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RESEARCH ARTICLE

MORPHOMETRIC VARIATION OF DIFFERENT PARAMETERS OF SNAIL *Segmentina trocoidea, VECTOR OF Fasciolopsis buski,* IN DIFFERENT SEASONS IN A PERENNIAL AQUATIC BODY AT MOURIGRAM, HOWRAH, WEST BENGAL, INDIA.

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Abstract

In bioecology as well as evolutionary biology the morphometric measurement of shell of various gastropod snails is very interesting job in malacology.There are various methods in this aspect. Although there are various reports in morphometry in different Palmonate mollusca but in *Segmentina trocoidea* there is no report. As it is very tiny mollusks it is very difficult to study. It pays importance as it is a vector snail of *Fasciolopsis buski*. The shell diameter, shell height, total body weight and empty shell weight were measured to establish the relation between them. The seasonal variation also plays important role in morphometric variation. The final and total result of the population collected from Mourigram aquatic body shows that the average diameter of 16,445 snails in three year is 2.198787 ±0.64mm
, average height is 1.649135 ± .65mg and average total weight is 2.454201 ± .05mg and the dry weight of empty shell is 0.695371 ±.067mg. The winter size group shows maximum diameter, maximum weight and maximum shell weight where as the summer size is medium and the rainy season size group is the minimum.

INTRODUCTION

Oriental zoogeographical realm is very rich in aquatic malacofauna.Their participation in the way of life of many organisms has made them significant in the ecological communities. Total numbers of species inhabiting the freshwater ecosystem are few as compared to marine ecosystem and our knowledge of this group is rather limited (Subba Rao 1989). Among Indian Planorbid Molluscan population of Pulmonate Gastropoda, very little is known regarding their importance as a food source and as vector. Among them *Indoplanorbis* and *Gyrulas* are mentioned as registered host for some digenian worm parasite such as *Fasciola hepatica*, *F. gigantica, F. buski* and various *Schistosoma* (Raut 1986) causing various gastro intestinal diseases of man and his domestic animals. *Segmentina* Fleming, 1817, is an important Planorbid freshwater Gastropoda which is distributed worldwide. In India *Segmentina* is represented by three species, viz. *Segmentina (Polypylis) calathus, S. (P.) tita and S. (P.) trochoidea*

(Benson 1836) was first recorded in 1836 at Barrakpur near Kolkata as *Planorbid trochoidea* by Benson (1831). Regarding taxonomic status of *Segmentina trochoidea* many workers (Kennard and Woodward 1926, Baker 1945, Benthem and Jutting 1956) differs their opinion.The anatomy of *Segmentina* is not known (Subba Rao 1989). Except for some taxonomic records (Fowell 1972, Pace 1973, Brandt 1974, Milosevic 1975, Hazelwood 1979, Izzatullaeh 1980, Subba Rao et al. 1980, Beriozkina and Starobogatov 1988, Stadnichenka 1990, Bech 1992) there is hardly any information on life-cycle and bio ecology of Segmentina (Yacine 1979, Gilman 1982, Bewriozkina and Starobogatov 1988). Few workers reported that *Segmentina* acts as intermediate host of various digenian parasites (Zhaltzahova 1975, Odening 1978, Gilman et al.1982, Alam et al. 1992, Kitaguchi 1992). *Segmentina (P.) trocoidea* was reported to be intermediate host of *Fasciolopsis buski* by Mehra, 1980 (in Subba Rao 1989) in Assam. Gilman et al. (1982) reported this as to be one of the intermediate host of *F. buski* in Bangladesh and it is subsequently supported by Alam et al. (1992) In the present paper there Is a very important and primary attempted to find out the morphometric variation of different physical grow parameters in different season in a perennial water body in Mourigram, Howrah, West Bengal. There are many methods to study the morphometry of Phylum mollusks. But Geometric morphometrics provides a complementary method for studying morphology. There is no or little information of the vector snail in the total world. Only few taxonomic accout and parasitic information are available (Prashad,1922, Ruth Clark , 2011, Ratnaponglakha et al 1988, Gołdyn etal 2008, Pat Hill 2004, Manning et al 1969, *Rojanapremsuk* 1970, IUCN. 2010. Budha, P.B. 2010, Devi Pallabi 2006, Albrecht 2007, David 1992, Thakur,1992). As shells serve to record information about their life histories and environmental habitats Snails have been analyzed in the field of morphometrics since the 1960s. In this study, I present a primary idea using applications to snail shells regarding common morphometry. We categorize many publications into four fields, morphology, ecology, taxonomy and evolution, and show that developments have been unequal among them. We describe the morphometry of the snail *S. trocoidea* mainly in the respect of height, weight and diameter and find out their correlation. Many other factors yet to be studied as there are but as the specimen are too small to study it need special effort. As there is no primary information in this field, this is only primary data of this species.

MATERIALS AND METHOD

A very good number of snail *Segmentina trocoidea* were collected from local pond of Mourigram, Howrah, West Bengal. The pond is actually a perennial jheel of Indian railway. This is also connected with branches of river Ganga. Snails were at first collected by standard method. At first aquatic vegetation, mainly water hyacinth, *Pistia, Ipomea, Charra, Lemna* and other aquatic macrophyte, were collected from different corner and different location by using small boat and hand net. They were carried in the laboratory immediately in a large plastic bag. The sampling was performed in every 15 day interval. So in 3 years a total 48 sampling were taken having 20 sampling site in each case. Time of sampling were performed within 10AM to 1PM. In the laboratory the macrophyte were washed in a large plastic tub having 50 l capacity. In each case special care were taken to remove the snail from the plant part. If mud were present that part was remove carefully by decantation and by using suitable sieve. However all the snail were removed from plant by constant shacking and jerking for 30 to 50 seconds. Special care was taken to remove the snail from the base of the petiole of the *Eichornia or Pistea*. Most of the adult and medium sized snail takes rest on that particular site especially at day time. After removal of all plant parts large snails such as *Pila, Endiplanorbis, Lymnaea and Bellamya,* most small mollusks are kept in the plastic tub. Finally among the snail species *Segmentina and Gyrulus* are taken for separation. However a special technique was followed to separate the above two species. In a tub having two speciesof mollusca, and 5 to 7 liter water was poured and start rotate immediately. When we stop hand rotation we observed two different behaviors of two different species. S *trocoidea* start to crawl on the bottom where as *Gyrulus* start to float on the surface water. Immediately we decant the surface water by using sieve to collect the above *Gyrulus* species. In that time *Segmentina* were found to crawl on the floor of the plastic tub. By using 0 camel hair brushes one by one the snails were collected and released in glass aquaria - cultured container. After separating the *Segmentina* genus by careful observation we remove the other species of *Sementina* other than *S.trocoidea.* It needs a special attention and a lot of experience. Generally we remove *S. calatha and S. taita.* If there is any confusion (as they are very tiny young specimen) they were observed under stereoscopic microscope.

The snails were kept in the glass aquaria. For the morphometric study the snail were grouped in five classes by eye estimation. The snails were sieved with plastic common sieve and placed on a blotting paper. The water was socked carefully before weight .The weight was taken first and that job must be finished within 10 minute. After taking weight the diameter were taken with very fine venire and slide caliper. With the same instrument the width were also measured. To avoid error, total measurement of the total experiment was performed by using the same set of instrument. After taking the total body weight the specimen were kept in aquarium and 20ppm copper sulphate were added to kill the specimen within 2 days. After death, the specimen was allowed to decompose in the aquarium

naturally. Then by keeping the dead and decomposed snail, after 10 days, under the running tap water for 45 minute the decomposed mass were removed automatically. Then the empty shells were collected and sun dried for 2 days. We should confirm that there was no water in the empty shell. The empty shells were kept in a clean glass beaker for future measurement of empty shell.

The total study were continued for last three year i.e., from November 2009 to October 2012. The data were collected two times in every month. After collection of data, suitable statistical analysis was performed. The physic- chemical parameters of the water of the studied area were performed in every 15 days by following standard protocol. The heavy metals were analyzed in the AAS.

RESULTS:

The morphometric study of the snail was performed, based on four parameters. They were dry shell weight, weight snail weight, shell diameter and empty shell height. These four parameter shows a distinct variation. A total of 16, 445 specimens were measured in three years. In first year, 2nd year and 3rd year the sample size were 5832, 3292 and 7321 respectively. The total study result were grouped in three season and they are winter (Nov - Feb -2009 – 2013), Summer (March to June) and Rainy (July to October).

The detail result of the morphometric study about diameter, weight and shell weight and height during three years are presented in table 1. This study of Measurement of shell parameters of specimen collected from Mourigram were presented in 3 different season The result of the annual average physio chemical parameters of the studied water were presented in table 2.

In Fig 2, correlation between shell height and shell weight of snail *S. trocoidea*, collected from Mourigram. In the Fig 3 shows the correlation between height and weight of empty shell of snail *S. trocoidea*, collected from field of Mourigram jheel. Fig 4 presents corelation between diameter and weight of empty shell of snail *S. trocoidea* collected from field of Mourigram jheel.

Season(month)	Diameter(mm)				Height(mm)				Weight whole (mm)				Weight dry shell(mm)			
	No	Range	Average	SE	No	Range	Average	SE	No	Range	Average	SE	No	Range	Average	SE
Nov-Feb (2009-20012	5832	0.8-5	2.580	.05	5832	.39-3.9	1.78	.09	5832	.1-11.7	2.89	.08	5832	.05-4.9	.96	.06
March-June (2011-2013)	3292	0.4-4	2.01	.06	3292	.33-3.02	1.66	.06	3292	.1-6.9	2.67	.04	3292	.05-4.8	.75	.05
July-Oct (2011-2013)	7321	0.5-4.5	1.98	.09	7321	.33-4.5	1.54	.03	7321	.1-8.9	2.01	.045	7321	.01-5.8	.46	.013

Table 1: Morphometric study of diameter, weight and shell weight and height of snail *Segmentina trocoidea* during three different seasons in three years.

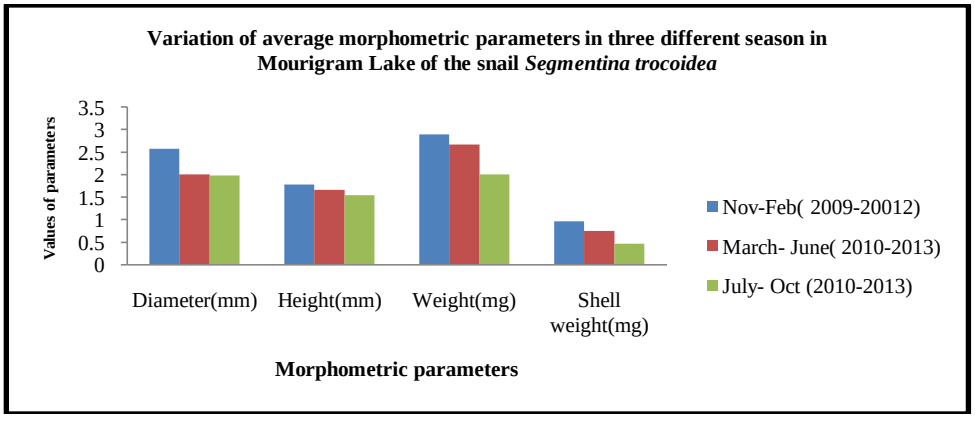


Figure 1: **Variation of average morphometric parameters of the snail *Segmentina trocoidea* in three different seasons at Mourigram Lake .**

WATER PARAMETERS	RANGE 2010	MEAN 2010	RANGE 2011	MEAN 2011	RANGE 2012	MEAN 2012
COLOUR TCU	79.00 – 171.60	134 ±12.22	65-187	138±12.22	76-156	146 ±18.22
TEMPERATURE ^{0}C	25.6 – 27.50	25.40±1.221	21-29	27.40 ± 1.921	24-28.9	29.40 ± 2.221
PH	6.1 – 7.4	6.6 ±064	6.2-8.9	6.6 ±164	6,8-7.9	6.9 ±069
SALINITY %	7.36 –9.40	8.50 ± 1.51	8.78-10.6	9.850 ± 2.51	7.86-9.35	8.90 ± 1.79
DISSOLVED OXYGEN (PPM)	6.96 – 7.21	6.7 ± 0.42	7.5-9.9	7.7 ± 0.30	7.9-10.0	8.7 ± 0.66
SETTLEABLE SOLIDS	0.39 – 1.52	0.62 ± 0.15	.55-1,89	0802 ± 0.44	.43-2.77	0.92 ± 0.54
TOTAL HARDNESS AS CaCO3 (PPM)	72.25 –110.60	92.56 ± 3.90	60-121	99.56 ± 4.670	51-126	112.56 ± 7.90
BIOLOGICAL OXYGEN DEMAND (BOD) (PPM)	18.65 – 29.22	23.98 + 3.48	22-34	27.98 + 3.72	17-32	23.878 + 3.74
CHLORIDE (PPM)	6.60 – 9.2	8.42 ±1.321	6.78-10.9	9.42 ±17321	7.78-11.9	11.42 ±1.321
SULPHATE (PPM)	0.00 – 1.20	0.06 ± 0.044	.00-.98	0.04 ± 0.066	.00-.09	0.03 ± 0.034
NITRATE (PPM)	2.85 – 4.96	4.05 ± 0.47	1.8-5.7	3.05 ± 0.37	2.9-6.6	5.05 ± 0.34
PHOSPHATE (PPM)	0.02 – 0.68	0.24 ± 0.19	.02-.78	0.14 ± 0.09	.06-.98	0.74 ± 0.39

Table 2: Annual average physico chemical parameters of the studied water at Mourigram jheel, West Bengal, India

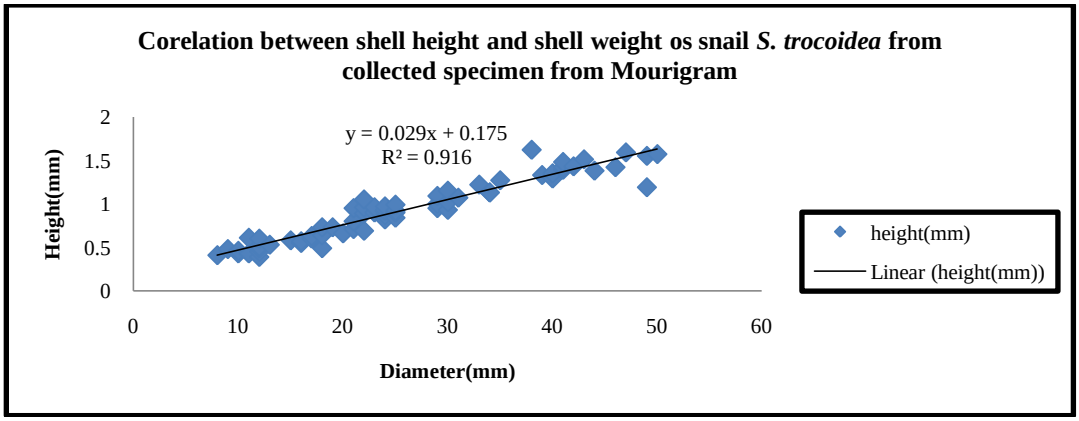
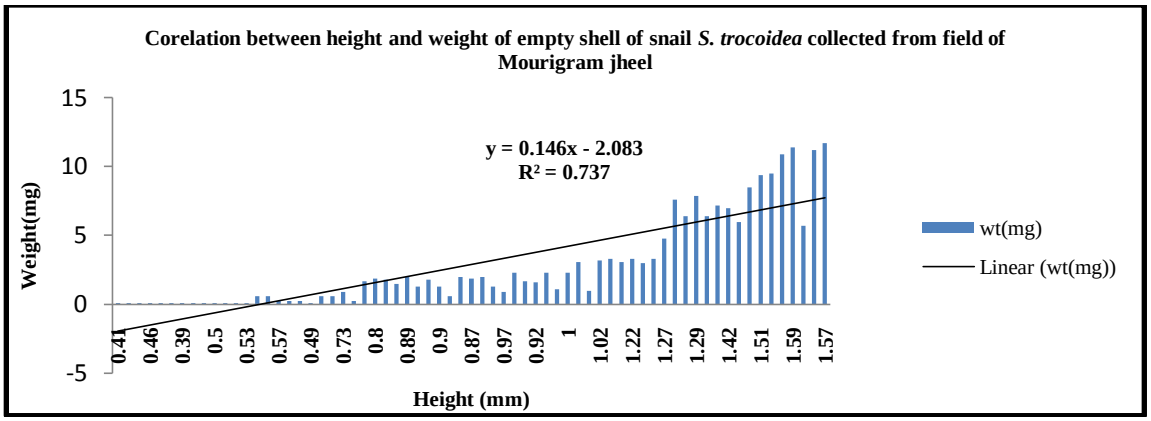


Fig 2: **Correlation between shell height and shell weight of snail *S. trocoidea,* collected from Mourigram .**



The Fig 3: – shows the **Correlation between height and weight of empty shell of snail *S. trocoidea* collected from field of Mourigram jheel**

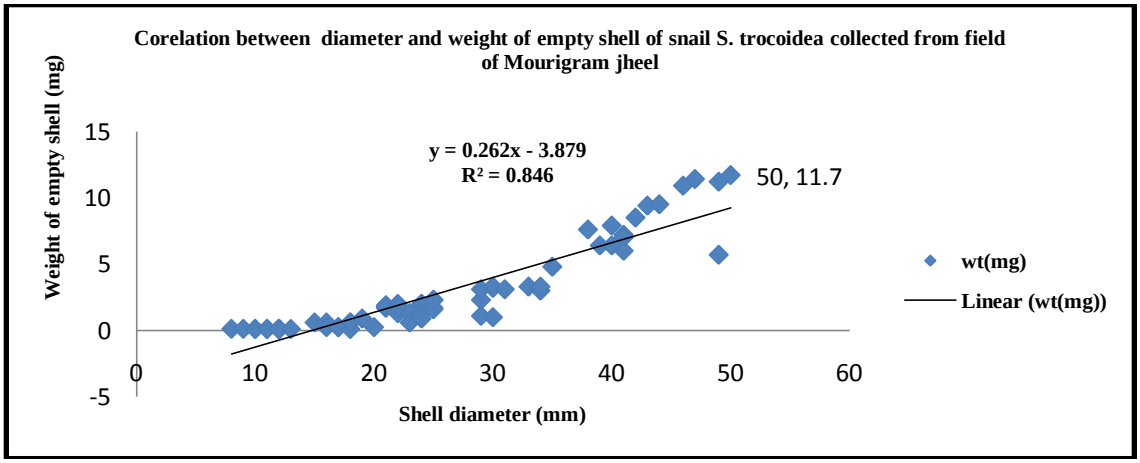


Fig 4:- Corelation between diameter and weight of empty shell of snail *S. trocoidea,* collected from field of Mourigram jheel

DISCUSSION:

The morphometric measurement of shell of various gastropod snail is very interesting job in malacology as well as evolutionary biology. There are various method in this aspect to find out the morphometry. To get biological information of gastropoda shell various sophisticated tools also available in the market.

From ninetieth century various methods are introduced which are based on simple linear measurements, such as shell length and shell width. These were standard practice in the field of malacology. All theoretical biologist (Raup 1966) gave the various modeling approach to compare the huge diversity of various group of Gastropod as well as pulmonata. Analysis of gastropod shell morphology with principal components (Jason and Sundber, 1983), discriminate functions (Dillon, 1984a, Dillon, 1984b), and factor analysis (Gould et al, 1974) were performed to solve various evolutionary problems. These were done by simple multivariate analysis. But recent development of various digitized technique the study of morphometrics was revolutionized since 1090(Rohlf 1993). These technique were applied to snail, *Epitonium*,(Johnston et al 1991) and in the field of evolutionary biology (Wagner ,1995., 1996).

But the primary motivation for recent study is to get some primary data and few primary information of the medically important snail species which were well established as a very good intermediate host of the *Fasciola hepatica* and others.

Regardless of methodological detail, however, the primary motivation for most of the studies cited above has been to use phenotypic variance in shell morphology as an estimate of genetic relationships among sets of natural gastropod populations. At least two challenges have long been apparent. One obvious hurdle is that gastropod populations sampled from the wild are typically composed of mixed-age individuals demonstrating indeterminate growth. Thus some large fraction of the total variance in shell phenotype manifest by most natural populations is not expected to be heritable, but simply to arise as a function of the mixture of ages in the sample. For this reason, malacologists of the 1970s and 1980s were attracted to principal component analysis. The next problem is the ecophenotypic changing behaviour. In many gastropod populations, some significant fraction of the variance in shell morphology is not heritable, but rather seems response to the local environment.

But the shell morphology of pre-hatching juveniles does not differ between sheltered and exposed populations, and heritability estimates from the analysis of sibling groups suggest that a large fraction of the variance in shell morphology observed in adults is a plastic response to wave action. The variation of bioecology in freshwater gastropod populations is especially very high. It is very distinct in shell morphology in the pulmonate snail *Lymnaea* (Lam and Calow 1988). Morphology was affected by nature of water chemistry (Rundle et al.2004). Another very important factor which certainly can influence the morphometry is the presence and absence of predator of various species and age and size (Bronmark et al.2011). This prey relationship also documented in the species of a pulmonate planorbid *Helisoma* (Hoverma 2009) and in *Prosobranch* (Krist 2002).

In recent years researchers has been interested to pulmonate snails of the genus *Physa (*Dillon ,Wethington 1995, Wethington, Dillon 1996, and Dillon, Wethington , Lydeard 2011). But there is not a single report about the snail *Segmentina trocoidea.* This situation is not in morphometry but from ecology to distribution this species is neglected.

Regarding the height of the snail *S. trocoidea* in different season indicate that in winter group the average value ranges from 0.39mm - 3.9mm and average is 1.78 ±.9mm. But the winter group shows that the average height is 1.66± .6mm (range 0.33-3.02mm) and the rainy season group shows that average height of snail is 1.54mm (0.33-4.5mm±.0). The result shows that the diameter and the height of the snail shell is well correlated. In diameter and height the summer size group is maximum and the rainy season group is minimum.

When weight of the living snail was considered the summer and winter size group shows more or less similar average that is 2.89mg and 2.67mg where as the rainy season group shows very less weight. The average weight of the rainy season was 2.01mg. It is far lower then the winter as well as the summer group. The cause of the actual loss of weight were interpreted when the weight of the empty shell were considered. In case of empty shell the winter, summer and rainy season group were 0.96mg, 0.75mg and 0.41mg. So in rainy season group the average shell weight of the snail *Segmentina trocoidea* is more or less half of the winter group. In one word it is very distinct that in the winter the average diameter, height and empty shell weight is maximum and in rainy season it was minimum.

The final and total result of the population, collected from Mourigram aquatic body, shows that the average diameter of 16,445 snail in three year is 2.198787 ±0.64mm, average height is 1.649135 ± 0.65mg and average weight weight is 2.454201 ± 0.05mg and the dry weight of empty shell is 0.695371 ±.067mg.

The winter snail group average diameter were 2.580 mm(0.8-5 and SE ±0.5) where as at summer the diameter were 2.01mm(0.4-4 SE±0.6) and at rainy season the average diameter were 1.98mm (0.5-4.5 SE ± 0.9). It indicates that winter size group of the snail *Segmentina trocoidea* is the largest and the medium group were found in summer and the lowest size group were available in rainy season. It indicates that in the rainy season, size group were very tiny or in other word the young and immature.

When shell of the above snail were collected from Mourigram wetland near the Railway station from different season we found that the various parameters of the empty shell. The final and total result of the population collected from Mourigram aquatic body shows that the average diameter of 16, 445 snail in three year is 2.198787 ±0.64mm , average height is 1.649135 ± .65mg and average total body weight is 2.454201 ± .05mg and the dry weight of empty shell is 0.695371 ±.067mg.

The correlation value between shell diameter and shell height is $R^2 = 0.916$ and regression equation is $y = 0.029x + 0.175$.It indicates that the diameter of the shell and the height of the shell were very much positively correlated.

When shell of the above snail were collected from Mourigram wetland near the Railway station from different season we found that the various parameters of the empty shell. The correlation value between shell diameter and shell height is $R^2 = 0.916$ and regression equation is $y = 0.029x + 0.175$.It indicates that the diameter of the shell and the height of the

shell were very much positively correlated. This species is very much important regarding health of human and other organism. But there is no report about the species. This preliminary study says that the morphometry of the snail diameter and height and shell weight is directly correlated with seasonal fluctuation of various physicochemical parameters of the aquatic environment. It need more and extensive research.

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