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Research Article

COMPARATIVE STUDY OF MORPHOMETRIC TRAITS OF TWO FRESHWATER SNAILS LYMNAEA ACUMINATA AND BELLAMYA DISSIMILIS

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ABSTRACT

Four hundred snails (400), two hundred (200) each of *Lymnaea acuminata* and *Bellamya dissimilis* with weight ranging from (0.40gm to 1.15 gm and 0.81gm to 4.23gm)respectively. Data was collected to evaluate phenotypic correlation and multiple regression equation analysis. The snails *Lymnaea acuminata* and *Bellamya dissimilis* shell width, aperture length, aperture width and total body weight were the parameters predict the animal shell length. The mean recorded animal shell length(ASL), animal shell width(ASW), aperture length(APL), aperture width(APW), and total body weight (TBW)was (2.108±0.29096cm, 2.82±0.50812cm, 1.285± 0.17700cm, 0.6895 ±0.14049cm, 0.53675± 0.19704cm and 3.157±0.36868, 4.721±2.9761, 1.225±0.15619, 1.00935±0.70899, 2.03935±0.64611) for *Lymnaea acuminata* and *Bellamya dissimilis*. The result showed correlation among morphmetric traits which indicated highly positive significant at (P<0.01%) for *Lymnaea acuminata* and for *Bellamya dissimilis* some parameters are highly significant and some are negatively significant (P<0.01%). All morphmetric parameters were best predicted animal shell length of *Lymnaea acuminata* and *Bellamya dissimilis* [r^2=68.5%, r^2=62.8%] respectively.

INTRODUCTION

The molluscan are soft body and unregimented animal. Having an anterior head ventral foot and dorsal visceral mass. Snails are symmetrical and their body lies within spirally coiled univalve shell. The phylum Mollusca is one of the great groups of the animal kingdom occurring in various habitats and is divided into freshwater, marine and terrestrial forms. The freshwater Pulmonate snail, *Lymnaea acuminata* (Lamarck) belongs to family Lymneidae that prefers either permanent or temporary water bodies with abundant vegetation. These animals are with dextral as well as sinisterly shell patterns with tapering tentacles, tubular pneumostome and separate gonophores' at the base of the right tentacle. Snails are hermaphrodite and breed almost throughout the year and lay down eggs on the submerged surface of aquatic plants Pande G S, (2008), Kumar N. *et al* (2016) [3,4]. The detail morphological of shell gives insight about their actual body growth Roth VL and Mercer JM. (2000) [6]. In snail Lymnaea both dextral and sinisterly forms are found in nature, with sinisterly individuals representing up to 2% of the population Wandelt J. *et al* (2004)[7]. Lam P and Calow P, (1988)[8]. Documented the direct current or flow of water has potential to change the shell morphology in the Pulmonate snail *Lymnaea*. Shells of Mollusk have been widely studied because of the possibility of describing the shell coiling with geometrical functions Stone JR, (1996) [9].

In this phylum, Gastropoda is a big class. In the whole world so far nearly 65,000 gastropod species have been described. The class Gastropoda comprises of three sub-classes; Prosobranchia, Opisthobranchia and Pulmonata. The snail, *B. bengalensis, B. dissimilis* is the largest freshwater prosbranch animal (Fretter and Graham, 1962). It is included under family Viviparidae which has a worldwide distribution. The freshwater mollusks play a significant role in aquatic ecosystem. Species like *Bellamya bengalensis, B. dissimilis, Pila virens* and *Lamellidens marginalis* are proven food for many aquatic animals and man. His analysis was done of the shell shape of Viviparous Georgians species it was revealed that the intraspecific difference was possibly caused due to the environmental factors, Katoh M and DW Foltz.(1994), Sangeeta madan S S(2015) [16-10]. Shell structure is taxonomic information that can be used to interpret evolutionary history, and relationship between molluscans species Yuh-Wen C. *et al* (2002) [12]. The shells of viviparous species show difference between the shapes, its sizes, their banded shells and its embryonic shells Smith DG. (2000)[13]. Shells are very useful

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as calcium salt in animal formulated feeds, making ornaments, ashtrays, scouring powder and ceramic materials Amusan JA and Omidiji MO (1990)[14] . Shells are described with reference to a geometrical model, which is completely determined by model parameters. Morphmetric studies were observed. Body measurements were used to see the shell growth pattern in every month. Morphmetric, the quantitative study of variation of shell shapes and their co-variation with other variables Rohlf FJ and DE Slice (1999) [15].

Shell morphology in gastropods might is amenable readily to geometric analysis. Shell morphology involves growth from the beginning of postembryonic life, provides ontogenetic information, and is correlated with behaviors and habitats, for example, shells that have low spires are more stable in areas of heavy wave environments Brusca and Brusca, (2003)[1]. There are limited numbers of reports on the correlation among morphmetric traits as well as prediction of live body weights from morphmetric traits of these two \ most popular breeds of snails in Nigeria.

This study was therefore undertaken to obtain correlation coefficients of morphmetric traits and in predicting animal shell length as morphmetric trait of two breeds of freshwater snails *Lymnaea acuminata and Bellamya dissimilis.*

MATERIAL AND METHOD

200 hundred *Lymnaea acuminata* were collected from the artificial pond located in botanical garden of university campus Aurangabad(19° 54'9.58 N and 75° 18.42E) and *Bellamya dissimilis* were collected from Godavari river near Kaygon bridge, Aurangabad(19˚37'57.44" N and 75˚14'30.41"E). Sample was done in four month (June to Sept) in monsoon season, preferably in morning time 8am to 10am.The sample were collected in plastic jar by hand picking using to dip net and hand gloves. After collecting the animal, they were brought to the laboratory, cleaned with water and maintained in the plastic trough with aerator. They were fed with algae and mulberry leaves, snails were selected on the basis of their active appearance with no injury on the foot and had weight ranging from (0.40gm to 1.15 gm and 0.81gm to 4.23gm) for *Lymnaea acuminata* and *Bellamya dissimilis* respectively. Measurement data were collected animal shell length (ASL), animal shell width (ASW), aperture length (APL), aperture width (APW) and total body weight (TBW). Electric weight balance used to measure weight and while threat and cm scale used to measure the length and width. Calculation was done in Minitab 14software and Excel 2007.

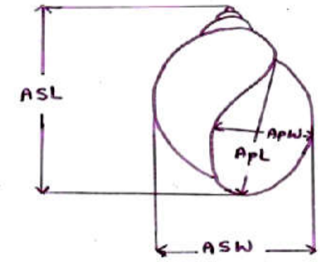
a

b

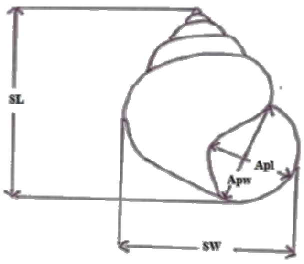
Fig 1 Gastropod Sample collection sites (A) Botanical garden and (B) Jayakwadi Dam

C *Lymnaea acuminate*

D *Bellamya dissimilis*



C



D

Fig 2 The figures are showing the measurement of some of the body parameters of snails (C) *Lymnaea acuminata* and (D) *Bellamya dissimilis*.

Abbreviation: (ASL=animal shell length, ASW=animal shell width, APL=aperture length, APW=aperture width.)

RESULT AND DISCUSSION

The results of the description of snail *Lymnaea* and *Bellamya* are presented in table (1)

Table 1 Mean Standard deviation (SD) of quantitative traits in *Lymnaea acuminata* and *Bellamya dissimilis* snails.

parameters	MEAN ± SD	
	***Lymnaea acuminata*(n=200)**	***Bellamya dissimilis*(n=200)**
ASL	2.108 ± 0.2909	3.157 ± 0.3686
ASW	2.82 ± 0.5081	4.721 ± 2.9761
APL	1.285 ± 0.1770	1.225 ± 0.1561
APW	0.689 ± 0.1404	1.009 ± 0.7089
TBW	0.5367 ± 0.1970	2.039 ± 0.6461

The result was expressed as mean and standard deviation. Mean animal shell length of *Lymnaea acuminata* was 2.108±0.2909, mean animal width was2.82±0.508, and similarly the mean aperture length was 1.285±0.177 and mean aperture width was 0.689±0.1404 and also mean total body weight was0.536±0.197. The mean animal shell length of *Bellamya dissimilis* was 3.157±0.368, mean animal shell width was 4.72±2.976 and similarly the mean aperture length was 1.225±0.1561, and also aperture width was 1.009±0.708 and total body weight was 2.039±0.646. The mean of all parameters of *Bellamya dissimilis* was recorded greater than *Lymnaea acuminata* in case of aperture length of *L. acuminata* shows slightly greater *B. dissimilis* i.e.1.255±0.177 and 1.225±0.156 respectively.

Table 2 Phenotypic coefficient of correlations (r_p) of quantitative traits of *Lymnaea acuminata* and *Bellamya dissimilis*

Lymnaea acuminata

Parameters	ASL	ASW	APL	APW	TBW
ASL	1	0.82144**	0.53702**	0.3978**	0.5721**
ASW		1	0.6855**	0.5667**	0.7079**
APL			1	0.6766**	0.6897**
APW				1	0.7958**
TBW					1

Bellamya dissimilis

Parameters	ASL	ASW	APL	APW	TBW
ASL	1	0.0964 NS	0.6199**	0.11537NS	0.7790**
ASW		1	0.09896 NS	0.01314 NS	0.13410 NS
APL			1	0.11809 NS	0.6569**
APW				1	0.1680*
TBW					1

Abbreviation: ASL=animal shell length, ASW=animal shell width, APL=aperture length, APW=aperture width, TBW=total body weight (NS= non-significant,(p>0.005), ** =highly significant (p>0.001),*=significant(p>0.001).

Table 3 Prediction for regression equation in *Lymnaea acuminata* and *Bellamya dissimilis* snails

Breeds	Multiple regression equations	R^2 %
Lymnaea acuminata	ASL=0.908+0.480ASW-0.006APL-0.338APW+0.165TBW	68.5%
Bellamya dissimilis	ASL=1.85-0.00129ASW+0.450APL-0.0091APW+0.375TBW	62.8%

Table (2) Showed the result of phenotypic correlation among the quantitative traits of the two breeds it indicates positive and highly significant at 1%level (P<0.01) correlation coefficient between ASL and all other parameters studied for *Lymnaea acuminata*.

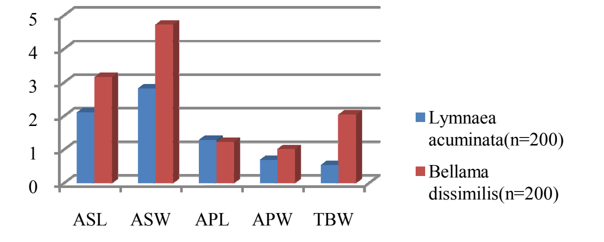
Whereas for *Bellamya dissimilis* there was positive and highly significant at 1%level (P<0.01) correlation coefficient and between of r=0.6199 obtain between ASL and APL and r=0.7790 obtain between ASL and TBW. And that of correlation coefficient of r=0.6569 obtain between APL and TBW was positive and highly significant.

The highest but positive correlation coefficient of r=0.1680 obtain between APW and TBW for *Bellamya dissimilis*. There was no significant (P>0.01) phenotypic correlation coefficient between ASL and ASW (r=0.0964) and between ASL and APW (r=0.11537) between ASW and APL (r=0.0989), between ASW and APW (0.01314), between ASW and TBW(r=0.13410) and between APL and APW(r=0.11809) for *Bellamya dissimilis*. The non-significant (P>0.05) phenotypic correlation denoted that these pairs of traits have no direct relationships. Positive and high significant correlation was obtain between the parameters such as ASL-ASW(r=0.821), ASL-APL(r=0.537), ASL-APW(r=0.397), ASL-TBW(r=0.572), ASW-APL(r=0.685),ASW-APW (r=0.566), ASW-TBW(r=0.707), APL-APW(r=0.676), APL-TBW(r=0.689), APW–TBW (r=0.795) was recorded by *Lymnaea acuminata* snails in this study .The prediction Equation performed for animal shell length of growing snails using morphometric traits from freshwater snails *Lymnaea acuminata* and *Bellamya dissimilis* (Table.3). The multiple regression equation indicated that these morphometric traits, i.e. animal shell width, aperture length, aperture width and total live weight best predicted animal shell length for *Lymnaea acuminata* (68.5%) and Bellamya dissimilis(62.8%) respectively. Olawoyin and Ogogo (2006)[17] also reported shell length as a better predictor of body weight for snails. Paul et.al in (1994)[18] showed accurate prediction for morphometric traits i.e. width, length, foot weight and total weight of *H .iris.* They conclude the morphometric variation parameters to encourage the development of strategies by the shell width rather than shell length. Similarly studies were undertaken for *Laevicaulis alte* from Odisha Das and Parida (2015)[22], they recorded (at 1 %level) significant positive correlation between shell length and total live weight (0.943**), length (0.898**) and live weight (0.823**), and was obtained linear regression equation considering three sets of morphometric variables i.e., animal shell length and circumference, total body weight and circumference, animal shell length and total body weight, ($Y= 0.607x + 0.017$, $R^2 = 0.806$), ($Y= 0.536x + 1.671$, $R^2 = 0.678$) and ($Y= 0.998x – 2.307$, $R^2 = 0.888$)) respectively. Statistically significant at 5% ($p>0.05$). Tokeshi *et. al* (2000) [21]. investigated the interspecific relationship between total weight and shell weight by plotting the mean shell weight and mean total weight of 10 largest individuals of each species ($y=-0.0597 + 1.009x$, $r^2= 0.997$.), in their study they found all three possible relationships between the proportion of shell mass and body size, i.e. positive, negative and none, were recognized among molluscan species inhabiting the same shore environment, they conclude that in some species the proportion of shell mass increased with body size, while in others it either decreased or showed no change with size.

Gastropods species *B. dissimilis* are known to be ecological indicators of eco toxicology in an aquatic environment Lam PKS, *et al* (1997) [19] from the evolutionary point of view, the shells have much more taxonomic data which is useful for interpreting the evolutionary data or the relationships among the species Yuh-Wen C, *et al* (2002) [20].

In most of the parameters it showed high and positive correlation at (0.01%) level, the values (r=0.844), (r=0.806), (r=0.808) between shell length and total body weight and this was from three sites Nagavara lake, Hebbal lake, Ranchenalli lake, Bangalore respectively. But in the present study the correlations between shell length and total body weight (r=0.779) was highly significant at (0.01%) level. The results of Correlation between shell length and aperture length (r=0.619) of the present study were somewhat relevant with the results of Ramakrishna S, *et al* (2014)[23] i.e. correlations between shell length and aperture length (r=0.677), (r=0.616), (r=0.831) from Nagavara lake, Hebbal lake, Ranchenalli lake, Bangalore respectively. This result shows Aluko FA, *et al.* (2014)[24] highly and positively significant correlation at 1% level ($p<0.01\%$). In the study of shows that the mean snail length was 2.108 ± 0.2909 and 3.157 ± 0.3686 *Lymnaea acuminata and Bellamya dissimilis* respectively.

fig.3 .Mean Standard deviation (SD) of quantitative traits in *Lymnaea acuminata* and *Bellamya dissimilis* snails.



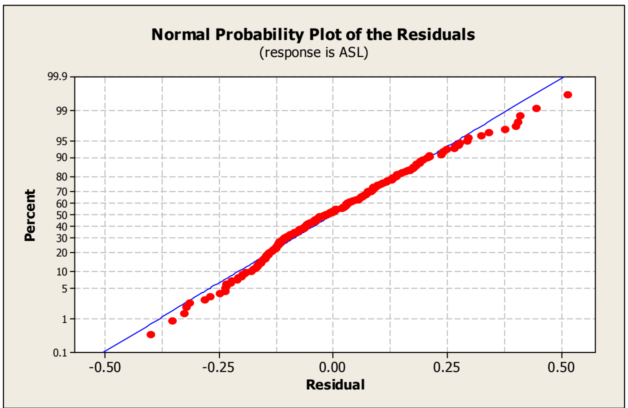


Fig 4 Normal probability plot of the residual for animal shell length in *Lymnaea acuminata* snail.

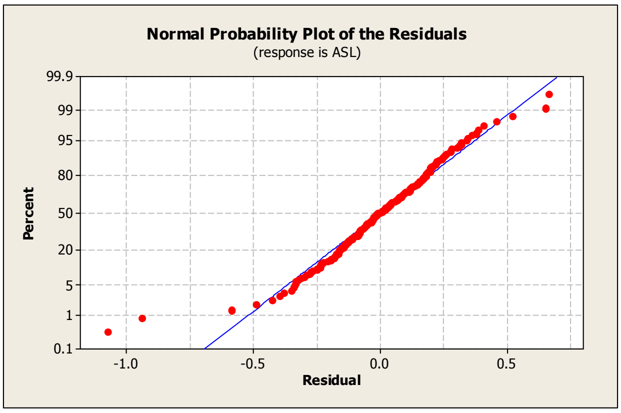


Fig 5 Normal probability plot of the residual for animal shell length in *Bellamya dissimilis* snail.

The graph (fig 2 and 3) indicates that the error terms are approximately normal, thus our assumption of normality is valid both the snails *Lymnaea acuminata* and *Bellamya dissimilis.* In observation we find that all *Lymnaea acuminata* snails were having dextral coiling of shell with 3-5 whorls and *Bellamya dissimilis* also having dextral coiling of shell with 4-6 whorls. Identification has been done on the basis of shell shape i.e, (Left handed aperture opening) shell called as sinistral and (Right handed aperture opening) shell called as dextral. Mostly the *Lymnaea acuminata* and *Bellamya dissimilis* species are dextral.

CONCLUSION

The results of this comparative study revealed there are significant differences ($p<0.01\%$) in body weight and animal shell width between *L. acuminata* and *B .dissimilis*. The *B. dissimilis* snails with 4-6 whorls are bigger heavier than *L. acuminata* with 3-5 whorls. But on phenotypic correlation among morphmetric traits *L. acuminata* recorded higher significant ($P<0.01\%$) positive strong correlation between animal shell length and other morphmetric traits studied, whereas *B. dissimilis* recorded lower significant values. However on prediction of animal shell length using multiple regression analysis, these morphmetric traits (ASW, APL, APW and TBW) predicted accurately for both *L. acuminata* and *B. dissimilis.*

Therefore, future work shall focus on determination of reproductive period/phase in a annual cycle and its neuroendocrine control that will provide a better understanding of life history strategies in these species.

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