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RESEARCH ARTICLE

MORPHOMETRIC STUDY ON *MACROBRACHIUM ASSAMENSE PENINSULARE* (TIWARI, 1958) FROM RAWASAN STREAM OF GARHWAL HIMALAYA, UTTARAKHAND, INDIA

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Abstract

Nineteen morphometric characters of *Macrobrachium assamense peninsulare* (Tiwari, 1958), a freshwater prawn were measured from 37 males and 41 females collected randomly. Statistical analysis was performed to analyze the intra population variation in *Macrobrachium assamense peninsulare* from Rawasan stream in Garhwal region, Uttarakhand, India. A significant positive correlation was obtained in between the parameters considered at the 1 % level of significance excluding some chelipeds parameters. Regression analysis was performed for three morphometric variables viz., Carapace length (CC) with Abdominal length (CA) and Carapace length (CC) with Rostral length (RL) and fitted regression equation $y = 1.2789x + 5.8026$ ($R^2 = 0.7031$) and $y = 0.3675x + 1.8288$ ($R^2 = 0.6875$) in female; $y = 1.3456x + 4.7359$ ($R^2 = 0.7749$) and $y = 0.3719x + 2.138$ ($R^2 = 0.6714$) in male respectively were obtained from the species.

Introduction:

In North India study on the freshwater crustacean is in infant stage due to the small size as well the small weight of the animal. In India, the fish farmers still depend upon natural seed supply for stocking their ponds. Hence, knowledge on the identification of the species chosen for culture is of an impelling necessity to eliminate mixing of species (Mariappan and Balasundaram, 1999). With this view in mind, the study was conducted to find out the morphological difference and growth pattern of chelipeds and body segments of *Macrobrachium assamense peninsulare*. Genus *Macrobrachium* has more than 200 species that share many morphological similarities. Study on *Macrobrachium assamense peninsulare* Fig. (1) in Garhwal region of Uttarakhand is scanty, and knowledge on its production and biology is inadequate. Morphological study of animal is important to identify the animal and also helpful in solving taxonomical ambiguities. Allometric or relative growth pattern of various decapod crustaceans has been studied widely (Hartnoll, 1978; Finney and Abele, 1981; Sumpton, 1990; Sarda and Cartes, 1997), including genus *Macrobrachium* (Holthuis, 1950; Jayachandran, 1998; Mossolin and Bueno, 2003; Mariappan and Balasundaram, 2004; Rana and Kumar, 2013). Although the Garhwal region have enormous fish fauna due to wide range of climate, topography, and riverine system and almostly studied by early workers. But crustacean study is still sparse and a narrow study reported from water bodies, and stream of low current velocity. Review of literature revealed scanty data available on its taxonomy and diversity from Garhwal region of Uttarakhand. Hence, the present study is under taken to fill up this lacuna in literature. The present study analyzed the morphometric data of *Macrobrachium assamense peninsulare* population in Rawasan stream. Data obtained from the morphometric and meristic analysis of the species will contribute in solving the taxonomical doubts and bio-ecological perspectives of the species.

Material and Methods:

The study was conducted in Rawasan stream of Uttarakhand, India located at $29^0$55'33.82"N and$78^0$26'42.41"E having elevation 2835 ft and eye altitude 20306 ft. The samples were collected from different selected sites from August to December 2013. A total of 37 male and 41 female were randomly collected and 19 characters (Wowor and Ng, 2007) were selected and measured with the help of Vernier caliper with nearest 0.1 mm accuracy. Total length (L1 and L2) and Carapace length (CC), Abdominal length (CA), Telson length (TL), Rostrum length (RL) and second Pleura height (CPL) and Length of the individual segments of second chela was also measured i.e., Highest propodus length (CPR) Highest propodus height (APR) Carpus length (CRL) Palm length (PL) Merus length (MRL) Ischium length (ISH). Each animal weighted individually on an electronic balance (±0.001g). Literally with the quantitative morphological measurements, some qualitative characters, including body color, body shape, sex, number of dorsal and ventral teeth of rostrum, type and the presence or absence of spines on the second chela is also noted. These Micro-observation i.e., Spine count, Propodus and carpus length measurement, Rostrum teeth count etc. were carried out with the help of hand lens and Stereomicroscope. The investigation period was monthly based and all the parameters were analyzed respectively and simple correlation coefficient is studied in between these parameters that are employed for the statistical interpretation of the data obtained from the study. Correlation analysis was carried out on 13 important morphometric parameters. Regression analysis was performed for three morphometric variables viz., Carapace length (CC) with abdominal length (CA) and Carapace length (CC) with Rostrum length (RL) only.

Result and Discussion:

The correlation analyses are tabulated sequentially (Table 1 and 2). Regression plots of morphometric parameters viz., CC and CA; CC and RL of *Macrobrachium assamense peninsulare* with fitted regression equation are also presented (Fig. 2a & b and 3a & b). A significant positive correlation was obtained in between morphometric characters considered at the 1 % level of significance in both female and male respectively excluding 2nd paraepods parameters. Regression analysis was performed for three morphometric variables viz., Carapace length (CC) with abdominal length (CA) and Carapace length (CC) with Rostrum length (RL) fitted regression equation $y = 1.2789x + 5.8026$ ($R^2 = 0.7031$) and $y = 0.3675x + 1.8288$ ($R^2 = 0.6875$) in female; $y = 1.3456x + 4.7359$ ($R^2 = 0.7749$) and $y = 0.3719x + 2.138$ ($R^2 = 0.6714$) in male respectively.

Fig. 1 *Macrobrachium assamense peninsulare* (study Specimen)

Table 1. Correlation coefficient (r) values for parameters of female *Macrobrachium assamense peninsulare* (N=41) from Rawasan stream in Garhwal region, Uttarakhand, India.

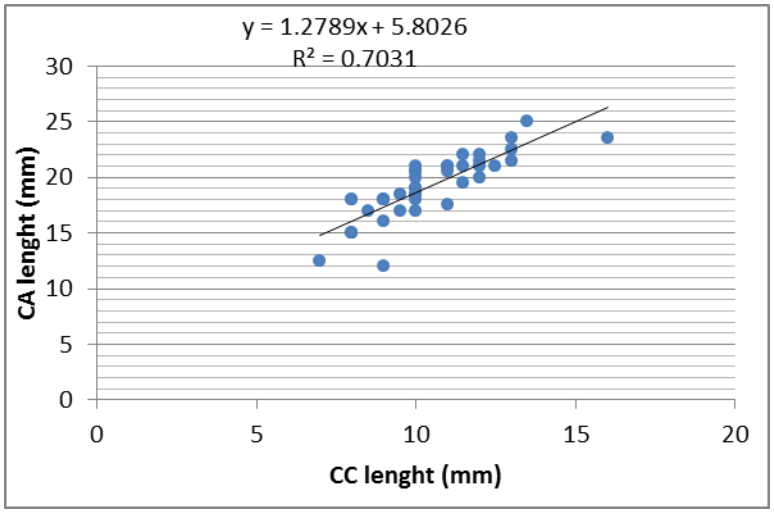
	L1	L2	CC	CA	TEL	RL	CPL	CPR	APR	PL	CRL	MRL	ISH
L1	1												
L2	0.975*	1											
CC	0.943*	0.923*	1										
CA	0.934*	0.921*	0.839*	1									
TEL	0.865*	0.860*	0.752	0.762	1								
RL	0.909*	0.838*	0.829*	0.795	0.810*	1							
CPL	0.811*	0.832*	0.783	0.743	0.740	0.634	1						
CPR	0.650	0.658	0.553	0.615	0.642	0.576	0.541	1					
APR	0.281	0.261	0.345	0.237	0.180	0.234	0.151	-0.231	1				
PL	0.486	0.490	0.391	0.487	0.475	0.438	0.422	0.935*	-0.344	1			
CRL	0.904*	0.882*	0.876*	0.806*	0.783	0.856*	0.722	0.536	0.350	0.374	1		
MRL	0.916*	0.928*	0.854*	0.838*	0.838*	0.849*	0.769	0.681	0.163	0.531	0.805*	1	
ISH	0.688	0.713	0.615	0.626	0.647	0.602	0.797	0.550	0.149	0.480	0.719	0.668	1

*Correlation Coefficient (r) is significant at the 0.001 level (2-tailed).

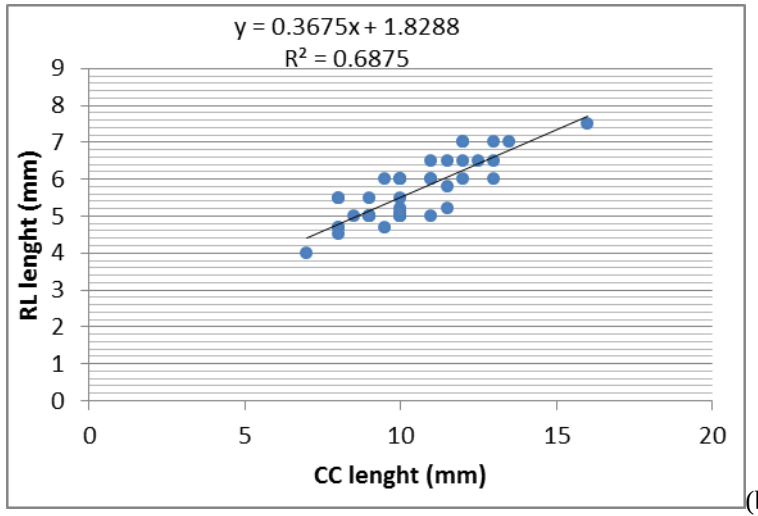
Table 2. Correlation coefficient (r) values for parameters of male *Macrobrachium assamense peninsulare* (N=37) from Rawasan stream in Garhwal region, Uttarakhand, India.

	L1	L2	CC	CA	TEL	RL	CPL	CPR	APR	PL	CRL	MRL	ISH
L1	1												
L2	0.995*	1											
CC	0.948*	0.957*	1										
CA	0.965*	0.964*	0.880*	1									
TEL	0.905*	0.894*	0.864*	0.799	1								
RL	0.912*	0.880*	0.819*	0.837*	0.902*	1							
CPL	0.923*	0.924*	0.890*	0.890*	0.847*	0.827*	1						
CPR	0.510	0.511	0.542	0.366	0.668	0.547	0.507	1					
APR	-0.068	-0.055	-0.032	-0.068	-0.030	-0.112	0.007	-0.142	1				
PL	0.605	0.601	0.622	0.475	0.710	0.619	0.620	0.839*	-0.112	1			
CRL	0.696	0.695	0.717	0.562	0.774	0.705	0.698	0.847*	0.008	0.795	1		
MRL	0.736	0.738	0.736	0.611	0.795	0.728	0.738	0.855*	-0.085	0.889*	0.947*	1	
ISH	0.602	0.602	0.591	0.498	0.683	0.581	0.617	0.803*	-0.064	0.798	0.890*	0.914*	1

*Correlation Coefficient (r) is significant at the 0.001 level (2-tailed).

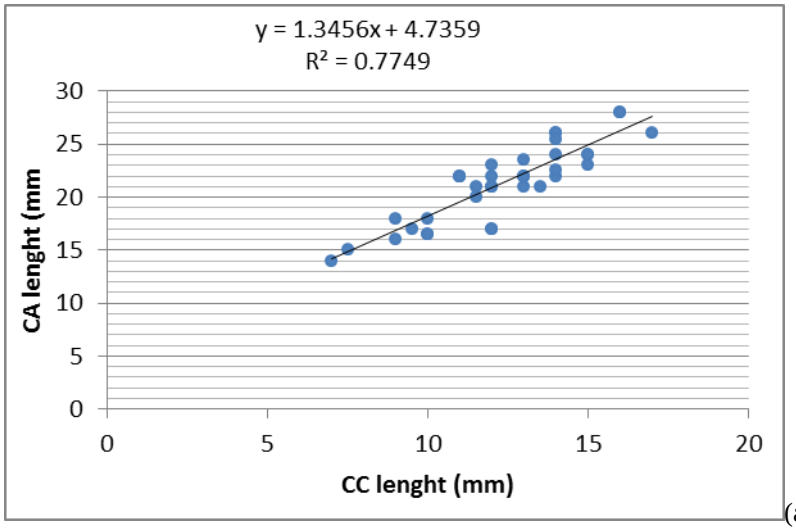


(a)

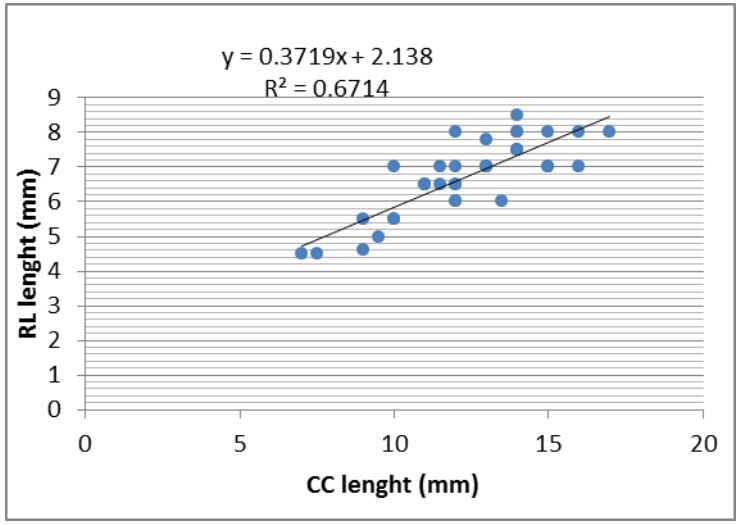


(b)

Fig. 2 (a & b) Regression analysis plots for morphometric parameters of female individuals of *Macrobrachium assamense peninsulare*.



(a)



(b)

Fig. 3 (a & b) Regression analysis plots for morphometric parameters of male individuals of *Macrobrachium assamense peninsulare*.

Description of *Macrobrachium assamense peninsulare* (Tiwari, 1958)

Sampling site is Rawasan stream, Garhwal region of Uttarakhand India, 37 male, 41 female, average total length ranges from 27-54 mm in female and 30-59 mm in male.

Diagnostic features:

Macrobrachium assamense peninsulare commonly known as "Jhinga machi". Prawn body is divided into three main divisions: the head, thorax and abdomen like other decapods. The head and thorax region joined to form cephalothoraxes which include mandibles, flagella, rostrum and eye containing a stalk. The abdomen has six body segments with five pair of walking legs and the last segments where uropods or telson with two pairs of dorsal spines, ending in a small acute median point. Rostrum is slightly slender reaching to the distal end of scaphocerite, rostral tip slightly upturned; rostral formula $\frac{7-9}{0-3}$ teeth placed more widely in posterior region of rostrum than anterior region, hair in between the teeth, carapace smooth. Spines on 2nd paraepods in male and absent in female, hair present on paraepods, segments of 2nd paraepods are unequal in mature animal and equal in length in young in male and female. *Macrobrachium assamense peninsulare* is light straw or brown in color and some are creamish with pink spot on the body, tips of walking legs are red. Bottom feeder present in stagnant water under the stones and green vegetation. Sexual dimorphism is significant having larger and heavier male than female and second walking legs is much thicker. The cephalothorax is also larger in male then female while abdomen is narrower in the female and presence of appendix masculine in the second pleopods of the males. The genital pore of the male is in between the base of the fifth walking leg but in female the genital pore is at the base of the third walking leg having gap in between them as compared to the males (New and Singholka, 1982). The pleopod of female forms a brood chamber in which the eggs are carried between the egg laying and hatching. A ripe Ovigerous female can easily be identified by the orange color of ovaries that occupy a large portion of the cephalothorax. Female with egg was also available in August and September months during the study periods. Since sexual dimorphism is prominent in adult.

The morphological data is sole being an exceptional data to be produced in terms of the species morphometry in Garhwal region and in future studies it will facilitate further understanding the impact of immediate ecological conditions on the *Macrobrachium* morphology and to study the species diversity in this region. Carapace length (CC) and Rostral length (RL) relationship and rostral teeth is species specific and contribute for finding significant differences related to species morphometric traits, as observed for other groups (Tiwari 1958; Cai et al., 2004; Jayachandran et al., 2007; Mariappan and Balasundaram, 2004). The ratio between cheliped length and carapace length is species specific and subjected to detailed statistical analyses in taxonomy studies (Holthuis, 1950; Jayachandran, 1998). According to our results, these morphological parameters are highly correlated with each other in the studied population.

Growth and development of animal depend upon the factors, including availability of food, habitat, time of metamorphosis, growth rate before and after maturity, age of maturity, and prolonged existence. Although, the present findings adds to the morphometric and meristic data for the species, the variation is attributed to the regional differences compared to the available literature. However, it is assets considering the data remaining to its rareness and first time reporting from the study region contributing to the understanding of the ecological impacts on morphometry in future.

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