

**MORPHOMETRY OF INDIAN ROOFED TURTLE, *PANGSHURA TECTA*
(GRAY 1831) IN BANGLADESH**

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Abstract: Morphometric study was conducted on Indian roofed turtle, *Pangshura tecta*, between January 1997 and December 2000 in several district of Bangladesh. The mean weight of adult male was 92.6 ± 13.3 g and of female 441.1 ± 185.4 g. The length and width of carapace as well as those of the plastron and the height of the shell varied with the body weight of the turtle. The percentage of hard parts of the body weight of *P. tecta* was 35.8 ± 2.5 %, whereas percentage of soft parts of the body weight was 64.2 ± 2.5 %. The average weight of the female *P. tecta* was 4.8 times higher than that of the male.

Key words: Morphometry, Indian roofed turtle, *Pangshura tecta*

INTRODUCTION

Turtles have long been associated with human either in myths, as food sources, as ornaments or as traditional medical ingredient (Rashid and Khan, 2000). The wetlands of Bangladesh are rich in Chelonian fauna that can contribute to ecological balance and control water quality (Hossain and Sarker, 1995a). Major species of freshwater turtles control the growth of aquatic weeds and other floating vegetation, and maintain healthy aquatic environment for wildlife and fish (Philip *et al.*, 1998). Freshwater turtles perform a valuable ecological service as scavengers in the tanks, rivers and stagnant water and thus keep the aquatic ecosystems free from pollution (Rao and Singh 1987).

Scientists like Boulenger (1890), Chaudhury (1912), Shafi and Quddus (1987), Khan (1980, 1982 & 1987), Fugler (1984), Barua and Islam (1986), Gupta (1987), Rashid and Swingland (1997), Rao and Singh (1987 and 1990), Rashid (1991), Hossain and Sarker (1993 and 1995a,b), Sarker and Hossain (1997) and Hossain (2000) worked on some ecological aspects of freshwater turtles of Bangladesh. Whitaker and Andrews (1997), Vogt and Benitez (1997) and Rhodin (2001) worked on morphometry, ecology, breeding biology and trend of trade of the selected freshwater turtles in different countries.

The situation of Asian chelonians is put into risk by habitat destruction (Collins 1990). In consideration of low reproductive rate of most species they are decreased drastically from natural habitat (Sandra and Daniela 2000). The Government of Bangladesh has decided to protect turtle and formulated some

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rules to establish turtle nurseries and hatcheries. Some of the turtles may be bred and raised in farms and would be released in nature to replenish the population. Experience will demonstrate the feasibility of using captive breeding as a tool to assist turtle conservation. In the present work the morphometry of commercially important freshwater turtle, Indian roofed turtle, *Pangshura tecta* was studied to ascertain the growth ratio per year in relation to body weight.

MATERIAL AND METHODS

The study was carried out at Matlab Bazar turtle market, Matlab upazila; Kaliatoli Bazar and Koiar-pool turtle market of Haziganj upazila, Chandpur sadar turtle market under Chandpur district; Baidder Bazar, Sonargoan upazila; Bot-toli, Jamtoli and Ghudara ghat under Narayanganj district; Mirpur section 10 and Ghudaraghat No 1, Tipu sultan Road, Sham Bazar and Kamalapur turtle export centre and Uttara Sector No. 14 turtle export processing centre under Dhaka district; Patkeel Bazar, Kadambari beel of Madaripur district; Zitka, Sebalaya, Gopinathpur of Manikganj district; and Moheshkhali and Kutubdia of Cox's Bazar district. The study was carried out between January 1997 and December 2000.

Morphometric analysis: A total of 125 *P. tecta* ($\sigma = 25$ and $\text{♀} = 100$) were used for morphometric analysis. Curve carapace was measured from tip of nuchal shield to end of pygal and curve plastron width measured from middle of inframarginal shield left to right side. Straight plastron was measured from the tip of intergular to end of anal shield. The shell height was measured with taxonomic board in perpendicular way. For convenience of statistical analysis, the males and females were separated into weight groups for the study of frequency distribution. The relationship between the body weight and surface area of carapace and plastron was considered. The distribution of number and percentage of males and females were determined.

The length-weight relationship of turtle was determined by means of regression analysis using least square methods from the original data at confidence level 95%. The regression co-efficient and correlation co-efficient were applied by means of 't'-statistic at 1% to 5% level of probability. The estimated weight was plotted against the corresponding length, width and shell height to obtain a linear curve distribution. Growth rate of various morphometric characters in relation to body weight of turtles was determined using the standard methods. For biometric study turtles were dissected and measured them on the basis of three categories, i.e. hard parts (carapace and plastron), soft parts (forelimbs, hindlimbs, neck, liver, heart and digestive tract) and other

soft parts (blood, spleen and residue). Percentage of different organs in relation to body weight was also calculated by means of regression analysis.

Identification: The turtle is commonly known as 'Kori Kaitta'. The carapace is elevated, oval with a distinct vertebral keel that is spiked, especially on vertebra ' III '. First vertebral is as long as wide or longer than wide and vertebral II and III are variables. Vertebral ' IV ' is longer than wide and ' V ' is wider than long. Plastron is truncated anteriorly, notched posteriorly and snout is pointed. Carapace has brownish, red or orange stripe along the first three vertebral. Plastron is yellow or pink with 2 - 4 black markings on each plastral scute. Head is with reddish crescent shaped post- ocular markings, curving up from below the eyes to meet on the forehead. Neck with 32 longitudinal lines. Behind each eye or supercilium there is a kidney shaped purple color spot.

Sex determination: Male *P. tecta* was smaller in size compared to female, possessed a comparatively longer tail, with thick base. Male also possessed a white band on the top of the tail, while female possessed a yellow band.

Data analysis: The data were analyzed by relevant statistical methods. Regression analysis between two sexes was made to find out the relationship and difference in means of different parameters. The difference between sets of data for given parameters were subjected to analysis of variance (ANOVA). Computer package program Excel and SPSS (Version 10.00) were used for all the statistical analysis.

RESULTS AND DISCUSSION

The weight of males varied from 68 to 120 g (mean 92.6 ± 13.3 g) and females 175 to 985 g (mean 441.1 ± 185.4 g). The mean weight of females was 4.8 times higher than males on an average (Table 1). The surface area of carapace and plastron as well as the height of shell of males and females increased in relation to body weight. From the regression equation it is evident that the body weight and surface area of carapace and plastron of male *P. tecta* was strongly correlated ($y = 0.6215x + 36.757$, $R^2 = 0.9339$ and $y = 0.1107x + 29.518$, $R^2 = 0.8751$) and the regression lines were linearly fitted [Fig. 1a, b]. Whereas, the body weight and shell height was not so strong by correlated ($y = 0.0032x + 1.1829$, $R^2 = 0.4878$) and the regression line did not maintain linearity, which means the increase of body weight might not increase the shell height. The body weight and surface area of carapace and plastron of female *P. tecta* was strongly correlated ($y = 0.3266x + 107.28$, $R^2 = 0.9774$ and $y = 0.1912x + 50.211$, $R^2 = 0.9775$) and the regression lines were linearly fitted [Fig. 2a, b]. Whereas, the relationship between the body weight and shell height was not so strong by correlated ($y = 0.0032x + 6.106$, $R^2 = 0.8618$).

Table 1. Morphometric measurements of *P. tecta*

Parameters	Male (n = 25)		Female (n = 100)	
	Range	Mean \pm SD	Range	Mean \pm SD
Body Weight (BW) g	68 – 120	92.6 \pm 13.3	175 – 985	441.1 \pm 185.4
Curve Carapace Length (CCL) cm	8.4 – 10.1	8.9 \pm 0.5	12.4 – 22.2	16.2 \pm 2.2
Curve Carapace Width (CCW) cm	9.2 – 11.1	10.3 \pm 0.5	12.1 – 20.1	15.3 \pm 1.9
Straight Plastron Length (SPL) cm	6.9 – 8.3	7.6 \pm 0.4	10.3 – 19.0	14.0 \pm 2.0
Straight Plastron Width (S PW) cm	4.9 – 5.4	5.1 \pm 0.1	6.8 – 12.5	9.4 \pm 1.3
Straight Shell Height (SSH) cm	1.3 – 1.7	1.5 \pm 0.2	5.7 – 8.8	7.5 \pm 0.8
Surface area of carapace (cm ²)	78.2 – 112.1	92.3 \pm 9.7	152 – 446.2	251.3 \pm 64.8
Surface area of plastron (cm ²)	35.3 – 43.2	39.1 \pm 2.3	71.3 – 238.5	133. \pm 36.1

Data relating to the various body measurements of *P. tecta* and the significance of correlation coefficient has been examined with the help of ‘ t’-statistics (Table 2).

Table 2. The correlation co-efficient of body weight with length, width of carapace, plastron and shell height *P. tecta*

Parameters	Correlation coefficient (R)	“ t’- statistic” calculated value
BW : CL ♂	0.729	5.11**
BW : CL ♀	0.972	39.48**
BW : CW ♂	0.920	11.28**
BW : CW ♀	0.943	27.35**
BW : PL ♂	0.639	3.99**
BW : PL ♀	0.957	3.92**
BW : PW ♂	0.486	2.67**
CL : PL ♂	0.369	3.98**
CL : PL ♀	0.967	37.68**
BW : SH ♂	0.496	2.68**
BW : SH ♀	0.842	15.46**

Note: Body weight (BW), Carapace Length (CL), Carapace Width (CW), Plastron Length (PL), Plastron Width (PW), Shell Height (SH). **Significance at 1% level (p < 0.01).

The percentage of biometric parameters, i.e. length and width of carapace, plastron and the shell height were estimated by the mean values of males and females. The body weight of males *P. tecta* was 17.4% whereas females was 82.6 %. The length of carapace of males was 19.5% and females was 80.5%. Carapace width of males was 40.2% and females was 59.8%, plastron length of males was 35.3% and females was 64.7%. Plastron width of males was 35.3% and females 64.7% and the shell height of males was 17.7% and females 83.3%.

The reliability of the above equations would be seen to be high from the co-efficient of correlation (R) values in all the cases. The data pertaining to correlation co-efficient of body weight and carapace, plastron and the shell

height of both males and females in Table 2 furnish an idea that the characteristics are highly correlated and their values are significant.

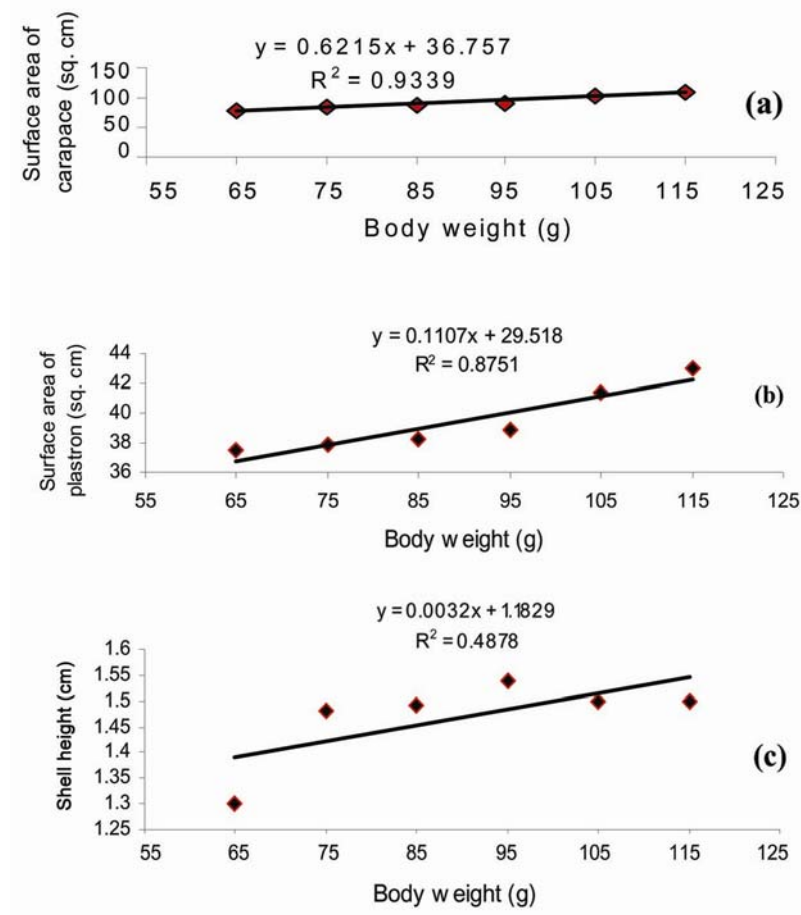


Fig. 1. Regression lines of male *P. tecta*: (a) Surface area of carapace on body weight (b) Surface area of plastron on body weight (c) Shell height on body weight

Biometric analysis of *P. tecta* showed that the weight of turtles varied from 565 to 700 g (mean 623.3 ± 36.5 g). The hard parts varied from 200 to 283 g (mean 223 ± 22.9 g and soft parts 365 to 450 g (mean 400 ± 24.9 g). The percentage of hard parts was $35.8 \pm 2.5\%$ and soft parts $64.2 \pm 2.5\%$ (Table 3). The relation between hard parts and soft parts was correlated and statistically significant ($R = 0.61$, $n = 12$, $t = 2.67$ and, $p < 0.05$). Of the hard parts, the carapace weight was (70.4%) it was always 2.4 times higher than weight of plastron (29.6 %), and the ratio was 7:3. Of the soft parts, the weight of digestive tract was the highest of all other soft parts of the turtles (Table 3).

Table 3. Biometric measurements (rate of growth of different body parts) of *P. tecta* in relation to body weight (n = 12)

Body weight of turtle (g)	Weight of different organs (g)											Percentage (%)		
	Carapace	Plastron	Fore limb	Hind limb	Lung	Liver	Heart	Stomach	Intestine	Others (residue)	Hard parts	Soft parts	Hard parts	Soft parts
700	180	70	58	80	14	22	6	25	99	145	35.7	64.3	35.7	64.3
590	153	60	50	65	12	20	6	20	74	130	36.1	63.9	36.1	63.9
610	154	62	52	68	14	20	7	23	78	132	35.4	64.6	35.4	64.6
565	140	60	45	60	12	18	7	20	78	125	35.4	64.6	35.4	64.6
640	160	73	55	68	14	21	8	25	84	132	36.4	63.6	36.4	63.6
610	145	67	58	65	11	20	7	22	85	130	34.5	65.5	34.5	65.5
650	205	78	50	60	10	20	6	21	80	120	43.5	56.5	43.5	56.5
600	142	65	52	60	11	21	7	26	88	128	34.5	65.5	34.5	65.5
610	140	65	54	63	12	19	7	28	92	130	33.6	66.4	33.6	66.4
605	145	60	50	65	12	21	7	28	82	135	33.9	66.1	33.9	66.1
620	155	65	47	63	11	20	6	30	88	135	35.5	64.5	35.5	64.5
680	168	68	58	75	12	22	7	33	95	142	34.7	65.3	34.7	65.3

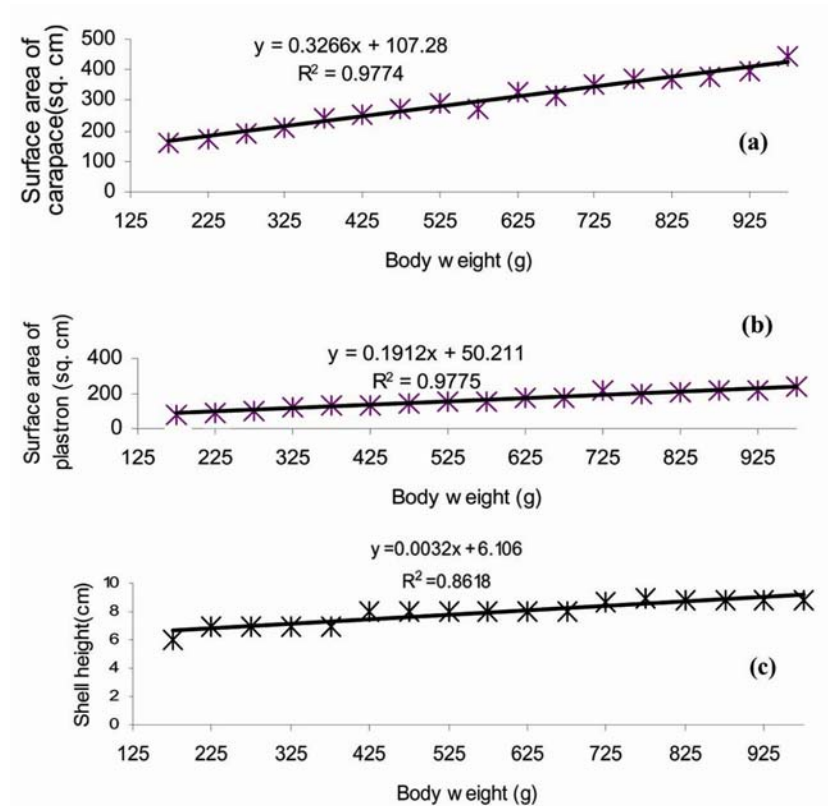


Fig. 2. Regression lines of female *P. tecta*: (a) Surface area of carapace on body weight (b) Surface area of plastron on body weight (c) Shell height on body weight

It was found that the maximum Curve Carapace Length (CCL) of male *P. tecta* was 10.1 cm and that of female 22.2 cm; Curve Carapace Weight (CCW) of male was 11.1 cm and that of female 20.1 cm; PL of male 8.3 cm and that of female 19 cm and the SH of male was 1.7 cm and that of female 8.8 cm. The maximum weight of male was 120 g and that of female 985 g. Smith (1931) and Das (1995) observed that the maximum carapace length of *P. tecta* was 23.0 cm where the sex and weight were not mentioned. Minton (1966) mentioned that the male was 17.0 cm and its SH 10.5 cm. Whereas, Moll (1987) stated that CL of large male was 6.6 cm, CW 5.4 cm, PL 6.1 cm, PW 4.1 cm and the SH was 3.7 cm, and BW 540 g ($n = 7$), the author also added that CL of adult female was 15.3 cm, CW 11.5 cm, PL 14.7 cm, SH 7.3 cm, and BW 510 g, other female had the CL 18.3 cm, CW 14.2 cm, PL 17.2 cm, SH 5.4 cm, and BW 960g. Frazier (1997) reported that CCL was 10.7 cm, SCL 9.3 cm, CW 12.1 cm, SH 4.6 cm and BW was 110g without mentioning the sex. Das (1991) concluded that the female *P. tecta* attained maturity at the length 23.0 cm, weight 600g. The present study

showed that the female attained maturity at the carapace length of 18.2 cm and body weight of 482 g. Shrestha (1997) mentioned that the turtle reaches about 230 mm in length. Minton (1966) mentioned from Pakistan, CL of female was between 16.4cm and 17.3 cm, CW 14.7 cm and 15.3 cm, PL 11.5 cm and 11.7 cm, SH 7.3 cm and 8.4 cm. when BW was 510 g, and the CL of male 6.6, CW 5.4, PL 6.3 cm, SH 3.7 cm and BW 54 g. These differences might have happened due to different habitat and study period and the abundance in the field.

The present study revealed that the females were 4.8 times larger than males. In addition, males differ from females by having a longer and thicker tail that opens beyond the carapace rim as was also reported by Moll (1987), Iverson (1992), Das (1995) and Rashid and Swingland, (1997). The female was significantly longer than male, similar observation was made by Shrestha (1997).

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