morphometric traits of males and females are given in Tables 3 and 4 respectively. From the analysis of correlation of various parameters, it can be seen that the two sexes of *M. lar* significantly differ in various morphometric characters. The morphometric

traits of female individuals showed more positive and significant correlations compared to their male counterparts. In males, the total length was significantly related with telson length, carapace width and body weight whereas the same in females was correlated with carapace length, telson length, abdominal length, carapace width and body weight. The rostral length did not show correlation to any of the other traits, both in males and females except a very low correlation with total length. The telson length showed relatively more positive correlation with total length than carapace length in male while it is reverse in case of female. In male, the abdominal length did not exhibit correlation to any of the other parameters whereas it showed positive correlation with total length, carapace length and telson length in female. The body weight and carapace width exhibited a high positive correlation in both the sexes. The body weight and abdominal length showed a significant positive correlation in females, whereas it was not significant in males.

Morphometric studies have been widely used for taxonomic purposes in decapod crustaceans and such studies are also made by several workers in the genus *Macrobrachium* (Jayachandran and Joseph, 1988; Chace and Bruce, 1993; Suzuki and Kusamura, 1997). Data from this study present the first report on the existence of morphometric relationships between sexes in the monkey river prawn population. From the analysis of coefficient of variation and correlation methods of various parameters, it can be seen that the two sexes of *M. lar* significantly differs in growth patterns of various morphometric characters.

Intra-sexual variation in morphometric traits was found to be low for *M. lar* from the Andaman waters. This was pointed out by low values of coefficient of variation (< 25%) for all measured variables and implied that each group consisted of a more or less phenotypical homogeneous group (Ferrito *et al.*, 2007). Low values of CV may possibly also give explanation for high inheritability (Mamuris *et al.*, 1998) and as a result a limited pressure of environmental variation on morphological

Table 3. Correlation between various morphometric traits of *M. lar* (male)

	TL	CL	RL	Tel. L	AL	ED	CW	BWt
Total length (TL)	-							
Carapace length (CL)	0.53	-						
Rostral length (RL)	0.52	0.18	-					
Telson length (TL)	0.84*	0.51	0.45	-				
Abdominal length (AL)	0.18	0.103	0.11	0.13	-			
Eye diameter (ED)	0.31	-0.09	0.24	0.28	-0.05	-		
Carapace width (CW)	0.86*	0.55	0.37	0.85*	0.12	0.29	-	
Body weight (BWt)	0.84*	0.53	0.28	0.83*	0.19	-0.009	0.83*	-

*p<0.01

Table 4. Correlation between various morphometric traits of *M. lar* (female)

	TL	CL	RL	Tel.L	AL	ED	CW	B Wt
Total length (TL)	-							
Carapace length (CL)	0.79*	-						
Rostral length (RL)	0.28	0.23	-					
Telson length (TL)	0.78*	0.91*	0.28	-				
Abdominal length (AL)	0.73*	0.94*	0.16	0.90*	-			
Eye diameter (ED)	0.46	0.40	0.20	0.65*	0.38	-		
Carapace width (CW)	0.74*	0.96*	0.20	0.92*	0.95*	0.42	-	
Body weight (B Wt)	0.75*	0.96*	0.16	0.89*	0.94*	0.39	0.97*	-

*p<0.01

variability (Soule and Couzin-Roudy, 1982). Moreover, there may be high restricted environmental conditions operating for each group, which checks appearance of significant difference within group. Two groups were likely to be influenced by low variation of environmental conditions.

A study of the range and mean of various morphometric data (Table 2) of *M. lar* showed that the males grow larger in size than females. This type of sexual dimorphism in size has been observed in many *Macrobrachium* species. Mossolin and Bueno (2003), Fransozo *et al.* (2004) and Mantelatto and Barbosa (2005) studying *M. olfersi*, *M. iheringi* and *M. brasiliensis* respectively, observed that males attained a greater total length than females as a function of the differences in growth rates and patterns of population structure between sexes. Similar observation was reported in *M. rosenbergii*, *M. malcolmsonii* (Jayachandran and Joseph, 1988) and *M. dayanus* (Koshy, 1971). Mantelatto and Barbosa (2005) while studying *M. brasiliensis*, also reported that the larger size attained by males may be linked to domination over females, as well as pre-adult males, during the copulation process. The morphometric traits of female individuals showed more positive and significant correlations compared to their male counterparts (Table 3 and 4). Only few parameters in both the sexes showed similar patterns of

significantly different growth in both sexes. The total length was significantly related with telson length, carapace width and body weight while telson length was positively correlated with carapace width and body weight. These significant relationships indicate the different pattern of growth in both the sexes. Significant variation between carapace length-body weight was found between sexes in the present study. Similar observation was also recorded in the lobster (*Metanephrops andamanicus*) from the Western Indian Ocean (Ivanov and Krylov, 1980). Cole (1958) and Rajyalekshmi (1980) also observed differential relation between carapace length and total length in *Palaemon serratus* and *Macrobrachium malcolmsonii*. Brusher (1972) found difference in relation between total length and telson length in *Penaeus indicus*. Finney and Abele, (1981) in their study indicated that variations in morphometric traits of different crustacean species are due to a function of sex and even within females of *Trapezia ferruginea*, morphometric relationship is negative in normal while it is positive among berried females. These variations in morphometric characters may be largely affected by genetic and environmental factors (Tzeng *et al.*, 2001).

The results of the present study establish clear sexual dimorphism in *M. lar* and also provide a general image of the relative growth of different body parts of taxonomic importance.

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